

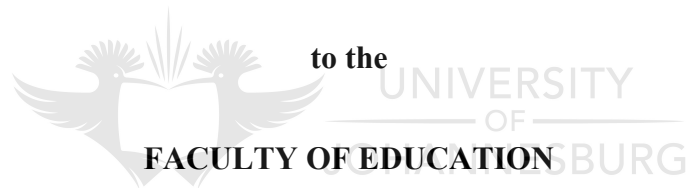
**THE LIVED EXPERIENCES OF HINDU TEACHERS AND LEARNERS IN THE
TEACHING AND LEARNING OF EVOLUTION IN LIFE SCIENCES IN THE FET
PHASE**

by

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Submitted in accordance with the requirements for the degree of

MASTER OF SCIENCE EDUCATION



to the

at the

UNIVERSITY OF JOHANNESBURG

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CO-SUPERVISOR: Dr U Ramnarain

JULY 2012

DECLARATION

I declare that the work contained in this dissertation is my own and all the sources I have used or quoted have been indicated and acknowledged by means of references. I also declare that I have not previously submitted this dissertation or any part of it to any university in order to obtain a degree.

Signature: _____

(Camantha Reddy)

Johannesburg

12 July 2012



ACKNOWLEDGEMENTS

I am most sincerely appreciative and grateful to the following people who have contributed in various ways to ensure the completion of this study:

- My supervisor – Dr Josef De Beer for motivating, supporting and guiding me through every step of this study. He is a true leader by example and has inspired me to succeed regardless of circumstances and time constraints. A word of thanks also goes to Dr U Ramnarain for his contribution as co-supervisor.
- My principal and a true proponent to lifelong learning – Mrs Almarie Van Zyl for her unwavering support in allowing me to devote sufficient time to complete this research.
- All the participants in this study who gave so freely of their time and were patient throughout the interview. This study would not have been possible without you.
- Ms Lynda Glaus for the transcriptions of eleven of the thirteen interviews and to Ms M Macgregor for the other two.
- Ms Carmenn Schutte – for helping me with the printing and lay-out of this document and for the graphic design of Figure 2.1.
- My family for allowing me to pursue this project and having to endure many take-out meals and leftovers in the process!
- My dearest parents – Bala and Saroj Reddy – for their endless support and encouragement throughout this endeavour. Thank you for impressing upon me the love for books and for creating a sound Hindu home in which the teachings of all religions were accepted and the right values always nurtured.
- Percy Ndlovu – my late helper of ten years who passed away so suddenly under tragic circumstances aged 30 years, shortly before this study could be completed. Without her I would not have had the time or commitment to devote to this work. I will forever be grateful to her for the loyalty and support she selflessly gave to me and to my family.

Over and above all else, I express deep and humble gratitude to the Almighty, the Supreme Energy, all-pervading in the Universe for bestowing upon me the ability and perseverance to complete this study.

ABSTRACT

The topic of evolutionary theory is new to the South African Life Sciences curriculum, having only been introduced in 2008 to the grade 12 cohort. A great deal of controversy and discussion surrounds the teaching and learning of evolution in many countries, and since the introduction of the topic, including South Africa. The primary source of this controversy arises from the conflict that many Christian and Muslim people experience between what their respective religions teach them about the act of Creation by God and the biological theory of evolution.

As a result of its recent inception into South African school, not much research has been done to explore how this topic is experienced by Hindu secondary school learners and teachers. The aim of this study is therefore to address two gaps, firstly to add to the almost total lack of information about the Hindu perspective of the topic of evolution. Secondly, to add to the knowledge base of the teaching and learning of evolution in secondary schools since the scant information available on the teaching and learning of evolution in South Africa is mainly confined to tertiary education. Literature was reviewed on various aspects relevant to this study such as the PCK, NOS, CCC, Hinduism and the teaching and learning of evolution overseas and locally.

In order to investigate the lived experiences of Hindu Life Sciences teachers and learners to the topic of evolution a qualitative study with elements of phenomenology was the chosen research design. This prompted the need to use a series of focus group and individual interviews with the various role-players as laid out by the overarching conceptual framework CHAT, the lens through which this study was viewed. Triangulation of data increased the reliability and validity of this study and was obtained by interviewing a Hindu priest as well as Hindu parents of Life Sciences learners. Interviews were transcribed, coded using the coding model by Saldana (2009) and analysed according to common themes.

The main finding of this study was that Hindu teachers and learners experience no conflict with the topic of evolution thus displaying a lack of major tensions linked to the CHAT model. Many Hindus are however ignorant of their religion and scriptures but nevertheless remain accepting of the theory of evolution. Their acceptance could be attributed to three major tenets of Hinduism that link to evolutionary concepts: the cyclical concept of time; the evolution of the soul during reincarnation and the idea that during times of calamity, God manifests on Earth in the form of Avatāras. Misconceptions of evolutionary theory abound

among learners and to a lesser extent the parents and teachers, particularly with respect to the notion of common ancestry. The teachers had adequate PCK but their knowledge of the NOS was limited.

Recommendations emerging from these findings therefore warrant greater attention to the NOS in both PRESET and INSET teacher training courses. These courses can also use the lack of tensions between the Hindu religion and the topic of evolution as a case in point to show that religion and science can exist in harmony with each other. The concept of a nearest common ancestor (NCA) should also be emphasised in these courses – thereby helping to dispel the misconception that humans descended directly from apes.



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LIST OF COMMON ABBREVIATIONS

ACE	Advanced Certificate in Education
AT	Activity Theory
BSc	Bachelor of Science degree (Baccalaureus Scientae)
CHAT	Cultural Historical Activity Theory
CAPS	Curriculum and Assessment Policy Statement
CCC	Controversial Conceptual Change
DoE	Department of Education
FET	Further Education and Training (Grades 10-12)
GDE	Gauteng Department of Education
INSET	In-service Training
LO	Learning Outcome
NCA	Nearest Common Ancestor
NCS	National Curriculum Statement
NOS	Nature of Science
OBE	Outcomes Based Education
PCK	Pedagogical Content Knowledge
PRESET	Pre-service training
SA	Specific Aim

LIST OF SANSKRIT TERMS USED AND EQUIVALENT ENGLISH MEANING

Adharma	opposite in meaning to Dharma. Adharma is unrighteousness, discord, corruption, etc.
Amrita	nectar of immortality available only to the Gods.
Atman	the soul/ spirit/ core of every living being. It is identical to the Supreme Energy.
Avatāra	different forms in which Lord Vishnu manifests Himself on Earth in times of great calamity/ adharma for mankind.
Brahma	the creator aspect of the Divine
Brahman/ Paramatma/ Paramatman/ Supreme Soul/ Supreme Energy/ God/ Divine	the all pervading force in the Universe that gives rise to all life forms and beings. The goal of all these beings is for their souls to return to this source and merge once again. Not to be confused with Brahma.
Dharma	ethics and duties of living things. Right conduct that governs how all life should behave.
Kalachakra	the wheel of time
Kalpa	one cycle of the four ages/ yuga. Also known as a “Mahayuga.”
Karma	right action
Maha	a prefix that means “great”
Mahakalpa	1000 Mahayugas and equal to one day of Brahma. This day is equivalent to 4.32 billion years in human terms.
Maya	the veil of illusion that clouds man’s intellect and prevents him from realising/ seeing the truth/ spiritual reality.
Moksha	liberation from Samsara and merging with Supreme Energy/ Paramatman.
Purānas	a class of Shāstra that originated in order to make Hindu scripture accessible to the masses of illiterate people in ancient India.
Rishi	a learned Hindu holy man who has renounced all attachment to material things and whose only goal is to attain God-realisation.
Samsara	re-birth into a new body/ form.

Satya	truth. Also the name of the first yuga in the Kalachakra when mankind experienced 100% truth and he was fully aware of his connection to the Divine. There was no maya in this age.
Shāstras	collective term for all Hindu holy texts/ scriptures. There are 3 types: Shruti, Smriti and Purānas. Examples: Vedas, Ramayana, Mahabharata, Bhagavad-Gita
Shiva/Siva	the destroyer aspect of the Divine.
Shruti	direct revelation of scripture through oral traditions
Smriti	the written record of all the oral scriptures.
Vedanta/ Upanishads	those parts of the Vedas containing their essence.
Vedas	the oldest of the Hindu scriptures of which there are four types and constitute the knowledge of God.
Vishnu	the preserver aspect of the Divine. He manifests as an Avatāra when Adharma is rife and mankind needs to be rescued (preserved).
Yuga (plural)/ Yugam (singular)	each of four ages/ epochs laid out in Hindu scripture that time is divided into. The four ages recur in a continuous cycle.

CHAPTER ONE

CONCEPTUALISATION OF THE STUDY

1.1. INTRODUCTION

This study focuses on the lived experiences of South African Hindu Life Science learners and teachers towards the topic of evolution with particular emphasis on grade 12 learners. The aim of this study is to contribute to the body of knowledge on the teaching and learning of evolution but specifically from the Hindu perspective. Studies on the teaching and learning of evolution in South African secondary schools are presently very limited mainly because this topic has only been introduced into the school curriculum since 2008. This study is therefore also an attempt to add to this field of knowledge. The Hindu perspective in this research field is almost completely absent from most South African research journals. Since Hindus constitute a substantial proportion of the South African Indian population, there is a need to fill this gap.

Currently, the topic of evolution is regarded by many people as the antithesis of creationism, a concept that is typically Christian in nature. In 2008, 44% of Americans polled in a Gallup survey, the renowned American polling organization, stated that:

“God created human beings pretty much in their present form at one time within the last 10 000 years or so.” (Dawkins, 2009:429)

By implication, this shows an association amongst teachers between acceptance of the theory of evolution and atheism (the idea that you cannot believe in God and accept evolution at the same time). Globally, there is an abundance of literature on the studies of the teaching and learning of evolution but mainly from a Christian and to a small extent, Islamic perspective. As a result of the topic of evolution being taught in the curriculum, these studies reveal varying degrees of tension and conflict developing in schools – tensions that arise mainly as a result of the conflicts between creationism and evolution or, between religion and science. A study by De Beer and Henning (2010) specifically focused on the radical conceptual change that is often needed to accommodate evolution within a person’s worldview.

The presence of these tensions in existing studies has prompted the placing of my study within the overarching framework of the Cultural Historical Activity Theory (CHAT). This will enable a macro view of the dynamics that exist from a Hindu perspective of teaching

and learning evolution. Any conflicts that do exist in this study will be placed into perspective using this framework which will serve as a lens to analyse and interpret the lived experiences of Hindu Life Science teachers and learners.

1.2. BACKGROUND TO THE RESEARCH STUDY

Much discussion and controversy has been centered on the topic of evolution since its introduction into the formal South African school curriculum in 2008, specifically into the Grade 12 Life Sciences curriculum. A great deal of this discussion looks at the influence of religion on the teaching and learning of the topic. There is some reluctance from teachers to discuss issues around evolution partly due to their religious convictions that seem to be in conflict with this topic. This is apparent from studies conducted by Sanders and Ngxola (2009) and Yalvac (2011) that revealed how several teachers found that there was conflict between their religion and the theory of evolution. This conflict served as a stumbling block to teaching the topic of evolution.

1.2.1. The South African Context

The South African education system, prior to 1994, was predominantly Christian-based. Dempster and Hugo (2006:106) refer to this education policy as being “based on Calvinism, which has as its cornerstone the absolute sovereignty of God.” In this education system, Creationism was the singular belief of how life on Earth came to be. The concepts of evolution and natural selection therefore did not have a place in the curriculum in public schools.

However, post-1994, the curriculum faced major upheaval, including the inception of OBE; the introduction of different Learning Areas and Knowledge Areas; and more recently in the Grade 12 Life Science class of 2008, the inception of the topic of evolution and natural selection. In 2011, discussions for a new curriculum document CAPS began. Scheduled implementation of this curriculum was in 2012 for grade 10 learners.

Life Sciences (referred to as Biology before 2006), is made up of four Knowledge Areas that are common to grades 10, 11 and 12 (the FET phase). In 2008, evolution made up an entire Knowledge Area (module) – Diversity, change and continuity of life on Earth - only for Grade 12. Aspects of the topic included historical aspects of Darwin and other early

evolutionists including Lamarck, Comte de Buffon and Erasmus Darwin; the mechanism of natural selection; theories of mass extinction, human evolution and alternative theories to evolution such as creationism and intelligent design. These alternative theories are based on Christianity. No mention was made about how other religions such as Hinduism, regard the theory of evolution. In South Africa, 551 668 people are Hindus (South Africa's population, 2010), according to the 2001 census. Thus the Hindu perspective on evolution warrants investigation.

Then in 2009, the Life Science curriculum encountered further re-shuffling. The different aspects of evolution – taxonomy, biogeography and mass extinctions – were then introduced in Grade 10. This cohort of learners continue with other parts of the topic in grade 11 (2010) – biodiversity, modifications of basic body plans and biogeography. In Grade 12 (2011), these Life Science learners are taught details of natural selection, speciation, human origins and human evolution and finally, the alternative explanations for the origin and development of life on Earth - creationism and intelligent design. These topics will form part of the Knowledge Area - Diversity, change and continuity of life on Earth - for each grade in the FET phase. Once again, the only alternative explanation for evolution was Christian-based, there was no reference made to other religious beliefs. Scrutiny of the new CAPS documents also shows the absence of including alternate worldviews such as that of Hinduism.

1.2.2. Teacher training for the topic of evolution

The introduction of evolution into the Life Science curriculum in high schools since 2008 meant that several teachers were unprepared since they were not exposed to this topic either at secondary or tertiary level. This therefore resulted in the Department of Education (DoE) putting together “crash courses” in the form of intensive workshops to support all Life Science teachers – especially for those who may have not encountered the topic during their teacher training. De Beer and Henning (2010:6) found that a great number of South African Life Science teachers only have teaching diplomas rather than a Bachelor of Science degree. Therefore formal tuition on evolution is absent.

Some of these short learning programmes were designed and run by the DoE themselves. Others were initiated by local universities (University of the Witwatersrand and University of Johannesburg). According to Hoban (2004), cited in Cronje (2011), workshops are beneficial to teachers but these should be enhanced by continual professional development.

Cronje (2011:8) also found that many teachers prefer that workshops deal with “skills, knowledge and hands-on ideas on how to handle difficult topics” rather than workshops that focus on policy. The short learning programmes on evolution therefore did seem to address the practical aspects of the topic and did not focus too much on policy (Anecdotal evidence based on researcher’s own attendance at workshops).

During these short learning programmes, teachers were asked to comment on some of their fears about teaching the topic of Evolution to learners. The main content for the topic of evolution was “taught” to the teachers – such as the historical aspects mentioned above (in 1.2.1), the origins of the Earth and of life on this planet. The concepts of speciation and natural selection were explained in detail.

Many teachers found it difficult to understand the concepts of natural selection; the origin of life on Earth and other aspects in evolution covered during these workshops. This was also evident from a handout received at a workshop conducted by the GDE in 2008 called “Frequently Asked Questions” (13th July 2007) where fourteen questions were asked by teachers and then answered. The questions showed the uncertainties that teachers had when it came to teaching the topic of evolution, e.g.

“Why has such a provocative and emotionally-charged topic been included in the curriculum?”; “My child has been brought up to believe that all life forms have been created by a Supreme Being. Will he/she be forced to change his/her belief system?”; “The curriculum includes a section entitled “Evidence for Evolution.” Will this evidence be presented as hard facts, or will the teachers show that this “evidence” is open to interpretation?”

These uncertainties reflect an underlying concern that probably stems from a lack of proper understanding of the topic of evolution (Trani, 2004). The notion of understanding a topic like evolution will be discussed in greater detail later on (1.2.10; 2.3; 2.5; 2.6).

1.2.3. Conflict between religion and evolution

Apart from a lack of understanding that many teachers have regarding the topic of evolution, another of the main concerns that emerged was that teachers themselves experienced conflict between the theory of evolution and their religion. Most of this conflict emerged from a Christian and Muslim perspective, both Abrahamic religions. The GDE course presenters offered some reassurance to teachers in this predicament. The reassurances included being open-minded in the classroom as teachers and not allowing

personal beliefs to impede content delivery, as well as saying to learners that learning about evolution does not mean that they have to stop believing in their chosen faith. If Life Science teachers who ought to be fully-trained professionals with fairly extensive subject content knowledge have these difficulties between their religion and evolution, then what kind of turmoil would learners experience?

According to Schilders, *et al* (2009:115) students should have a good understanding of evolution as it may contribute to the development of their worldview. A worldview refers to a framework of ideas and beliefs through which an individual interprets and interacts with the world. The authors place a great deal of emphasis on the importance of students having a worldview and using this to increase their understanding of the nature of science. In other words, students ought to use their religious views, regardless of what religion it is, to enhance their understanding of evolution, rather than dealing with them as two separate issues that are not compatible with each other. This view of the authors is examined in detail later on from the Hindu perspective (2.8).

Studies indicate that many students, who reject evolution, do so because they feel it contradicts their worldview (Cobern, 1994; Dagher and BauJaoude, 1997; Downie and Baron, 2000). Science tries to help people understand the natural world while religion looks at our reasons for being on Earth and “how we should live” (Cavanagh, 2009). Students should be made to see that it is acceptable to have compatible scientific and religious worldviews, further supporting the view presented by Schilders, *et al* (2009:115) mentioned in the previous paragraph.

This point is also made by Cobern (1996), who stated that student worldviews should not be viewed as a hindrance to conceptual development in science. Studying evolution, therefore, should not exclude one or the other. This point is qualified by the view that “with evolution being taught in classrooms across the country, each student’s background must be taken into consideration so that more people can begin to accept evolution as part of their lives” (Andrews, 2005).

These views show that it is possible and perhaps necessary for students to be able to view the conflict between their worldview with scientific convictions and to realize that these are not exclusive domains that cannot be integrated in some way. Since there is a great deal of information on the Christian worldview as it applies to evolution and some information on the Islamic perspective, this study will focus on the Hindu worldview towards teaching

and learning evolution. This will entail looking at the lived experiences and any possible conflict of ideas between evolution and the Hindu faith amongst Hindu learners and teachers. If there is no conflict, then my study would look at how ideas from Hinduism and evolution are possibly assimilated into Hindu learners' worldviews.

1.2.4. A place for the Hindu perspective

None of the concerns raised at these short learning programmes concerned the Hindu perspective. This gap in the body of knowledge needed to be addressed and encouraged the researcher to undertake this study. There was no anecdotal evidence to suggest that there was a conflict between Hinduism and evolution, unlike between Christianity and evolution. The researcher's personal, superficial knowledge of the Hindu religion and of some Hindu scriptures hinted that in the absence of such conflict there might be an acceptance of evolution. However, this needed to be confirmed by a formal, rigorous study involving among other facets, a sound investigation into the Hindu religion that did not depend on anecdotal evidence and hear-say alone.

1.2.5. Hinduism in a Nutshell

Although a more detailed account is provided in Chapter Two, it is necessary at this point to explain some of the characteristics of the Hindu religion. In South Africa especially, not much is known about it by non-Hindu people.

Hinduism is regarded as being the oldest religion in the history of human civilization (Subhamoy Das, 2009) and it claims to have more than 750 million followers globally (Rood, 1994). This makes up almost 17% of the world population. Annual mid-year statistics from Statistics South Africa showed that in July 2009, the population of SA was made up of 2.6% Indian people. The 2001 census revealed that Hinduism was practiced by 1.2% or 551 668 of all South Africans. Approximately 47.3% or 527 352 of Indian South Africans, 0.13% or 5 329 Coloured South Africans and 0.05% or 16 426 Black South Africans are Hindus, the most common religion among South African Indians is therefore Hinduism (South Africa's population, 2010). Even though Indians and especially Hindus are a minority group in South Africa, it was feasible to conduct this study on how Hinduism affects the teaching and learning of evolution in South African schools because South African Hindu communities have valuable perspectives to add to the topic of evolution.

According to Monier-Williams (cited in Ramaswami *et al*, 1999:2) “Hindus were Darwinians many centuries before Darwin and Evolutionists many centuries before the doctrine of Evolution was accepted by scientists of the present age.” There are therefore several aspects of this religion of Hinduism that would allude to evolution. Unlike most other religions, that have a single tome prescribing the laws and dogma for that religion, Hinduism has several scriptures that outline different facets of this ancient religion. Some of these scriptures will also be cited in Chapter 2 specifically for their links to evolution.

Essentially, these scriptures reveal that there are several beliefs and tenets by which Hindus ought to live. For the purposes of this study, however, three main belief systems in Hinduism will be examined particularly because of their links with the topic of evolution:

1. The cyclical nature of time
2. The law of Karma and Reincarnation
3. The advent of the avatars

Each of these will now be explained briefly:

1. The Cyclical Nature of Time

In the Christian view of creationism, the concept of time exists in a linear form that extends from “creation to judgment.” On the other hand, one of the most basic Hindu ideas lies in the belief that time exists in a cyclic form (Brown, 2002) that is believed to be the process of creation that is affected by the Divine.

A Holy Trinity also exists in Hinduism, though in a different connotation to Christianity. In Hinduism, there are the three aspects of existence: Creation, Preservation and Destruction. Each of these is controlled by a different form of the Divine - Brahma, Vishnu and Shiva respectively. It is these three deities that make up the Hindu version of the Holy Trinity. One of the Hindu scriptures is the Vishnu-Purāna which gives an interlinked account of creation and preservation of the Earth and life-forms within it. In this scripture, mention is made of the perception of time as being “eternal, without beginning, nor is its end known” (cited in Penner: 1966, 291) – once again alluding to the cyclical nature of time. This is in direct contrast to the Abrahamic religions which put forward that time exists in a linear fashion from Creation to Judgment.

One cycle is in turn divided into four epochs of time. These epochs add up to a period of 4 320 000 years in human terms and are known as one Mahayuga (*Maha* = great and *Yuga* = age). According to Hindu scriptures, there are 1000 Mahayugas in one day of Lord Brahma (the Creator), which means that there are 4.32 billion years in one day of Lord Brahma (O'Connor, 2008). Time is represented as Kālā Chakra – the Wheel of Time.

According to evolutionists, the Earth is 4.6 billion years old. These two figures therefore correspond very closely in terms of the age of the Earth. This then shows that Hinduism and evolutionary theory are very similar at least with regards to the age of the Earth. The ongoing nature of evolution and natural selection also corresponds with the cyclical nature of time in Hinduism which implies that there is no definite “end” to life on Earth. In other words, there is no particular pinnacle of evolution that all life forms are striving to evolve towards.

2. The Law of *Karma* and Reincarnation

Linked closely to this cyclical nature of time, Hinduism also has as one of its main beliefs, the principles of *Karma* and reincarnation. Very simply, the law of *Karma* postulates that our present fate has been pre-determined by all the past actions of the forms occupied by the soul. Therefore, our present actions will determine our future. The principle of reincarnation suggests that each person will therefore be re-born into a life that was determined by his/her previous actions. According to the Bhagavad-Gita (one of the core Hindu scriptures), there are no exceptions to the law of *Karma* for any soul.

In Hinduism, the physical, material body is merely a vehicle for the journey of the soul and the ultimate aim of reincarnation is for a soul to become one with the Divine – as mentioned in Brown (2002:103) that “throughout the endless cycles of time ... there must always have been the physical vehicles – such as humanlike bodies – necessary to reach the very highest stages of consciousness.” This is called attaining *Moksha* or liberation so that the soul is released from this cycle of birth and death and ultimately from the attachment to a material body. It is believed that the purpose of *Moksha* is for the soul to merge with the Divine from which it arose in the first place. The soul is referred to as the *Atman* in the Hindu scriptures – the Upanishads.

With regards to this link to evolution, the principle of reincarnation explained briefly above shows an evolution process of the soul where it strives from a simple form that is attached

to material and physical pursuits on Earth towards a more complex spiritually advanced state in which it can merge with the Divine. A parallel can be drawn between this spiritual evolution and evolutionary biology which considers the evolution of physical bodies. The idea of evolution is therefore not foreign to Hinduism, even though a difference between spiritual and physical evolution exists.

Reincarnation and Karma also has similarities with the view in evolution that all life forms on Earth originated from a common ancestor – Darwin’s Law of Common Descent. This is further supported by a citation in Brown (2002:103) which states “the origin of species given in the Vedas is similar to Darwinian evolution in that it involves physical descent from a common ancestor.” The Vedas are another series of Hindu scriptures and are believed to include an account of creation on Earth.

One of the Vedas, called the Rig-Veda, surmises that creation was a gradual occurrence and that the primitive universe was at first homogeneous but then split up to form an “inhomogeneous state” that allowed the formation of the first particles (Das, 2009). The theory of gradualism is one of the mechanisms by which evolution is thought to occur and Darwin himself appeared to believe in this (Brown, 2002).

An additional link of the process of reincarnation to evolution is that just as organisms on Earth are said to have evolved from simple to complex structures, similarly the soul is supposed to be evolving spiritually so that at each new birth, it reaches a higher level of realization or development. This belief is one of the core tenets of Hinduism and will be discussed in greater detail in Chapter Two (2.8.7).

3. The Advent of the Avatāras

Another aspect of Hinduism with links to the concept of evolution refers to the belief of the advent of Avatāras on Earth throughout its approximate four billion year existence. Avatāras are broadly defined as physical manifestations on Earth of the Supreme Being. Brown (2007) refers to this as “Avataric Evolutionism”. Hindu scriptures pronounce that during times of strife and discord on Earth, Lord Vishnu descends on Earth in various forms (called Avatāras) in order to restore righteousness amongst man (Bhagavad-Gita, Chapter 4 Verse 8).

The first of these avatars was in the form of a fish, followed by a turtle, a boar, a dwarf, a man-lion and others as will be explained in Chapter 2 (2.8.3). In Book I of the Vishnu-Purana, the advent of these Avatāras is described as the “orders of creation proceeding from ... a primordial creation” (cited in Penner, 1966:283). These Avatāras seem to echo the stages of evolution of life on Earth from fish to reptiles to mammals. Reference to “a primordial creation” hints at the notion in evolutionary biology of the *earliest* common ancestor of all life forms on earth in the form of a primitive prokaryotic cell. In this sense, Hinduism has once again revealed similarities with the theory of evolution.

As a result of the three aspects just discussed and other similarities between Hinduism and evolutionary biology, it was hypothesized in this study that Hindu learners and teachers do not have many reservations in accepting the theory of evolution. This acceptance is also asserted in Reiss (2009:1939) who states that “an acceptance of evolution is fully compatible with a religious faith ... more obviously true of many other religions – including Hinduism.” The analysis of the data collected will therefore verify or refute this hypothesis and these findings are presented in **Chapter 5**.



1.2.6. Theoretical and Conceptual Framework

The dynamic interplay that exists between different role-players in any teaching and learning exercise can best be explained in a coherent manner using the Cultural Historical Activity Theory (CHAT) lens that was formulated by Engeström (1987) and a number of other Vygotskian contributors. Jansen (2008) differentiates between a theoretical and conceptual framework by suggesting that the former makes up “a higher level of conceptual organization” while the latter is “a lower level of conceptual organization” in which different concepts are used to explain a phenomenon. Regardless of the definition, however, he asserts that a theoretical/ conceptual framework is used to explain the data obtained and to understand it.

My study which looks at the lived experiences of Life Sciences teachers and learners can best be explained using the Cultural Historical Activity Theory (CHAT) as a theoretical framework to firstly identify tensions that may exist among them and secondly, to analyse and explain the data. The eminent researcher Vygotsky advocated that cultural tools developed via social interaction, can promote learning if further guidance is provided by a

more knowledgeable individual (Rogoff, 1990:140). The topic of evolution being fairly new in the South African school curriculum requires improved teaching and learning techniques which can be achieved via adequate tools and knowledgeable and skilled teachers. This study therefore examined how the topic of evolution is dealt with from a Hindu perspective.

Using third generation CHAT as proposed by Engeström (1987:78, cited in Hardman 2005a:3), (see Figure 1), possible conflicts or tensions can for example exist between learners' everyday experiences and what they are taught in the science classroom.

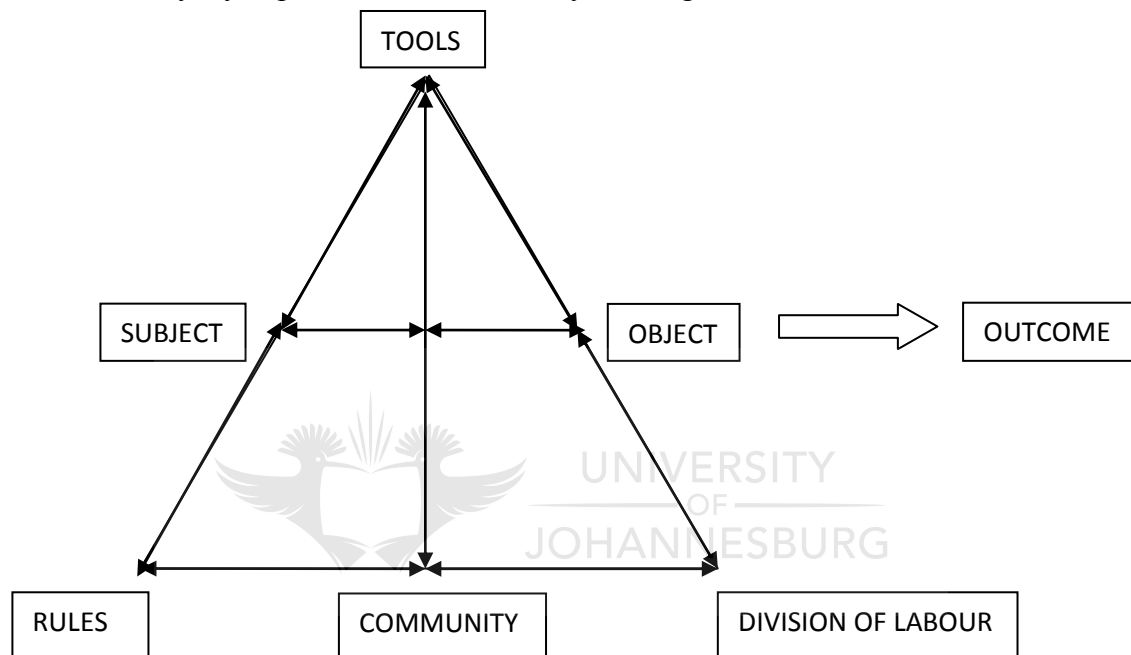


FIGURE 1.1 – CHAT MODEL Source: Engeström, 1987:78

Briefly, the elements from this study according to the CHAT model are as follows:

Subject – Hindu learners or teachers

Rules – as laid down by the curriculum documents and by the Hindu religion.

Community – refers to the teachers, HOD's and principal, and learners in the school, religious community, family of the learners, and the DoE (e.g. subject advisors)

Division of labour – encompasses the sharing of knowledge acquisition by teachers, parents and religious leaders, and learners' engagement with evolution theory.

Tools – refer to the teacher’s pedagogy and pedagogical content knowledge (PCK), teaching and learning aids e.g. textbooks, videos, religious texts, and the national curriculum.

Object – the effective teaching of evolution to Hindu learners and whether learning outcomes have been attained.

Outcome - the understanding of the topic of evolution and its assimilation or accommodation into learners’ existing worldviews. This is important because it contributed to the aim of this study i.e. to improve the teaching and learning of evolution as well as to increase the understanding of this topic.

An example of how the dynamics of the CHAT model would be used as a lens in this study would be the influence of the community and prevailing beliefs from which the learners come. This can create tensions about what learners are taught at school. The religious lessons taught by the community may influence what is learnt in evolution at school if they are in a direct contrast to each other. These and other conflicts as outlined in Engeström’s model of Activity Theory, if they exist, are used to analyse the data obtained.

1.2.7. Evolution and Controversial Conceptual Change (CCC) Theory

Religious lessons and behaviours taught to children by their parents and religious institutions result in them forming a worldview in which they use every day or common-sense language to make sense of what they are taught. According to Säter and Maridal (n.d), conceptual change deals with “this potential conflict between common sense vs. scientific use of language” (p.1). Many learners struggle to explain scientific concepts using the everyday language that they have become accustomed to using.

In the topic of evolution, controversy can arise because of the conflict between children’s worldviews around creationism and the theory of evolution which appears to negate this view. Some learners are able to accommodate for this conflict by reorganizing their prior knowledge, resulting in conceptual change (Säter and Maridal, n.d). Other learners are able to assimilate this difference by adding new information on to their existing knowledge framework. The former is referred to as “strong/radical knowledge restructuring” while the latter is known as “weak knowledge restructuring... or conceptual capture” by the authors (ibid).

On page 10, the authors refer to “students’ capacity to live with unsolved conflicting views” (ibid). This applies to many people, including teachers, who cannot change their own worldview regarding the topic of evolution. This unwillingness of teachers to change their existing ideologies impacts on the pedagogy that will be used to teach this topic.

1.2.8. The Role of Pedagogical Content Knowledge (PCK)

Teachers play different roles in the classroom, and these roles can be identified when classroom dynamics is viewed through a CHAT lens. They can be the Subject in the activity system and can be part of the Division of labour as explained above. Teachers, specifically in terms of their knowledge and pedagogy of the topic of evolution, can also be a Tool. However, cognitive development for learners can only be achieved if the teacher is more skilled and knowledgeable in the topic than the learner (Rogoff, 1990:148).

According to researchers cited in Cronje (2011:4) many teachers transfer misconceptions to learners because there is an inconsistency between their subject content knowledge and the subject itself. This inconsistency is evident by their poor teaching styles and poor didactical skills (Horak and Fricke, 2004 cited in Cronje, 2011) and is in turn translated into poor pedagogical content knowledge (PCK). The researcher documented with coining the term PCK is Shulman (Van Driel *et al*, 1998) who used the concept of PCK to refer to the way in which teachers interpret and manipulate subject content knowledge so that learners can easily understand it. Shulman therefore regarded PCK as representing a blend “of content and pedagogy into an understanding of how particular topics, problems or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction” (Shulman, 1987:8 cited in Van Dijk, 2009:260).

Furthermore, Van Dijk (2009:261) states that “teachers develop PCK in their individual teaching practice.” This development of PCK arises as a result of an amalgamation of how teachers interpret subject matter, how they understand certain learning problems and of an awareness of students’ misconceptions on the topic (Shulman, 1986:9 cited in Van Driel, *et al* (1998). As a result of a lack of proper training in the topic of evolution (as mentioned in paragraph 1.2.2.), De Beer and Henning (2010) found that teachers lack the knowledge and insight of the most fundamental basic concepts pertaining to evolution. These authors also found that teachers lack the didactical skills or knowledge of teaching strategies which are necessary to teach evolution. These findings therefore indicate that many teachers have a

weak PCK of the topic of evolution and this can in turn negatively influence how learners understand the topic.

The PCK of Hindu Life Science teachers plays an integral role in teaching the topic of evolution in this study. Their PCK not only influences how Hindu learners understand evolution but learners of all religions who are in their class. One of the contributing factors to how PCK develops in science teachers is the teachers' own religious beliefs or worldviews as discussed in the previous paragraph.

1.2.9. The Nature of Science

The beliefs, worldviews and assumptions of teachers and learners influence their understanding of the Nature of Science (NOS) (Vhurumuku, 2011). In various studies from 1998 to 2002, researchers Bell, Lederman and Abd-El-Khalick have repeatedly distinguished between scientific processes and the Nature of Science. They regard scientific processes to include data collection, analysis of the data and the drawing of conclusions, while the NOS "is concerned with the values and epistemological assumptions underlying these activities" (Bell *et al*, 2000; Lederman *et al*, 2002). According to Vhurumuku (2011), our understanding of the NOS depends on our individual views and postulations concerning the knowledge and process of science, rather than "on our knowledge of specific scientific laws or our ability to use science process skills." It is therefore the subjective notions of scientific knowledge and how this knowledge is formed that constitutes how the NOS is understood by individuals.

While there are several different tenets of the NOS from various fields of study e.g science, history, philosophy and sociology, seven main ones are listed with special relevance to school learning (Vhurumuku, 2011; Khishfe & Lederman, 2006; Bell *et al*, 2000; etc):

- I. Science is empirically based
- II. Scientific knowledge is tentative, yet durable
- III. The difference between observations and inferences
- IV. Scientific knowledge is theory-laden but partly subjective
- V. The role of imagination and creativity in science
- VI. The absence of a single scientific method
- VII. The difference between laws and theories

The seven tenets of the NOS mentioned are of special significance in my study because of its focus on the theory of evolution that came about through these and other tenets of the NOS. Hence, each of these seven tenets will be discussed in greater detail and with particular reference to the theory of evolution in section 2.6 of this dissertation.

The NOS is a necessary component in the Life Science curriculum for two main reasons: Firstly, it is a means of developing the scientific literacy of learners. The importance of this is emphasized by the American Association for the Advancement of Science (AAAS) and the National Research Council (NRC) (Khishfe and Lederman, 2006; Bell, *et al*, 2000). The National Curriculum Statement (NCS) in South Africa also pronounces the value of the seven tenets of the NOS by incorporating them into the three Learning Outcomes (LO's) for the Life Sciences as follows:

- LO 1: The learner is able to confidently explore and investigate phenomena relevant to Life Sciences by using inquiry, problem solving, critical thinking and other skills.
- LO 2: The learner is able to access, interpret, construct and use Life Sciences concepts to explain phenomena relevant to Life Sciences.
- LO 3: The learner is able to demonstrate an understanding of the **nature of science**, the influence of ethics and biases in the Life Sciences, and the interrelationship of science, technology, indigenous knowledge, the environment and society.

The specific reference to the NOS shows that this curriculum recognizes the value of instilling the core principles of the NOS in order to uplift the learners scientifically. By crediting the input from society and ethics, this LO addresses the subjectivity of scientific knowledge. The recent Curriculum and Assessment Policy Statement (CAPS) replaces the LO's with Specific Aims (SA's) 1, 2 and 3.

Further explanation of LO 3 in the NCS (DoE, 2003) or the SA 3 in CAPS states that it “raises learners’ awareness of the existence of different viewpoints in a multicultural society, and encourages open-mindedness towards all viewpoints... based on scientific knowledge, beliefs, ethics, attitudes, values and biases, and may change over time due to new information.” This policy document therefore endeavors to introduce some of the tenets of the NOS such as the tentative nature of scientific knowledge and that there is no

single scientific method. The implementation of these tenets in the South African learning environment, however, may not always succeed. The issue of implementation will not be discussed in this dissertation and requires more research in future studies.

Bell *et al* (2000:564) claim that despite the inclusion of NOS in the American science curriculum since the start of the 20th century, “research has consistently shown that both students and teachers are generally unable to articulate adequate understandings of the nature of science.” This implies that since South Africa has only recently introduced this new curriculum (since 2006) and its reference to the NOS, a massive task awaits in order to make any progress towards developing a scientifically literate society. This task therefore depends heavily on science teachers who firstly need to understand the NOS themselves before they can convey this to their learners.

The second reason for the NOS being a component of the Life Science curriculum is that it is important for learners to understand how the theory of evolution came about. In Life Sciences since 2008, emphasis has been placed on “Hypothesis Testing” where learners are shown how scientists made their discoveries through a time-consuming and often laborious process that involved observation, formulation of hypotheses, repeated investigations, followed by analysis of results and eventually conclusions that either refuted or agreed with their initial hypothesis. This introduced learners to the scientific process. They also learned that scientists often worked together in a community of practice where they experienced each other’s subjectivity, values and worldviews (Isaacs, 2010).

Reiss (2009) contends that conflicting religious ideas should be considered as worldviews rather than as misconceptions. According to Reiss (2009), it is more important for learners with different worldviews (like Creationism) to *understand the nature of science* rather than to *accept controversial theories* such as that of evolution (emphasis added). This study therefore also looked at the extent to which Hindu teachers use the Nature of Science when teaching evolution.

1.2.10. Teaching Evolution

Several studies on the teaching of evolution in many countries including South Africa have revealed several tensions and difficulties. Sanders and Ngxola (2009) state that “many teachers worldwide have found evolution to be a problematic addition to school curricula.” Two major concerns from teachers emerged from their research: firstly, many teachers in

other countries leave out teaching evolution either due to a conflict with their own world view or due to fear from the public and learners' communities; and secondly, teachers lack the necessary content knowledge or have misconceptions about evolution (ibid).

Dagher and Boujaoude (2005) researched Lebanese students' perceptions of evolution and found that it was necessary to first teach learners the nature of science before they could understand evolutionary theory. These students appear to reject this theory because of their poor knowledge of the scientific method combined with their religious views and worldviews (ibid).

Bybee (2002) presents a compelling account for why "We should teach about biological evolution." According to his paper, learning about evolution will teach students about the reasons for the diversity of life on Earth, the presence of genetic variation among individuals, the results of limited resources for organisms and the case for natural selection. He adds that if the nature of science is combined with the theory of evolution, it will teach students, among other things, how scientific knowledge develops (ibid).

When students are taught about the nature of science they need to also be convinced that "they are not rejecting religious beliefs as a condition for accepting this new tool" (Scharmann, 2005:13). In my study, therefore the importance of the nature of science for Hindu Life Science teachers is also examined, especially with regards to the teaching of evolution.

1.2.11. The Theory of Evolution

A study such as this will be incomplete without a short depiction on the theory of evolution itself. Evolutionists have used multiple fields of scientific evidence to determine that the Earth is approximately 4.6 billion years old and that life evolved here over millions of years.

A Biology text-book used for students writing the GCSE and 'A'- Level examination, acknowledges that for some people the origin of life on Earth is "a matter for religious faith rather than scientific thought" (Fullick, 1994:428). This text-book as well as the most recent one used by Grade 12 Life Science learners in South Africa, *Understanding Life Sciences for grade 12*, (Isaacs *et al.*: 2010) proposes that evolution did take place and that a possible explanation for how it took place is through Darwin's theory of Natural Selection.

Darwin's theory suggests that organisms engaging in sexual reproduction produce offspring with a great deal of variation amongst them. Most organisms also produce more offspring than can survive. The offspring that do survive do so because they have certain favourable characteristics that are advantageous in the environmental conditions prevalent at that moment in geological time. These offspring then survive, reach maturity and have their own offspring that will carry those same favourable characteristics that enabled the survival of their parents in the first place. Those offspring with unfavourable characteristics will die before reaching maturity and cannot reproduce – the unfavourable characteristics therefore die with them. This phenomenon is now commonly referred to as the “survival of the fittest” (Fullick, 1994:431; Isaac *et al*: 2007:247).

This process amongst organisms over vast expanses of geological time has resulted in the formation of new species (speciation) and has resulted in the diversity of life that is present on Earth today. Thus the theory of evolution is also regarded as the theory of descent with modification, which suggests that all life forms on Earth today are descended from a common ancestor and that they were modified from one generation to the other due to the mechanism of natural selection (Isaac *et al*: 2007).

The process of natural selection and the law of common descent form the basis of the topic of evolution in Life Science in South African schools. There is therefore no room for the creation of life forms by a Creator as 44% of Americans believed in the survey quoted in the introduction to this Chapter. In my study, this mechanism for evolution as well as the theory of evolution itself and its possible conflict with Hinduism is explored.

1.3. MOTIVATION FOR STUDY

As a Hindu teacher attending the workshops for the teaching of the new topic of evolution, it constantly struck me that there was no information offered on how the teaching and learning of Evolution may or may not be affected by teachers and learners of the Hindu faith both in South Africa and globally. This was surprising since Hinduism is the predominant religion among South African Indian people and over 600 million people practice Hinduism on the sub-continent alone (Lipner, 1998). This apparent lack of information then motivated me to pursue this study into how Hindu teachers and learners view the topic of evolution from the perspective of their faith.

According to Sanders and Ngxola (2009), the beliefs of some religions can hinder the acceptance of evolution. It is therefore the responsibility of teachers to “be aware of, and accommodate not only Christian beliefs but other religious and traditional belief systems.” My study will encompass one of these “other” religions – Hinduism – in order to add to the body of knowledge for the teaching of evolution from different cultural perspectives. As mentioned earlier, I will be especially focusing my research on South African Hindu Life Science teachers and learners.

1.3.1. Studies in South Africa on Teaching Evolution

My preliminary readings on the teaching of evolution in South Africa revealed a limited amount of information, indicating that not many studies were conducted in this field. Researchers such as Sanders and Ngxola (2008; 2009), Dempster and Hugo (2006), de Beer and Henning (2010), Chinsamy and Plagányi (2007), Durand (n.d), Parle and Waetjen (2005) are a few who have performed studies on teaching evolution in South Africa. Parle and Waetjen (2005) have performed a study that explores the reactions of African students on learning evolution. However, none of these studies had any data about how Hindu secondary school learners regard this topic. These gaps in the research field reiterate a need for my study which looks at the teaching of evolution from a South African Hindu perspective.

1.3.2. International Studies on Teaching Evolution

As an introduction to this study, it is necessary to look at similar studies in other countries in order to give my study some global perspective. Several studies have been conducted in American schools on the topic of teaching evolution. It was revealed that 51% of the people polled agreed that evolution should be taught in schools together with alternative theories such as intelligent design while in the UK, 54% of the people surveyed agreed with the same question (Shepard, 2009). This shows that most of the population in America and the UK is actually in favour of teaching alternative viewpoints to evolution.

However, it seems that in the USA, schools are at the mercy of the country’s leaders who are “fundamentalists, truly ignorant of evolutionary theory” (Sherrer, 2005:45). It is therefore their voice that is heard in state meetings about excluding evolution from school curricula, rather than the voice of scientists. The voice of fundamentalist politicians in the USA has resulted in the teaching of evolution being met with radical objections and public

outry. This included court cases in Kansas to restrict the content being taught and charging teachers in courts of law who decided to teach evolution to learners. An example is the landmark trial of John Scopes, a teacher, who was charged in 1925 for teaching evolution (Sherrer, 2005) because it went against the biblical story of Creation.

The state of Alabama passed a bill recently that allowed teachers “to present scientific, historical, theoretical or evidentiary information pertaining to alternative theories or points of view on the subject of origins” (Sherrer, 2005:45). This shows that the state of Alabama is trying to open the discussion on evolution being introduced into schools. This new point of view has however, been met with some resistance from the creationist camp. A controversial comment was made by the Alabama Christian Coalition president Senator Beason in an attempt to protect creationist views. He said that this “bill could open the door to... undesirable alternative origin ideas like those of Hinduism” (Sherrer, 2005:45). Further studies into the Hindu perspective of evolution are therefore necessary to remedy such statements and promote tolerance rather than widen barriers between different cultures.

Sherrer (2005) also reveals results of a survey that was conducted among all the states in America to assess the level of high school education in terms of “making evolution the centrepiece of all life sciences.” The thirteen states that failed were those that either did not teach evolution or gave it less attention. According to this survey, the USA is at the bottom of the list among thirteen major countries for knowledge in the biological sciences. According to Sherrer (2005:46), America must allow freedom in science education for its people “if it is to compete effectively within the modern world” and to avoid being overtaken by Japan and Europe economically and technologically.

Although this survey was conducted in America, it shows the possible consequences of not teaching the topic of evolution in schools anywhere else as well. It emphasizes the importance of teaching evolution so that it is understood and also because it forms the basis of biology education as is effectively summed up in the oft-quoted statement by Dobzhansky (1973) that “Nothing in biology makes sense except in the light of evolution.”

The need exists then for South African schools to explore the recently introduced topic of evolution for its effective teaching and learning. This will in turn allow an enhancement in the understanding of the Life Science curriculum.

1.3.3. Necessity for Hindu Perspective in Teaching Evolution in South Africa

In South Africa, we are fortunate to an extent that the education policy has changed from the Christian National Education (CNE) system (1948 – 1994) that excluded any reference to evolution, to the present National Senior Certificate (NSC) curriculum that seems to embrace all the essential elements of evolution. This shows that South African politicians are not forcing their fundamentalist views (if any) on to curriculum developers to ignore the topic of evolution as has happened in the state of Alabama and is mentioned above in paragraph 1.3.2.

We are also the proud keepers of a constitution that proclaims equality of all races, cultures and religions. Dempster and Hugo (2006), however, mention the dual nature of school science to ideally allow learners to have basic scientific literacy while also stimulating them to pursue further study into scientific disciplines. This is especially important in South Africa presently where there is an increased focus on the development of science and technology among learners – LO 3 in the NCS (DoE, 2003) for Life Sciences – “interrelationship of science, technology...” or SA 3 in the new CAPS.

Teaching evolution affects this duality, say the authors, and “contradicts common sense and the deeply held religious beliefs of many communities within South Africa, whilst at the same time, being the key concept uniting the biological sciences.” The perspectives of these communities are therefore also important in contributing knowledge to the field of teaching evolution. This in turn can inform better pedagogy to enhance understanding of the topic of evolution. Hindus make up several communities around South Africa and their perspectives on this topic of evolution is therefore just as valuable as perspectives of other communities.

The apparent contradiction mentioned in the previous paragraph is discussed further by Dempster and Hugo (2006). They look at whether the new Life Sciences curriculum introduced into South African schools from 2006 gives learners a coherent picture of evolution as an organizing principle in Biology or whether it is taught as an end-result, where learners are only required to know the principles of Darwinian evolution.

Their study reveals that much work remains to be done in teaching evolution at schools in order to instill the former, which would be a more appropriate method. Furthermore, their study shows that the new curriculum “leaves the door open to other ways of knowing,

including creationism” (ibid, p. 111) and that this combines the empirical with faith-based knowledge so that learners associate them together. My study on the lived experiences of Hindu teachers and learners contributes to examining how evolution is taught from a different cultural perspective.

1.4. AIM OF STUDY AND RESEARCH QUESTIONS

This study therefore intends to examine the experiences of Hindu teachers and learners on teaching and learning evolution in schools today since most evolution–creation debates in existing literature has a Christian base. I would look at this debate (if it exists) in Hindu teachers and learners. This study would also add to the body of research on the teaching of evolution at schools as recommended by Dempster and Hugo (2006) in the preceding paragraph.

The following research questions allow these aims to be reached and will direct this study:

- 1) What are the lived experiences of South African Hindu teachers on the teaching of evolution in Life Science?
- 2) What are the lived experiences of South African Hindu learners on the learning of evolution in Life Science?
- 3) How do Hindu people view the process of evolution?

1.5. RESEARCH DESIGN

The topic of my study refers to the “lived experiences” of Hindu teachers and learners. As a result, my study will be a generic qualitative one with elements of phenomenology. The focus of a phenomenological study is to make sense of “the essence of experiences about a phenomenon” (Cresswell, 1998). I will therefore make use of mainly individual interviews with the subjects of my study, though focus group interviews were also conducted.

I used purposeful sampling selecting grade 12 Hindu Life Science learners as the participants in several focus group interviews. These interviews provided a general view of evolution amongst Hindu learners. Individual interviews with selected learners were then

done to obtain a more in-depth view. Hindu parents of learners taking Life Science as well as Hindu teachers of Life Science were purposefully chosen to take part in individual interviews. Hindu priests were also selected purposefully to engage in one-on-one interviews.

The scarcity of information available on evolution in the Hindu perspective provoked the need for these interviews with Hindu parents and Hindu priests. This cross-section of a Hindu community also allowed triangulation of my research since I obtained different perspectives to my questions. In addition, by interviewing different sections of the Hindu community, it allowed contextual analysis of the tensions laid out in the CHAT model.

1.6. RESEARCH METHODOLOGY AND DATA COLLECTION

In-depth individual interviews were carried out with Hindu parents of learners taking Life Science, Hindu Life Science teachers and with Hindu priests. Hindu Life Science learners were also individually interviewed. Focus group interviews were conducted with small groups of grade 12 Hindu learners taking Life Science from four schools in Johannesburg and Pretoria.

Some prepared questions were of a similar vein for all interviews in order to ascertain aspects that included whether respondents were practising Hindus; their knowledge of Hindu scriptures; how they as Hindus viewed the theory of evolution; etc. Other questions were specific to each group of respondent. (*See Appendices G to J for questions*).

All interviews were conducted in May 2011. By this time, the topic of Evolution had just been taught in schools and it was still soon enough for learners to remember details of the topic. Interviews were audio-recorded and then transcribed to facilitate analysis. Data was also collected in the form of a short questionnaire to teachers only, specifically on the nature of science. Although, this added micro-elements of a quantitative study they were insufficient to give this study a quantitative methodology.

Since my study has elements of a phenomenological analysis, I was guided by the analysis outlined by Giorgi (cited in Moustakas, 1994). After the interviews were transcribed, they were checked for accuracy. I looked for patterns from the data, e.g. what are the

perceptions and barriers that teachers and learners face when dealing with natural selection and evolution? The following steps from Giorgi served as guidelines in the analysis:

- a) The interview transcriptions were all first read through in order to get a sense of all of them as a whole.
- b) Meaning units were then identified to help me understand the phenomena being investigated.
- c) Meaning units were defined and redundancies eliminated.
- d) Meaning units were integrated.
- e) Meaning units were articulated.

Content analysis was used to ensure a systematic and objective method of analysis. This entailed coding, re-coding, categorising, looking for recurring concepts, phrases, patterns and themes.

Triangulation of results was obtained by interviewing Hindu parents of children taking Life Science and a Hindu priest. They represented the role of the community in the activity system.

1.7. COMPLIANCE WITH RESEARCH ETHICS

In order to abide by the rules for ethical clearance, permission was sought from the GDE and from the District Office (D9) [*See Appendix A*]. All the participants (interviewees) in this study were given permission letters to sign. These letters outlined the study, assured them of the confidentiality of their responses, their anonymity, their prerogative to withdraw at any stage of the study and informed them that the interview would be audio recorded. The letters also informed them that they would receive feedback of the study once it was complete. Samples of these letters are included in the *Appendices B to E*. Actual letters are not included here since they contained real names of participants and schools and this would breach the confidentiality clause in this study.

1.8. OVERVIEW OF DISSERTATION CHAPTERS

Chapter One covered a broad view of the study in terms of the background to the topic and motivation for the study. The research questions guiding this study are included in order to focus the information that follows. A brief outline is provided on the research design and methodology for collection of data from the Hindu community.

Chapter Two contains a comprehensive literature review. The aspects of CHAT – the theoretical framework for this study; controversial conceptual change (CCC) that includes worldviews as well as Pedagogical Content Knowledge (PCK) will be discussed in terms of current literature. Literature on teaching evolution and the nature of science as well as of the theory of evolution itself will be analysed. An in-depth look at Hinduism related to the theory of evolution will also be presented. This literature study will encompass both research conducted in South Africa and globally.

Chapter Three presents a detailed description of the research design used as well as literature on the chosen methods. Research methodology will be described in detail. Aspects of the research ethics followed in the study will be included.

Chapter Four is a record of the data collected as well as analysis of this data received from the interviews as well as from the short questionnaire that teachers had to complete on the nature of science. It contains a detailed, critical discussion of the data obtained. This discussion will then be compared against the initial research questions. Conclusions will be made based on this in Chapter 5.

Chapter Five lists the findings, possible recommendations emerging from my study, limitations of the study and the way to future research are also included in this final chapter.

CHAPTER TWO

LITERATURE REVIEW

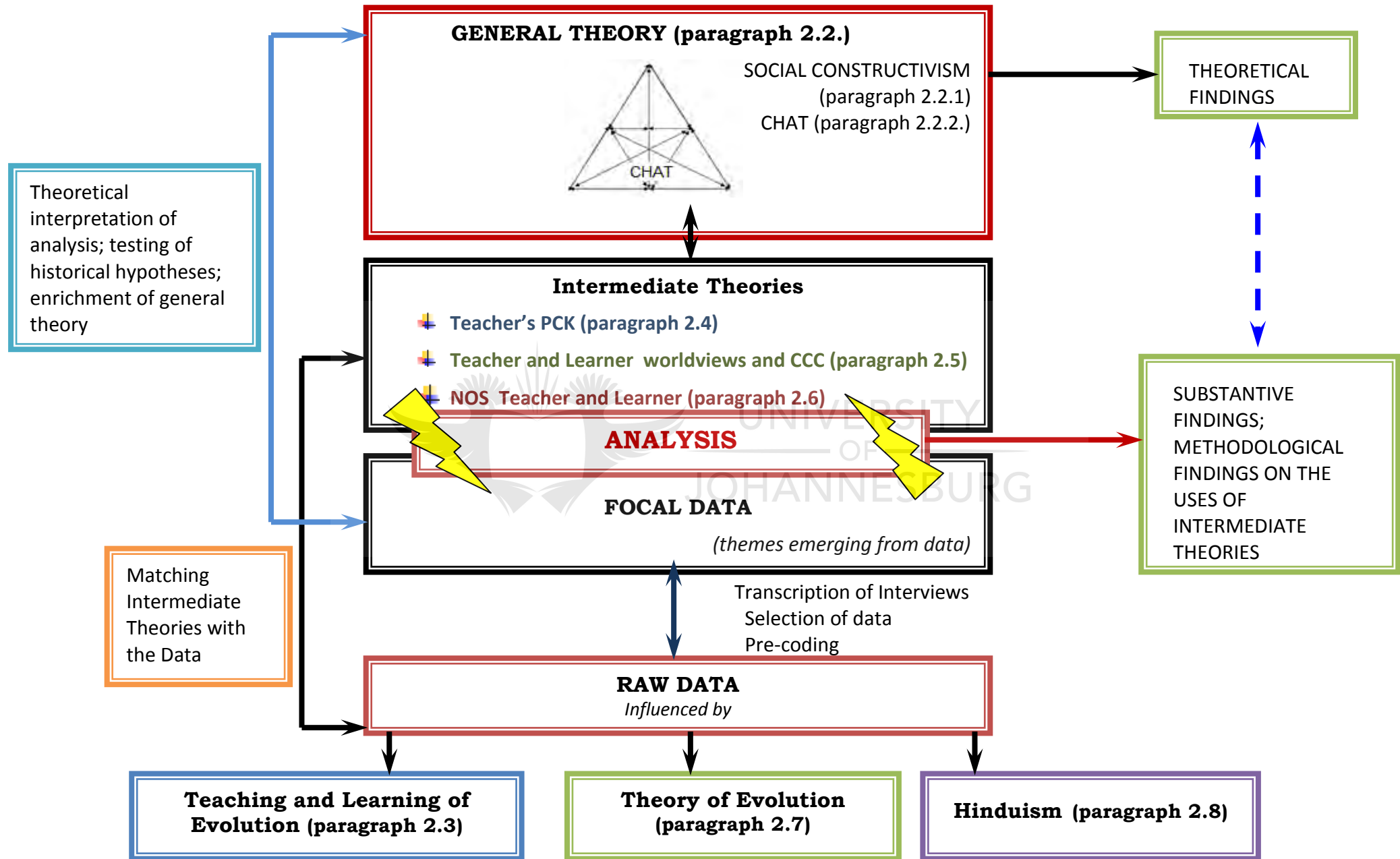
2.1. INTRODUCTION

My study is an investigation of the lived experiences of Hindu teachers and learners to the topic of evolution. As such, it requires an in-depth literature study that begins with the over-arching Cultural Historical Activity Theory (CHAT) which has its roots in the “grand theory” of social constructivism. This situates the study within a particular theory and allows the analysis of tensions that may exist in preventing learners and teachers from having a full conceptual understanding of the topic of evolution. CHAT will also allow an examination of the interplay between the various components that exist in the activity system of Hindu Life Sciences learners and teachers with regards to the topic of evolution. Engeström (2011), one of the foremost authorities on CHAT believes that it should not be used as a “cookie-cutter” theory. Rather intermediate theories are also necessary in order to further refine and contextualise the data in a study. Hence, my study also requires an analysis of literature on other studies based on the teaching of evolution in other countries as well as in South Africa. Since the teaching of evolution is paramount to this study, literature on the PCK of teachers and the NOS was also examined.

The lived experiences of teachers and learners require a discussion of CCC for how their worldviews contribute towards either understanding or accepting the theory of evolution or both understanding and accepting it. The theory of evolution itself will be presented as it is included in the South African curriculum with some attention given to human evolution. An introduction into the Hindu faith and some of its basic tenets is also done in order to make sense of interviewees’ comments and the relationship thereof to evolution.

Although these aspects are discussed separately as outlined above, it is important to note that there are considerable overlaps and links between them that will also be discussed as the literature review progresses. In order to navigate through this rather lengthy chapter, I have provided an outline of the various aspects that will be discussed here, in the form of a diagram: *[Adapted from Engeström, ISCKAR Conference, Rome, 2011]*

FIGURE 2.1 – NAVIGATIONAL TOOL TO POSITION INTERMEDIATE THEORIES IN CONTEXT OF THE CONCEPTUAL FRAMEWORK OF CHAT



2.2. THE THEORETICAL AND CONCEPTUAL FRAMEWORK FOR THE STUDY

According to Jansen (2008) a theoretical or conceptual framework is used in a study to analyse data and to explain why that data occurred. He differentiates between the two by placing a theoretical framework at a “higher level of conceptual organisation” that uses a “grand theory... to explain a particular set of events” while the latter depends on one or more concepts linked together “to explain a particular event.”

In my study, the “grand” theoretical framework used is that of **constructivism**, and more specifically social constructivism, with a particular focus on Piaget and his theory of how children learn. This theory is used because my study is directed towards how the topic of evolution is perceived by Hindu teachers and learners in a learning environment – secondary school – and within a specific curriculum – Life Sciences. How these learners and teachers perceive the topic of evolution is explained using a constructivist approach since they have to make meaning of the information they receive.

Within this broad theoretical framework of constructivism lies the **activity theory** which is used as a conceptual framework and has its roots in another constructivist, Lev Vygotsky. Making meaning is an active and reversible process that entails modification, transformation and an understanding of this transformation process (Piaget, 1964). The different elements in the activity theory (subject, tools, object, community, etc) and their interplay served as a means to coordinate the data received and make sense of it in relation to the topic of the lived experiences of Hindu Life Sciences teachers and learners.

Although both Piaget and Vygotsky were constructivists, they had contrasting views of how children learn. Piaget ascribed that learning begins with the individual based on his/her physical development (brain) and this leads to their social development. Vygotsky however, believed that learning started on a social level (ZPD) which then allowed a child to develop internally. Further discussion on these two theorists is done later on in this chapter (sections 2.2.1 and 2.2.2).

Each of these frameworks will now be discussed in greater detail.

2.2.1. THE THEORETICAL FRAMEWORK – SOCIAL CONSTRUCTIVISM

Constructivism is a theory of knowledge proposing that reality depends on an individual's constructions or perceptions. It contrasts with the realism theory of knowledge that proposes the existence of an independent reality that is waiting to be discovered - independent because it does not depend on the constructions of the perceiver. The foremost constructivist was Jean Piaget who stated that "the essential functions of the mind consist in understanding and in inventing, in other words, in building up structures by structuring reality" (Piaget, 1971:27 in Von Glasersfeld, n.d).

Piaget was regarded as a child developmental psychologist. Ginsburg (1985) states that Piaget's interest lay in "biologically-based forms of knowledge, not socially-based forms" and that his theory is focused on "biological epistemology." He was therefore interested in the cognitive development of children and theorised that they develop intelligence through a series of four stages based on their physical growth from birth to adulthood (Von Glasersfeld, n.d; Cohen and Younghee, 1999).

Using this biological background, Piaget regarded knowledge development as a spontaneous process linked to the process of embryogenesis (Piaget, 1964). This is of particular significance to my study which is grounded in the Life Sciences curriculum. Piaget (1964) believed that "learning is subordinated to development" meaning that the maturation of biological structures in the nervous system dictates how and when learning will occur hence his four stage theory of cognitive development in children is linked to their physical development.

Of further significance to my study is Piaget's use of the theory of evolution in explaining knowledge development, specifically of the notion of adaptation, to explain how our knowledge constructs achieve a "coherent balance that avoids internal contradictions" (Von Glasersfeld, n.d). The implication is that our constructed knowledge of the world allows us to successfully interact and live in it. Our experiences allow the generation of knowledge that must fit reality. This fit may be different for each individual depending on how they perceive the reality. According to Piaget, a successful fit means that the organism is adapted within the limits of the environment and "adaptedness ... is tantamount to the ability to survive" (Von Glasersfeld, n.d citing Piaget, 1976:18). This is especially significant to my study

because the idea of adaptation is borrowed from Darwin's theory of evolution which considers how organisms evolve by adapting to their environment.

In his time, Piaget's theories of cognitive development went against the behaviourist theories of psychology and cognition where the behaviourists believed only in concrete evidence that could be "seen and measured in experiments, preferably in ... laboratories" (Von Glasersfeld, n.d). Piaget instead, considered the abstract – "the mind, ... concepts, meanings, purposes and ... knowledge" (ibid).

Unlike the behaviourists who viewed knowledge as a "static entity" (ibid) waiting to be discovered, Piaget, a constructivist, proposed that individuals were actively responsible for their own generation or construction of knowledge. Watts and Bentley (1991) explain that our knowledge is limited by what our cognition can produce. These authors regard constructivism as "the result of proactive mental construction" (ibid).

Piaget (1964) therefore considered knowledge construction to be an active process that in turn makes learning and understanding active as well. Ginsburg (1985) elaborates on Piaget's view "that to know something in depth requires that one rediscover the matter for oneself" and that this rediscovery entails active learning. According to Piaget, active cognitive development in children occurs as a result of three essential processes: **assimilation, accommodation and equilibration**.

Assimilation is the process where "people transform incoming information so that it fits within their existing way of thinking" (Siegler, 1995). It is the process used to acquire knowledge meaningfully as explained by Ausubel (1985), "New information is linked to relevant, pre-existing aspects of cognitive structure and both the newly acquired information and the pre-existing structure are modified in the process." This shows that in order for new knowledge to be constructed in an individual's mind, new information received must be actively assimilated or integrated with their existing knowledge framework in order to ensure meaningful learning of that new information.

"**Accommodation** refers to the ways in which people adapt their ways of thinking to new experiences" (Siegler, 1995). Von Glasersfeld (n.d) explains that accommodation occurs when experiences are assimilated but they don't fit with the existing

knowledge, it then “creates a perturbation” which then means that the experiences must be changed.

Equilibration includes both assimilation and accommodation by allowing an interaction between existing ways of thinking with new experiences. According to Siegler (1995), equilibration is the “overall keystone of developmental change within Piaget’s system.” This keystone is therefore a hallmark of active and meaningful learning.

Most people have existing worldviews that stems from a religious upbringing. Very often this worldview conflicts with scientific knowledge as shown by studies on the Christian and Islamic perspective on evolution (Naudé, 2012 and Yalvac, 2011). In this case accommodation will then become a necessary process for any meaningful learning to occur. This is illustrated simplistically in the following example:

Many Christian and Muslim teachers and learners believe completely in the story of Creation as expounded in their respective religious texts – this is then their existing worldview. However in Life Sciences, the theory of evolution states that life evolved on Earth over billions of years by natural selection, resulting in the present diversity of life – this is new information that is perceived to be in conflict with their existing worldview. If these learners and teachers are to engage in meaningful learning, their existing knowledge structure must change to accommodate this new information. Alternatively, this new information forms a new structure in their psyche which must in turn be accommodated [*Source*: anecdotal evidence].

Learners and teachers of these faiths therefore have to engage in the process of accommodation to understand the theory of evolution as a result of these tensions. The Hindu religion, on the other hand, has several similarities with the theory of evolution as explained in section 2.8 of this dissertation. This implies that in order for learning of the theory of evolution to occur amongst Hindu learners, assimilation rather than accommodation ought to occur. In other words, Hindu learners ought to change new information to fit in with their existing knowledge and way of thinking.

However, the process of accommodation is not as easy to achieve as described in the simplistic example (researcher’s own example) due to the clash between prevailing worldviews and scientific knowledge. Hardy and Taylor (1997) attribute this

difficulty to accommodation being a cognitive process that depends, most often on the profound influence of society and culture on people.

Generally, however, although Piagetian theory appeared not to focus on the social influence on a child's cognitive development (Rogoff, 1990; Ginsburg, 1985), society's role on cognitive development is clarified: Piaget theorised that children begin their cognitive development on an individual level and gradually use society to advance this development as they grow older.

On the other hand, Vygotsky (who laid the foundation on which followers like Leontiev and Engeström developed the activity theory), theorised that children use social guidance to help them communicate and make their own meaning of activities (internalisation) and that this in turn would allow them to achieve individual cognitive growth (Rogoff, 1990). This contrast between the two theorists of how children learn is effectively summed up by Rogoff (1990:144), "For Piaget, development moves from the individual to the social, and for Vygotsky, development moves from the social to the individual." Howe (1996) echoes this difference between the two constructivists by stating that cognitive development according to Piaget is based on the individual's internal level of maturation while for Vygotsky, this development is based on the external social world of the individual.

However, it must be emphasised that Piaget was no detractor from the important role that society played in a child's cognitive development. According to Von Glasersfeld (n.d), "Piaget did not ignore the role of social interaction" but gave it due recognition in accordance with the child's physical development. Piaget was able to distinguish between the types of knowledge needing individual attention that eventually gave rise to those that depended on social influence – a progression based on the child's physical development from birth to adulthood as stated previously at the beginning of paragraph 2.2.1.

The theoretical framework of constructivism is therefore necessary in my study in order to understand how children learn and make meaning of new information (the theory of evolution) especially if this information is in conflict with their existing worldview (their religion). The process of meaning-making depends both on the individual as well as on societal influence, that is, both the theories of Piaget and Vygotsky are used to direct my study. The societal role in achieving meaningful

learning for the individual child is the focus of the conceptual framework of this study – CHAT.

2.2.2. THE CONCEPTUAL FRAMEWORK - CHAT

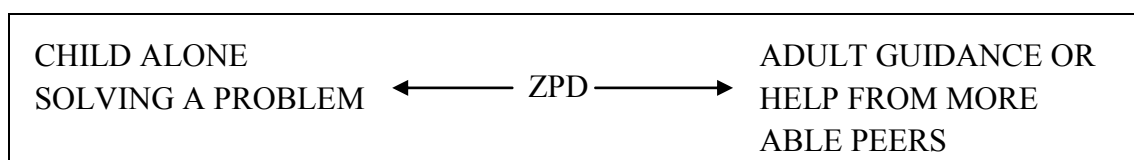
The Cultural Historical Activity Theory (CHAT) originated in the work of the Russian psychologist Vygotsky (Blunden, 2011; Stetsenko and Arievitch, 2004). Although CHAT is the over-arching theory of my study, it cannot be used as a cookie-cutter model. Instead CHAT is also influenced by several intermediate theories such as PCK, NOS, CCC and worldviews. These will be discussed in great detail later on in this chapter. However, a detailed discussion of CHAT is necessary before that.

Vygotsky is renowned for his idea of the Zone of Proximal Development (ZPD) which he defines as:

The distance between the actual developmental level as determined by individual problem solving and the level of potential development as determined through problem solving under expert guidance or in collaboration with more capable peers.

(Vygotsky, 1978:86; italics in original)

This definition can be represented diagrammatically as follows:



The guidance received will allow “developmental processes” in the learner to become internalised which will in turn “become part of the child’s independent developmental achievement” (Vygotsky, 1978:90). This will allow for meaningful learning as explained for the process of assimilation to take place.

This means that Vygotsky (1978) draws from Piaget, with his view that learning is both a social or collaborative action as well as an individual one. He theorises that in children, their development of culture occurs on two levels: “First it appears on the social plane, and then on the psychological plane” (Vygotsky, 1978:163). He refers to the former as inter-psychological and to the latter as intra-psychological. This process

of the social becoming the psychological is called **internalization** by Leontiev (1981) in Tharpe and Gallimore (1991).

According to Vygotsky (1996) “Culture is a product of man’s social life and social activity.” It is therefore man’s interaction with other people in society that creates a culture. This culture in turn, is responsible for the generation of world views in people that are difficult to cast out in place of scientific knowledge as the discussion showed in paragraph 2.2.1 with regards to the Piagetian concepts of accommodation, assimilation and equilibration of knowledge. In addition, Vygotsky (in Howe, 1996:43) regarded social interaction as indispensable to the individual cognitive function as well as to the “functions of assimilation” thereby integrating the Piagetian concept into his own socio-cultural theory.

These views must be considered when looking at how Hindu learners regard the topic of evolution. These learners, like learners of other religions, do not enter the Life Sciences classroom with an empty mind – instead they are deeply influenced by several ideas, some of which come from their parents, religious leaders, past teachers and even their peers. Children, therefore learn and make sense of new information in the context of their environment. They use their social environment (i.e. other people) as a “prism” “to refract” their learning experience (Vygotsky, 1978). The community plays a pivotal role in moulding this experience for children, hence the need to use CHAT as a framework for my study. The contextual basis for learning is dealt with later in the paragraph 2.5 on scientific and everyday concepts that children are confronted with.

As mentioned previously, Vygotsky, as a social constructivist, emphasised the role of society and culture in the learning process that children undergo. His main principle, according to Rogoff (1990), was “that higher mental functions are internalized from social interaction.” This process of internalisation was echoed by Piaget who “focused on the active involvement of the child *as an individual* working with objects and making sense of the world through that activity” (ibid, p. 34; italics in original). Piaget, unlike Vygotsky, did not place much emphasis on the socio-cultural influence for children’s learning especially in the early years due to their as yet incomplete physical development but theorised that all knowledge is the result of an individual’s own construction. Von Glasersfeld (n.d), in support of Piaget, states that new ideas

are “generated by an individual’s novel organization of perceptual and conceptual material.”

Hardman (2008) uses Vygotsky’s ZPD to explain that children learn more with assistance from more experienced others than if they learn on their own – this assistance is referred to as “mediation” and occurs on a social and cultural level between the children and the more knowledgeable teachers. Life Sciences teachers therefore need to be well-trained and knowledgeable in order to effectively mediate learners’ understanding of topics, including the topic of evolution.

The mediation of cognitive and social development is enabled by means of “cultural tools and signs.” One of these cultural tools is speech which gives “meaning to action” (Duran *et al*, 1998:314). Vygotsky was mainly focussed on language and speech development relative to thought and in a series of experiments in the 1960’s, Vygotsky concluded that communication could be integrated with tool-assisted problem solving (Kozulin, 1990).

Hardman (2005a) explains further that “every experience the child has is mediated by cultural tools.” Vygotsky (1978) believed that “artefacts mediate all human action;” that this mediation exists between the subject and object of action and that this subject is usually an individual (Beatty and Feldman, 2009). Foot (2001:60) elaborates that an action for Vygotsky is made up of three aspects: a subject, an object and mediational tools that are represented as Vygotsky’s first generation activity triangle:

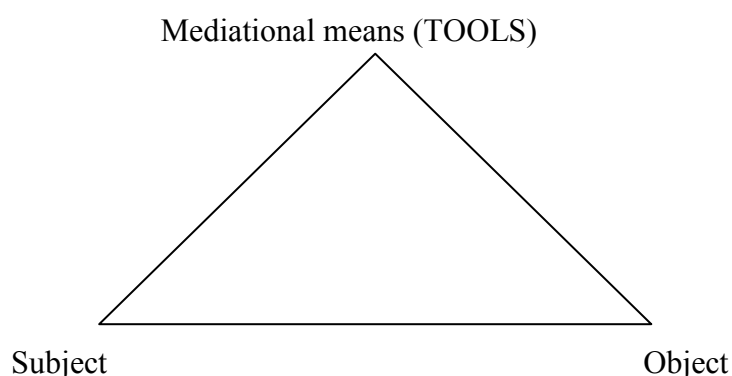


FIGURE 2.2 – VYGOTSKY’S FIRST GENERATION ACTIVITY THEORY
(Engeström, 1987 in Beatty and Feldman, 2009)

The emphasis of this first generation activity model is on the individual’s behaviour and how their actions on objects are culturally mediated (Beatty and Feldman, 2009).

In other words, the model focuses on the influence of social, cultural tools on an individual's behaviour. However, this model does not explain how the individual responds and contributes to the collective, collaborative activity of learning in society (Hardman, 2008; Beatty and Feldman, 2009). This shortcoming was then addressed by one of Vygotsky's students, Leontiev (1981) in Hardman (2008) who devised a second generation activity theory:

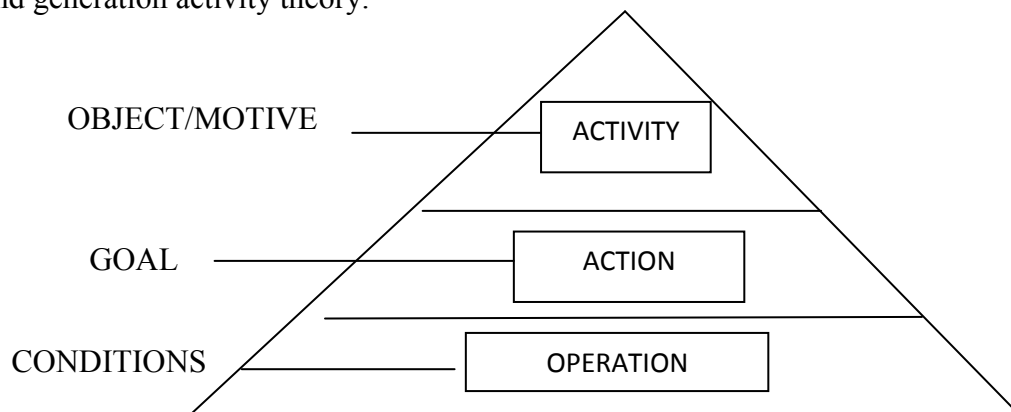


FIGURE 2.3 – LEONTIEV'S SECOND GENERATION ACTIVITY THEORY (Hardman, 2008:70)

Leontiev's model serves to show that unlike Vygotsky's notion of individual activity being goal-directed and short-lived, "collective activity is object-oriented" and more long-lasting (Hardman, 2008:70; Engeström, n.d; Foot, 2001). For Leontiev, an activity system was made up of a community, rules and division of labour in addition to the three aspects covered by Vygotsky, that is, subject, object and tools (Beatty and Feldman, 2009). Stetsenko and Arieivitch (2004) state that Leontiev's theory is centred on the idea that individuals attain the "cultural norms and experiences of previous generations" – thus adding to the collective nature of the activity system.

The central notion that these authors describe is that the self used to be regarded as an individualistic, separate entity but is now seen to be influenced by social factors – "The shift away from strictly individualist notions of human subjectivity and development is quite evident...the self is presented as being profoundly shaped by social factors..." (Stetsenko and Arieivitch, 2004:477). This notion is linked to the theories of Piaget and Vygotsky who both, albeit in different ways, gave credence to the contribution of the social towards the development of the individual.

Leontev believed that “an object is not an ‘end’” (Foot, 2001) but uses the word “horizon” to characterise it – just as a horizon can never be reached even though it can be seen, similarly, an object is seen as the intended goal but can never be fully attained since it is constantly being re-defined and re-constructed as the activity changes.

Roth and Lee (2007) draw a fitting analogy explaining how the operation, action and activity of Leontiev’s second generation activity theory relate to each other. They compare these three facets to the interweaving of fibres, strands and eventually thread – moving from the microscopic to the macroscopic view. An activity, like thread can be seen and is exemplified by tangible objects and motives such as planning lessons and managing curriculum implementation.

In turn, the individual strands making up this thread can only be discerned upon closer magnification of the thread, just as the finer components of an activity are found to consist of concrete actions that are achieved through particular goals. Further magnification of strands reveals microscopic fibres which cannot be seen with the naked eye. Similarly, concrete actions can only take place as a result of operations that come from an unconscious level that are intangible and cannot be seen. These operations are dependent on the initial goal and conditions of that learning context. The relationships between each level just described are dialectical because they each influence the other – once again emphasising the collective nature of an activity system (ibid).

Thus teaching and learning the topic of evolution would be facilitated by a collaboration that includes the individual’s view of the topic amidst a collective background of their previous knowledge and perceptions as Hindus. This background is however, not shown in Leontiev’s model.

The third generation activity theory was proposed by Engeström (1987) and is used most often and most effectively to show the development of an individual’s actions into a social collaboration with the aid of certain tools or artefacts (Hardman, 2008:70). Engeström elaborates that such social activity can only occur if there is division of labour among the community members and if there are rules to govern the actions of the subject towards an object (Engeström, n.d; Foot, 2001). According to

Engeström (n.d), “an activity system is built around its object” thereby establishing the importance of the object which gives the system its durability.

The six aspects forming the third generation activity theory are inter-linked with multi-directional two-way arrows that show the dynamic interplay between them.

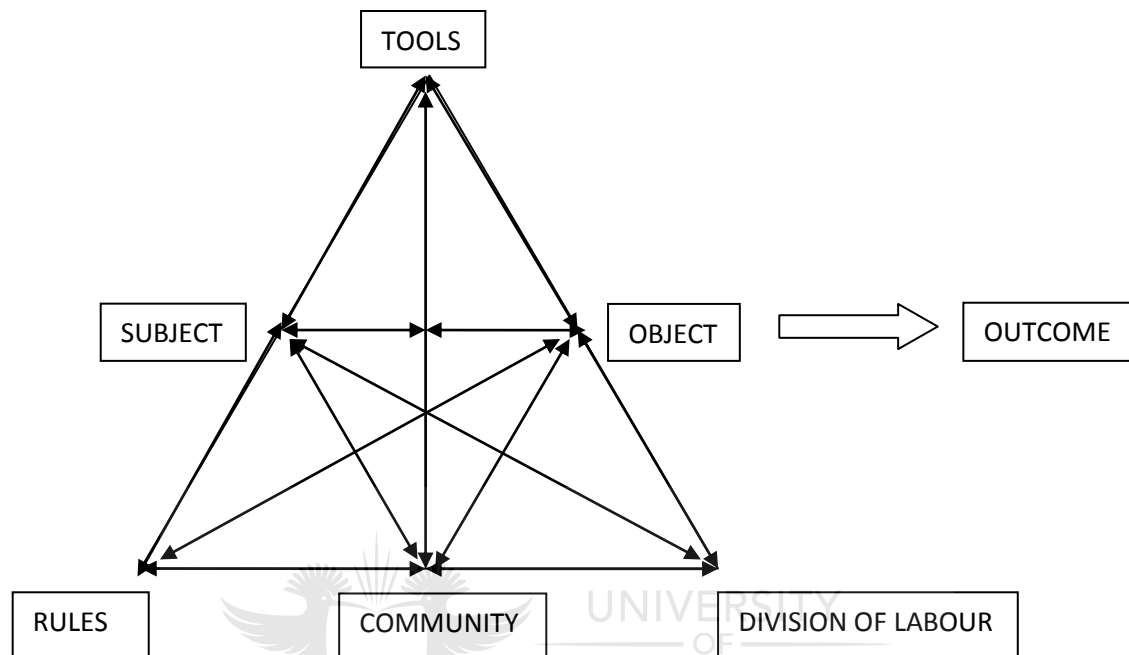


FIGURE 2.4 – ENGESTRÖM’S THIRD GENERATION ACTIVITY THEORY (Engström, 1987 and Hardman, 2008:71)

This model is referred to as CHAT by Engeström *et al* (Beatty and Feldman, 2009:4; Engeström, 1987:78) – FIGURE 2.4. The use of CHAT as a conceptual framework for my study therefore enables a multi-dimensional, activity-based analysis on which to focus attention.

This activity triangle clearly shows a combination of Vygotsky’s first generation model with Leontiev’s second generation model. The action of the individual (subject) is represented in the upper half of the triangle while the lower half links the individual’s actions to the collective, social aspect (Hardman, 2008:71) – almost as if the social is a foundation for the development of the individual. The merging of the two models shows the influence of the social on the individual as suggested by Vygotsky who emphasised the role that society plays in developing the individual. The dynamic nature of this influence is represented by the double-headed arrows, indicating that this activity system is not static but constantly developing.

The dynamic interplay between the six components of the activity system is also faced with conflict or tensions. Foot (2001:63) refers to this as “contradictions” that allow the “activity to develop rather than function in a fixed and static mode.” They enable growth to take place that can expand the activity system. Beatty and Feldman (2009) regard contradictions as one of the principles characterising CHAT and the central role they play in motivating change and development.

According to these authors, contradictions are not the same as conflicts. There are four levels of contradictions that historically accumulate structural tensions within and between activity systems and which give rise to “disturbances and conflicts” (Beatty and Feldman, 2009). Contradictions are therefore regarded as existing on a broad scale and carrying a legacy of discord between many activity systems while conflicts are more narrowly confined to each element in a single activity system. Foot (2001) emphasises that contradictions in an activity system allow the development of that activity and are not a sign of weakness that need to be conquered. Rather, contradictions can function in the ZPD of Vygotsky (1978) by forming a link “between an activity system’s present and its foreseeable future” (Foot, 2001:64). Capper and Williams (2004:9) regard contradictions (and disturbances) in an activity system as “fundamental concepts” that act as “potential springboards for learning, innovation and development.”

Roth and Lee (2007:203-204) and Capper and Williams (2004:9-10) identify four possible types of contradictions that can occur in an activity system:

1. Primary Level – within the parts of an activity system e.g. between rules
2. Secondary Level – between parts of an activity system e.g. between rules and the object
3. Tertiary Level – between activity systems e.g. the rules of one system compared to the rules of another system
4. Fourth Level – historical disturbance e.g. between the rules of the present situation and the rules of that situation in the past

The conceptual framework in my study uses Engeström’s third generation activity theory (CHAT) which draws attention to the secondary level of contradictions, hence

the double-headed arrows between the six parts. However, the four types of contradictions listed reveal that the activity system is dynamic on many levels.

In my study of the lived experiences of Hindu teachers and learners towards the topic of evolution, possible conflicts between various aspects of the activity system are discussed. This analysis is intended to contribute towards understanding the teaching and learning of evolution from different cultural perspectives.

Stetsenko (2008) presents an article that echoes this idea of collaboration where Vygotsky is constantly cited to confirm the importance of “social, collective activity” “at the centre of” human development. Of great relevance to the Life Sciences, is the notion that she uses of collaboration in a much wider field by discussing the value of humans acting together collectively rather than “fragmenting” themselves into individuals in order to rectify the current ecological problem that is facing the Earth. In other words, humans need to work together in unity to alleviate the negative effects of human habitation on natural ecosystems; sustainable development must be practised instead of individuals selfishly seeking self-gratification as is the present practice.



Stetsenko’s view was also shared by Sir David Attenborough in a documentary *Planet Earth – The Future* (BBC, 2011) who said that “the one thing that can unite the people of the world is the common goal of nature conservation. It can allow us to move away from the gross materialism that is plaguing the world and towards spirituality and unity of people.” This statement is especially significant since Attenborough makes specific reference to spirituality which is an aspect of my study that relates to Hinduism – a religion that has as one of its tenets the need to move away from the pursuit of material possessions and towards spirituality and the Supreme Soul which is the same in all living things. More details about these aspects of Hinduism will be discussed in paragraph **2.8**.

Of greater relevance to my study, is Stetsenko’s mention of human evolution being not only biological in nature but that humans are “agents whose nature *is* to purposefully transform their world” (Stetsenko, 2008:483). They are able to do this because of “the reality of cultural history of human civilisation in the form of a ... flow of collaborative practices of people aimed at transforming their world” (ibid).

She also agrees with the CHAT adherents that collaborative activity is what makes us human, "... human activity is taken in CHAT to be the basic form of human life... Activity is at the origin and is formative of everything that is human in humans, including their psychological subjective processes and the knowledge produced by them." These views emphasise the social nature of cognitive development proposed in Vygotsky's theory.

The activity system devised by Engeström is used as a conceptual framework in my study since it places the individual's actions at the apex of the activity system. It also provides a more complete picture of the subject who becomes influenced by many different aspects such as rules, division of labour and the community itself. I used the highly lucid explanation provided by Hardman (2008) to explain this model: It means that the individual (subject) is able to operate on the object so as to achieve a predetermined outcome using certain tools. At the same time, the subject is directed by specific rules, the community of which they are a part of and by a division of labour. The two-way arrows represent the dynamic (active) nature of each item on the triangle and how they are each able to influence the other – thus creating the ACTIVITY theory.

As already mentioned, according to Engeström (n.d:7), "An activity system is built around its object." In the case of my study, the object can either be from the perspective of the Hindu learner or from the perspective of the Hindu teacher. For the former, the object would be the effect of learning about evolution and its outcome of achieving some level of understanding. For the teacher however, the object would be the development of an effective PCK to teach evolution for enhanced understanding for learners from both a secular and a religious point of view.

In my study, the different points on Engeström's third generation activity triangle are represented as follows:

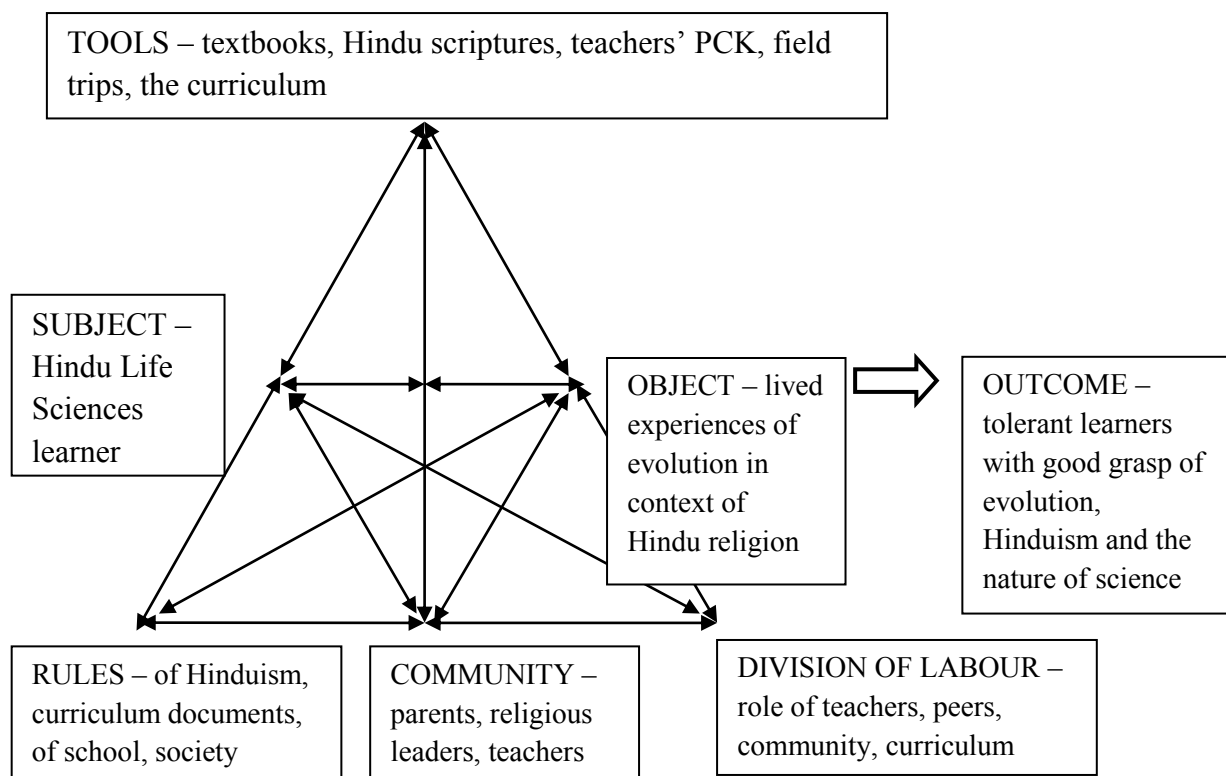


FIGURE 2.5 – THE LIVED EXPERIENCES OF HINDU LIFE SCIENCES LEARNERS TOWARDS THE THEORY OF EVOLUTION REPRESENTED AS AN ACTIVITY SYSTEM

The **subject** refers to the Hindu Life Sciences learner who is influenced by the **rules** of Hinduism as well as by the rules of the NCS document which prescribes what needs to be learnt about evolution. **Tools** such as text-books, the teacher’s pedagogy used in the classroom, field-trips and Hindu scriptures mediate between the learners (subject) in order to attain the **object**, which is the lived experience of learning about evolution from a Hindu perspective and achieving the Life Sciences outcomes set out in the National Curriculum Statement or the Specific Aims in the more recent CAPs document.

By acting on the object in a certain manner, he/she will achieve an **outcome** that should satisfy the goal of the NCS document in terms of the three Learning Outcomes specified there for Life Sciences. The **outcome** is also to develop tolerant Hindu learners with a sound understanding of the theory of evolution and the nature of science. All of this takes place within the context of the **community** which the learners are a part of, including the school, the religious groups and family unit.

The Hindu Life Sciences teacher including their PCK and their knowledge of the NOS, can also be the **subject** of an activity system as shown in FIGURE 2.6:

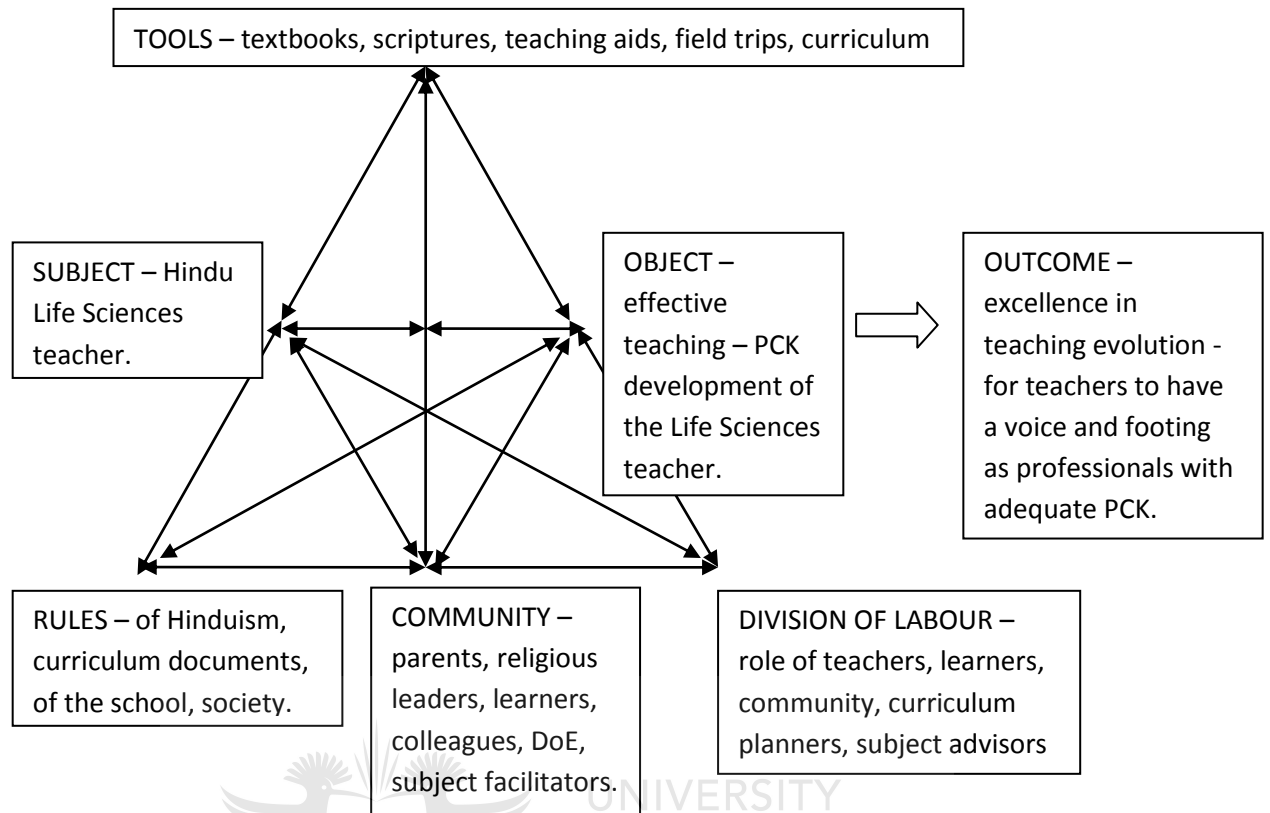


FIGURE 2.6 – THE LIVED EXPERIENCES OF HINDU LIFE SCIENCES TEACHERS TOWARDS THE THEORY OF EVOLUTION REPRESENTED AS AN ACTIVITY SYSTEM

Beatty and Feldman (2009) propose an unusual approach to using CHAT as a research lens, where he “combines” two activity systems (that of the teacher’s and learner’s experiences). He then makes use of the teacher as the subject and the learners as the object in this activity system. This is very useful in my particular study where the lived experiences of both Hindu learners and teachers are considered. This activity system is shown in **FIGURE 2.7**.

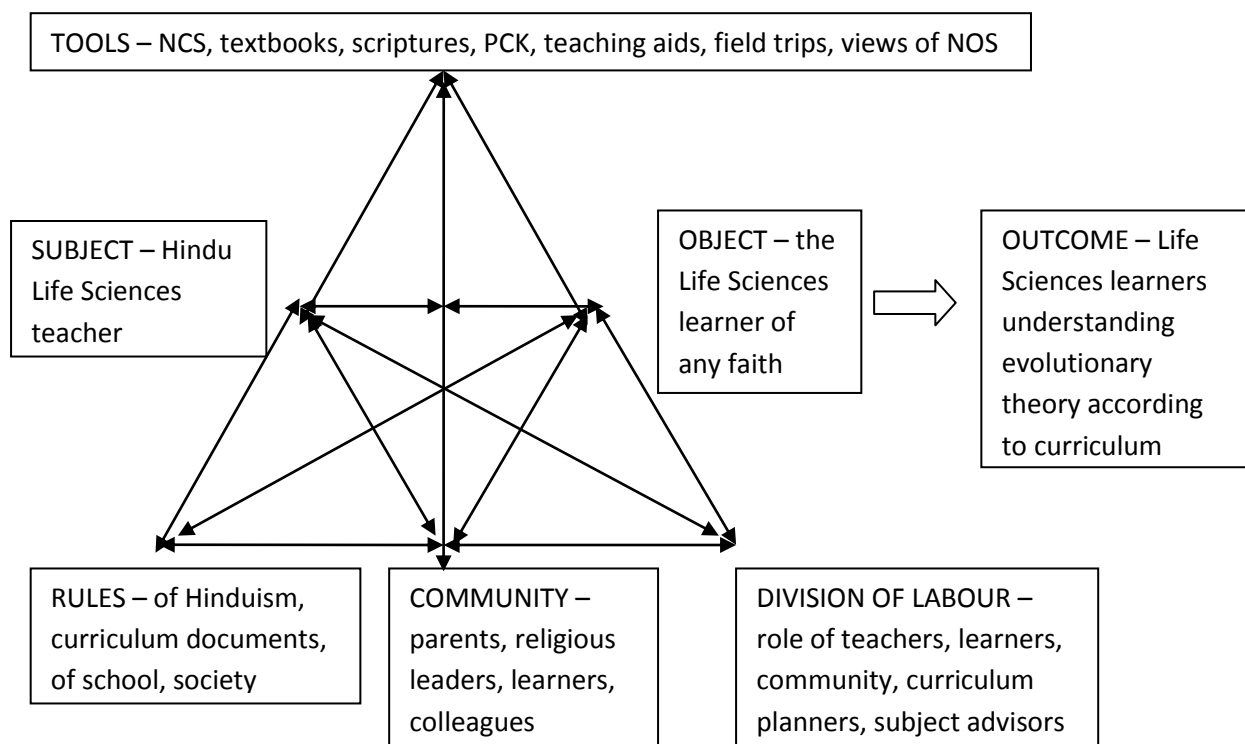


FIGURE 2.7 – THE LIVED EXPERIENCES OF HINDU LIFE SCIENCES TEACHERS AND LEARNERS TOWARDS THE THEORY OF EVOLUTION REPRESENTED AS AN ACTIVITY SYSTEM

The teacher is governed by the **rules** of the curriculum documents and the professional community to which they belong. Just like the learners, the actions of the Hindu teacher are also conditioned by the rules of Hinduism that have contributed to the formation of their own worldview. The **tools** available to the teachers are their PCK – linked to this are their views of the NOS, the language of instruction, workshops and teaching aids (chalkboard, data projector, videos, text-books, etc).

According to Capper and Williams (2004:6), a **tool** can be anything used by humans to influence the environment to achieve our needs, however, at the same time “the nature of the tools we use also shapes our own thinking about what to do and how to do it.” In my study, tools could be physical, cultural or theoretical in nature (Beatty and Feldman, 2009). Physical tools are for example the chalkboard or videos; cultural tools include the language of instruction and religious views; while theoretical tools refer to the notions of PCK, CCC and the NOS that the teacher has and which influences his actions.

The teacher as subject acts on the learner as the **object** (according to Beatty's (2009) use of CHAT as a lens) in order to achieve the **outcome** laid out in the curriculum documents. Ultimately, evidence of this outcome will be shown once the topic is taught, by learners who have a clearer understanding of evolutionary theory, the nature of science used to arrive at the theory and are then secure with their prevailing worldview.

The unit of analysis in this activity system is the teacher's professional development. The teacher needs to teach evolution to learners, and need to have the necessary PCK to also be able to address any religious objections that a learner might have. The **community** in which the teacher operates includes the school management team, cluster groups of other Life Sciences teachers from other schools, the subject facilitator, and parents of learners and on a more personal level, the religious group that he/she belongs to.

Division of labour is brought about in various ways - the teacher is responsible for disseminating knowledge while learners are responsible for internalising this knowledge and using it to advance their own understanding and worldview. It must be acknowledged that teachers also wear a second hat: that of lifelong learner. Many of our Life Sciences teachers never studied evolution in their undergraduate training, and many of them rely on professional development programmes for PCK development in this field.

It also occurs by the **community** in which the teacher belongs, where each member contributes differently to help the teacher fulfil his/her allotted responsibility. This help, however, is not always freely or consciously provided by members of the community. Usually, it is up to the teacher to use these contributions in the best way possible to fulfil the outcomes. An example of this could be where a parent is against the topic of evolution being taught to their child but the teacher could use this to explore different religious views about the topic in class.

The subject advisor also has an important role to play in the **division of labour** on the activity model with the teacher as the subject. Since the topic of evolution is new to the curriculum (only since 2008), many teachers are not so sure of their knowledge

about it to teach it well. This is evident from extensive studies conducted by Sanders and Ngxola (2009) with South African teachers. Many teachers therefore depend on facilitators, who are supposed to be subject-experts, to guide and support them through the process of teaching this topic.

Engeström's third generation Activity Model is used as a conceptual framework to guide discussion of the lived experiences of Hindu teachers and learners with the topic of evolution. This model will also be used to compare the tensions that exist among Muslim and Christian learners and teachers (Yalvac, 2011 and Naudé, 2012) with the results obtained in this study concerning Hindu teachers and learners. The teaching and learning of evolution has been the focus of many studies – internationally and more recently in South Africa as well. Literature based on these studies will now be reviewed.

2.3. STUDIES ON THE TEACHING AND LEARNING OF EVOLUTION:

This study concerns the lived experiences of Hindu teachers and learners with the topic of evolution in Life Sciences. One of the aspects that need to be considered in order to ground this study is therefore the manner in which evolution is taught and learnt amongst other religious groups of people. This has served as the basis for several investigations both internationally and to a lesser extent in South Africa – both of which are discussed in this section. It also highlights the gap that this study addresses: whereas there are many studies reported on in literature that examines Christian and Muslim perspectives, very little has been done in Hinduism.

2.3.1. INTERNATIONAL STUDIES:

2.3.1.1. Studies in India

Hindus comprise almost 80% of the population in India, the birthplace of Hinduism. However, an exhaustive search for any studies conducted in India regarding the teaching of evolution turned up a nil result. It seemed that there was no research conducted on this topic in academic circles using India or Hindus as an investigative unit. Once again this lack of information about the views of Hindu teachers and

learners on the topic of evolution reveals a gap in this area of knowledge and highlights the need for my study.

A great deal of research was instead found in several other non-Hindu countries where Christianity or Islam was the predominant religion. A few of these studies are discussed at length in the sections to follow.

2.3.1.2. Studies in the United States of America

America appears to lie at the forefront of studies into the teaching and learning of evolution. Downie and Barron (2000) in their study with Scottish students, state that the controversy surrounding the teaching of evolution is mainly an American occurrence. They state: “Outside the USA, creationism seems much less important.” Blackwell, *et al* (2003) cite Moore (2000) who states that “Creationism as a movement is usually identified with the United States. Abrie (2010:105) mentions that “the non-acceptance of evolution in the United States of America is well-documented” and that “in many other parts of the Western world, rejection is rare.” Audi (2009:23) reports that although the topic of evolution is standard in science education in most countries, “it remains a focus of controversy” at least in the USA. Numerous research papers from various American states are available on this topic, a few of which will be reviewed in this section.

A study on the teaching of evolution in America would be incomplete without reference to the landmark Scopes Trial of 1925. Teaching evolution in America has undergone several upheavals since the beginning of the 20th century. According to Austerberry (2000), between 1900 and 1920 American biology textbooks described evolution clearly but due to growing religious fundamentalism, their exposure steadily diminished. Laws were passed banning the teaching of evolution. However, in 1925, Scopes, a biology teacher was fined for defying the law by teaching the origins of man according to science rather than the creationist version. For the next 40 years, the issue of anti-evolution was deftly ignored by U.S. Supreme Court.

Then in 1961, new textbooks were published that re-emphasised the teaching of evolution – this was in response to the launch of the first artificial satellite by the Soviets. It became apparent to most of the American public that science and

technology in their schools was second-rate. The new text-books rekindled the evolution-creation debate. Many laws were then passed to allow the teaching of evolution without an influence of the creationist viewpoint. However, these laws were not strictly followed nationally since many states continued to debate what could be taught from a political and legal platform. This debate persists even today.

The near-preoccupation with the teaching of evolution in American schools seems to stem from the radical creationist sector of American society who does not support the teaching of this topic. Bowman (2008:70) cites the results of a recent Gallup Poll that reveals almost a 50:50 split between an evolutionary and creationism explanation for human origins for more than 25 years. In addition, a survey of American people conducted by the British Council revealed that “51% agreed that evolution should be on the curriculum alongside other theories, like intelligent design” (Shepherd, 2009). This means that the American public polled have remained almost equally divided in their stance on creationism or evolutionism for the past 25 years.

Surveys in 2000 by Gross show that even when evolution is taught in schools it is mainly taught “as a concept *lacking* scientific credibility” (Bowman, 2008:71, italics in original). When the theory of evolution is taught it is reported to be dealt with “in depth” by only 26% of high school students polled. This implies that the topic of evolution is not given proper attention by teachers. Bybee (2002:616) regards the exclusion of evolution from the curriculum as an assault on three levels, viz. “the integrity of science, the professionalism of science teachers, and the scientific literacy of all students.” Thus, even an improper coverage of evolution in schools can lead to problems on these three levels as well.

Anecdotal evidence mentioned by Bowman (2008:69) shows that “public high school science teachers skirt[ed] the theory of evolution or offer[ed] up creationism or intelligent design as valid alternatives.” This author defines creationism as the idea that all living things were created by God more or less in their present form and that no common ancestor is shared by man and apes. Studies by Moore *et al* (2011) show that many biology teachers in America teach creationism because of their strong religious beliefs together with their worldview that is entrenched in “Biblical literalism” (p.225). Bowman (2008:71) also defines intelligent design as the idea that

since living things are far too complex to have undergone the highly improbable process of evolution, then an intelligent designer must have been involved.

The idea of Intelligent Design was introduced into some American schools by the anti-evolutionists, when in 1987 the Supreme Court passed a decision that banned creationism from public high schools. The term creationism was then simply replaced by the term intelligent design, thereby retaining the idea of a grand architect but without overt religious links, in order to appease the Supreme Court ruling. Reiss (2009) explains that intelligent design has grown in political influence since the 1990's and that it attributes the "intricacy of the order we see in the natural world to an intelligence" (Reiss, 2009:1938). He states that natural selection is deemed to be inadequate because it is an undirected process and must therefore be ascribed to a designer.

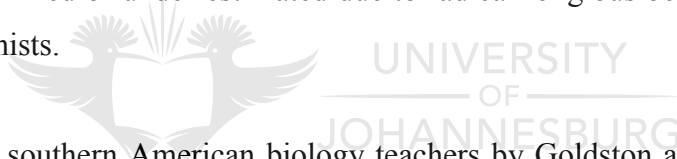
Creationism and Intelligent Design are viewed by evolutionists as being "not science, but an extension of a fundamentalist religious belief" and that the only place for creationism should be in philosophy courses rather than in biology or science courses (Blackwell, *et al*, 2003:58). The government of the United Kingdom has criticized both creationism and intelligent design as having no scientific basis that should only be discussed as part of religious education (Shepherd, 2009). This alludes to the statement made by Hammond in Cavanagh (2009) that science allows people to understand the natural world while religion should allow people to question why we are on earth and "how we should live."

There is therefore a place for both religion and science to co-exist without either being right or wrong, a point also raised by an Illinois teacher who quotes that both evolution and creationism are "belief systems that can never be truly or fully proved or discredited" (Berkman and Plutzer, 2011:404). In fact, some learners who started a biology course resisting the theory of evolution due to their religious convictions, eventually progressed to a position that combined science and religion. This was evident in studies conducted by Zimmerman (2006) cited in Nelson (2008).

Studies on Utah-based teachers by Chuang (2003) suggest that one of the strategies for students to allay their misconceptions about evolution is that they need to

understand the difference “between scientific knowledge and faith-based knowledge, as well as [to] understand that neither science nor religion encompasses all ways of knowing.” This comment implies that people should not restrict their notion of knowledge construction to only two ways of obtaining knowledge – science and religion – instead they should be open to other forms of knowledge generation as well.

However, despite these arguments from the two sides – evolutionists and creationists –advocates for the teaching of biological evolution believe that evolution is the primary conceptual idea that organises the various topics within the life sciences (Bybee, 2002). Rutledge and Mitchell (2002) regard the theory of evolution as the “central and unifying theme of the discipline of biology... and serves as an underlying framework of the discipline.” These views are aligned to the well-known statement made by Dobzhansky that “nothing in biology makes sense except in the light of evolution.” The importance of including evolution in school curricula therefore cannot be undermined or under-estimated due to radical religious beliefs, specifically from the creationists.



Studies of three southern American biology teachers by Goldston and Kyzer (2009) reveal that even though they are given autonomy in deciding whether to teach evolution or not, socio-cultural and socio-political factors play a more dominant role in undermining its importance in the curriculum. For example, text books in these southern states include evolution as a topic but also print a disclaimer about the controversy surrounding natural selection as a means for introducing large-scale changes for the diversity of life on earth. Examinations in these states also leave out questions on evolution thus implicitly suggesting to teachers that it is an unimportant topic that teaching time should not be wasted on. This indicates therefore that teachers lack the unequivocal power to teach evolution regardless of their individual beliefs or that of their students. Instead their decision about what to teach depends ultimately on state legislature, that is, on the prevailing political climate.

On the other hand, biology teachers in the American state of Indiana use the standards set by that state “to justify the teaching of evolution to administrators, parents, and students” (Donnelly and Boone, 2006:251). These teachers therefore respond

positively to the state-set standards and use them to enhance their teaching of evolution. Lerner (2000), cited in Donnelly and Boone, (2006) pronounced the state of Indiana's standards as excellent, a grading that has some link to the higher level at which evolution is taught. It is apparent, therefore that teachers make a difference in how the standards are interpreted and that the willingness to teach evolution freely has a direct bearing on the level of standards for that state. Lerner concluded that "unsatisfactory state standards appeared to be influenced by creationist ideas" (Donnelly and Boone, 2006:238).

His conclusion receives some confirmation from the study conducted with the southern teachers described in an earlier paragraph who were more opposed to teaching evolution in depth and used their state legislature to justify this resistance that was also partially due to their students' religious beliefs. The Indiana teachers however, used the state standards to improve their teaching of evolution. Differences in the teaching of evolution among different American states therefore exist, with some states having a more liberal attitude towards the topic than others. This difference seems to be more prevalent depending on the level of religious fervour with a leaning towards creationism as mentioned above by Lerner. Downie and Barron (2000) reaffirm this view that the "rejection of evolution correlates strongly with religious belief – mainly various sorts of Christianity or Islam."

Fowler and Meisels (2010) conducted studies on biology teachers' attitudes in the state of Florida. They found that there were a large number of science teachers with creationist beliefs and that these teachers were unable to merge their religious beliefs with science. One of the consequences of this discord was that Florida's science teaching standards received an "F" symbol in a national report. Fowler and Meisels (2010) study in Florida also showed that teachers who are comfortable with evolution being part of the school curriculum were more likely to use the state-set standards to justify teaching it – a view shared by the teachers studied in Indiana.

These teachers in Florida also felt that evolution was "a central principle in biology" that students needed to understand in order to understand biology (Fowler and Meisels, 2010). This once again alludes to Dobzhansky's earlier mentioned statement and highlights the necessity of including evolution in school curricula as a unifying

theme in biology. This in turn would lead to improved student achievement in science (Fowler and Meisels, 2010); a view shared by Nelson (2008) whose study shows that by teaching students evolution more effectively, it will enhance their ability to engage in scientific and critical thinking which will in turn increase their scientific literacy. As mentioned earlier, this emphasis on scientific literacy is also in keeping with Bybee (2002) who proclaimed that excluding evolution from school curricula would be an assault on the scientific literacy of students.

In summary, the studies conducted in the American states described above reveal that there is a divide between evolutionists and creationists. The latter group are driven by their religious (mainly Christian) beliefs and their inability or unwillingness to reconcile their religion with science. These religious fundamentalists are primarily located in the southern states of America while teachers in the northern states are more liberal and accepting of evolution. The northern states are also more willing to use enhanced teaching methods to improve the teaching and learning of evolution which they also acknowledge will improve the scientific literacy of their students. It will be interesting to see how South African Life Sciences teachers compare with their American counterparts regarding their views on teaching evolution.

Studies on the teaching of evolution in other countries will now be examined.

2.3.1.3. Studies on Teaching Evolution in Scotland:

Downie and Barron (2000) conducted extensive studies in Scotland over a twelve year period in which they looked at the level of evolution-rejection among first year university biology students. They found that there was a decrease in the number of students rejecting evolution over the 12 year period. These rejecters of evolution however made up only 4 – 11 per cent of the total number of students surveyed.

Surprisingly for the researchers they found that nearly 10.2% of medical students who took part in the study rejected evolution. The majority of these rejecters claimed to have a religious belief, “...most evolution rejecters did so on the basis of religious belief...” (ibid). There was a high number of Muslims amongst these rejecters, ranging between three to thirty two per cent over the twelve year period. Another researcher found that the “staunchest anti-evolutionists were Muslims.” (Short, 1994, cited in

Downie and Barron, 2000:7). This was also confirmed in a South African study, conducted by Yalvac (2011). Downie and Barron (2000) also found that a significant number of the rejecters classified themselves as Christian while the ones who regarded themselves as Catholic made up a lower proportion of the rejecters.

The findings of their twelve year study show that some first year biology students do not accept the cornerstone of science education, which is evolution, a process regarded by scientists to be the basis of the study of biology. However, the majority of students who participated in their study seemed to accept evolution. These acceptors noted that they did not find a conflict between their religion and their acceptance of evolution.

Therefore Scottish first year biology students generally have no problem with the theory of evolution, adding to the view that evolution-rejection is mainly an American issue – as Downie and Barron (2000) state in the introduction to their paper, “In the USA, biologists are increasingly worried by the impact of religious fundamentalists on the teaching of evolution.”

2.3.1.4. Studies in Lebanon:

Research was conducted on college biology senior students in Lebanon by Dagher and BouJaoude (2005) to ascertain how they regard the nature of evolution. They found that most students placed a great deal of importance on the nature of scientific evidence and scientific processes in order to accept or reject the theory of evolution.

In an earlier study where the researchers looked at how these students accommodated their understanding of evolution with their religious beliefs (Dagher and BouJaoude, 1997) they found that almost one third of their sample rejected evolution on religious grounds. These students preferred to accept their religion over scientific knowledge using the argument that the former is more permanent than the latter which is constantly changing as new evidence comes to light.

Hokayem and BouJaoude (2008) looked at Lebanese college students' views on the theory of evolution. They received similar results to that of the study conducted by Dagher and BouJaoude (1997) in that there was an equal spread of students who accepted and those who rejected the theory of evolution. Those who rejected the

theory did not cite their religion as a reason, instead the main reason for rejection was due to a lack of substantial evidence for the process of evolution occurring (Hokayem and BouJaoude, 2008).

The students in all of the Lebanese studies were either Christians or Muslims so there was no definite division between these two religions with regards to evolution being accepted or rejected. Thus, there appeared to be no conflict between Lebanese students' religious beliefs and their acceptance of evolution. This is surprising given the location of the study since Lebanon is regarded as a hot-spot for both Christian and Muslim religious fundamentalists – one would therefore expect religion to play a dominant role in students' worldviews and how they regard the theory of evolution. In fact, of the students surveyed in Hokayem and BouJaoude's (2008) study, only one male student rejected evolution on the grounds that it conflicted with his religious beliefs. However, he was even willing to consider that his religious texts were not to be interpreted literally at some points.

To reiterate, it is apparent that Lebanese students who are mainly Christian or Muslim, generally do not find a conflict between their religion and the topic of evolution. This view is in contrast to the fundamental Christian views on creationism that is evident in many schools in some American states as discussed in paragraph 2.3.1.2.

2.3.1.5. Studies on Teaching Evolution in Pakistan:

This controversy between evolution and religion in the West also forms the backdrop for a study in a predominantly Muslim country. Pakistan is a country where Islam is the principal religion practised by its populace – in 2006, 95% of the population was Muslim. A study conducted by Asghar, *et al* (2010) looked at how the topic of evolution is dealt with in Pakistani High School Biology curricula, where the “Islamic faith is the cornerstone.”

Islam is an Abrahamic-based religion and has many similarities to Christianity particularly the Old Testament. Creationism therefore also plays a dominant role in Islam in terms of the origin and evolution of life on earth. The rationale for Asghar, *et al* (2010) study is based on the lack of information on how Islamic scholars react to

evolution compared to the abundance of information available on how Christian theology and the West regard it.

The researchers analysed several biology text-books and curricula from various states in Pakistan with a focus on how evolutionary theory is handled. Remarkably, they found that the Pakistani high school biology curricula actually entwine religion and science with specific reference to evolution. This was in direct contrast to the American schools where a clear distinction is upheld between the two fields (Asghar, *et al*, 2010). According to the researchers, several Muslim scholars and academics in many Muslim countries have officially accepted evolution, although the general public is not altogether convinced.

The text-books analysed showed a weaving together of Islamic beliefs and Qu'ranic scripture with scientific knowledge. The Qu'ran is the main scripture for Muslims and can be compared to the Bible for Christians. The interweaving of science and religion is done in order to promote the primary objective that is the appreciation of Allah as the "Creator and Sustainer of the universe" (Asghar, *et al*, 2010:67). The biology text-books contain both religious text as it appears in the Qu'ran and scientific content in the form of hypotheses and the former is often used to verify the latter – thus creating no conflict in the reader's mind between religion and science. This format and wording of the Pakistani text-books allows many Muslims "to reconcile the scientific evidence with religious perspectives about the common origin and relatedness of all living beings" (*ibid.*). Thus it could be viewed as being almost the same as an Intelligent Design approach which has a mainly Christian origin.

According to this study by Asghar, *et al* (2010), the purpose of merging the fields of religion and science in Pakistani biology curricula is to strengthen conceptual links between them thus allowing the two fields to be compared and joined together. None of the text-books analysed by the researchers propose that creationism is an alternative to evolution – yet another distinction from how Western curricula handle the two fields of thought. The Pakistani text-books support evolutionary theory with scientific evidence and discussions of evolutionary mechanisms and some even use appropriate quotes from the Qu'ran to substantiate the theory of evolution (Asghar, *et al*, 2010), thus adding religious authority to the scientific content.

By incorporating evolutionary science with Islam, the Pakistani curricula and text-books send out a clear three-fold message to the students and general populace: that their religion permits the acceptance of evolutionary science; to strengthen their faith in Islam by assuring them that there is no conflict between their religion and science; and to reassure Pakistani society that science education is not a threat to their religious faith (Asghar, *et al*, 2010). The final claim made by the researchers is that Pakistani text-books and curricula do not go against the teaching of the theory of evolution.

These results show that in a predominantly Muslim country such as Pakistan, there are determined efforts to include evolutionary science in the school curricula without creating a divide between science and religion. The two fields are therefore not regarded as exclusive to each other where students are forced to choose one or the other – as is the case in many western schools.

According to other researchers cited in the study by Asghar, *et al* (2010), Muslims fall into a continuum of beliefs with regards to acceptance of the theory of evolution. At the one end are Muslims who fully accept evolution based on the available evidence and who recognise it as a “fundamental principle of modern science” (Asghar, *et al*, 2010:65) while on the other end are those Muslims who reject the theory because of a conflict between their religion and evolutionary theory. In between these two extremes are Muslims with varying degrees of acceptance based on how they have reconciled their religious worldviews with evolutionary evidence available (cited in Asghar, *et al*, 2010).

In Pakistan, religious authorities gave credence to the intertwining of Islam with science in school text-books, resulting in reconciliation between the two, whereas in predominantly Christian-based countries like America and South Africa, there is no official religious standpoint accepting evolution. Many people in these countries therefore cannot reconcile their faith with evolution, probably because they have not been given the religious authority to do so.

2.3.1.5.1. South African Muslim perspectives on evolution compared to Pakistani Muslim perspectives

To reiterate, the rationale for Asghar, *et al* (2010) study was based on the lack of information on how Islamic scholars react to evolution compared to the abundance of information available on how Christian theology and the West regard it. Borrowing from this rationale, therefore, my study is necessary in order to shed some light on how Hindus regard the theory of evolution, since the Hindu perspective is all but absent in most academic circles.

Studies conducted among South African Muslim teachers and learners by Yalvac (2011) and by De Beer and Henning (2010) showed that the majority of respondents do not reconcile their religion with the theory of evolution. Thus, many Muslim teachers and learners in South Africa were opposed to evolutionary theory because of their fundamental religious views and therefore could not accept it as an explanation for the origin and evolution of life on earth. A similar study by Naudé (2012) amongst Christian teachers and learners indicated more of a “mixed bag” of perspectives, with some Christians also having very fundamentalist views, and rejecting the theory of evolution. It must be noted, however, that South Africa is not a predominantly Muslim country, and that the curricula does not show a merging of any religion with the science of evolution – unlike the situation in Pakistan.

Perhaps this divide between the two fields in South Africa reinforces the differences between them by providing no authority on the permissibility of religion with scientific views – as was the case in Pakistan. Reiss (2009:1937) states that “many religions give weight to personal and/or ... institutional authority in a way that science generally strives not to do.” In other words, if a religious institution deems evolution to be acceptable then people will generally regard that seriously.

2.3.2. STUDIES ON TEACHING AND LEARNING EVOLUITON IN SOUTH AFRICA

The route to the present National Curriculum Statement (NCS) and more recently since 2012 the Curriculum and Assessment Policy Statement (CAPS), being adopted in schools across South Africa today is a historical one. It began with the political rather than pedagogical Curriculum 2005 (C2005), developed after the relatively

peaceful demise of apartheid in 1994 (Harley and Wedekind, 2004). C2005 was developed in a bid to radically transform the education system in a previously racially divided South Africa towards a more equal and integrated one that focussed on the learner and made the discovery of knowledge a new paradigm in schools.

Outcomes-Based Education (OBE) then became the new and often dreaded buzz word in South African schools and became the focus of much criticism and debate (Jansen, 1997; Rasool, 1999; Mahomed, 1999). Finally, nearly seventeen years after realising the abject failure of OBE, the government planned to replace it with yet another curriculum policy – Curriculum and Assessment Policy Statement (CAPS) – for implementation in grade 1 and grade 10 in 2012.

These curriculum reforms in South Africa whilst being ultimately politically motivated also sought to establish a degree of social reform and social equality (Dempster and Hugo, 2006) – concepts that were new to the fledgling democratic country. One of the means of achieving this was to introduce Learning Outcomes (LO's) to each subject (referred to as Learning Areas in the NCS). In Life Sciences the three LO's listed in paragraph 1.2.9 of Chapter One show that critical thinking, inquiry-based skills, interpretation of data and integration of different types of knowledge are a part of this curriculum, post-apartheid South Africa. In CAPS, the three LO's are replaced by three subject Specific Aims.

These aptitudes are supposed to promote a more free-thinking society who will not allow it to become indoctrinated by the propaganda of authorities as was the case during apartheid. Furthermore, during the apartheid era, education was deeply entrenched in Christian National Education (CNE), an ideology that “reflected the political and religious orientation of the state” (Parle and Waetjen, 2005:532). Evolutionary theory was also excluded from the curriculum before 1994 and Dempster and Hugo (2006:106) explain that this was “because it conflicted with the religious beliefs of the government” which were Calvinistic in nature and therefore rooted in the “absolute sovereignty of God” (ibid.). Under this ideology, the teaching of Biology was therefore “fragmented and content-driven, and also theoretically impoverished” (ibid.). The introduction of the aptitudes mentioned under the LO's by

the current government therefore strived to address “this legacy of scientific illiteracy” (ibid.).

2.3.2.1. Evolution in the South African curriculum after the demise of apartheid

The introduction of the topic of evolution into the Life Sciences curriculum since 2008 has been yet another milestone in South African education. The outline of this topic in the curriculum has been covered in greater detail in Chapter One, paragraph 1.2.1. Naledi Pandor, Minister of Education in 2002 “recognised the importance of mainstreaming biology and evolution in the schools (*sic*) curriculum” (Parle and Waetjen, 2005:526) in order to foster understanding “of racial variation and how it came about” (ibid.). The Minister’s intentions were therefore an attempt to improve race relations and promote social equality in South Africa, one of the core objectives of the new education system that began in 1994.

According to Odora Hoppers, a researcher cited in Parle and Waetjen, (2005:526), “Western religion, science and imperialism” have systematically “silenced and marginalised Indigenous Knowledge Systems.” This statement is of particular significance to my study which looks at how Hindus regard the theory of evolution. Hindus have a rich history of their own indigenous knowledge and their view of evolution has been largely ignored by the west – hence the need for my study – to draw attention to these views from a South African Hindu context.

Given that the topic of evolution has only been introduced into the South African curriculum since 2008, studies on the teaching and learning of this topic are very recent and not as extensive as in other countries. A study was conducted by Chinsamy and Plagányi (2007) on first year science students at the University of Cape Town (UCT) to gauge their knowledge of evolution and their attitudes towards learning about it. It was found that the students had limited knowledge of evolution as a result of them not having learnt evolution at school and encountering it for the first time at university. Many of the students also found it easier to accept simple factual information rather than more complex evolutionary concepts. The researchers concluded that this was because of their deep-seated religious views which probably interfered with their ability to be objective (Sinclair, *et al* cited in Chinsamy and Plagányi, 2007:251).

Learning about evolution also did little to change students' initial perceptions if they rejected evolution at the start of the study and this was attributed to the strong emotional ties towards their religion (Chinsamy and Plagányi, 2007). The researchers' findings are in accordance with similar studies in other parts of the world where the stronger the religious views the more difficult it is to accept evolutionary theory. Teaching and learning evolution therefore becomes more problematic because of this clash between religion and science and the failure of students to reconcile the two domains. The researchers refer to this as an "intellectual and spiritual dilemma" (ibid.).

A comparable result was found in a study conducted by Abrie (2010) at the University of Pretoria, another South African university targeting students training to become Life Sciences teachers. These students were surveyed before 2008 so they had not learnt about evolution at high school. The focus of this study was therefore to examine the attitudes of these pre-service teachers towards the theory of evolution and to see how willing they were to teach the topic once they became teachers. It was found that the majority of these student teachers had religious views that conflicted with the theory of evolution and that this would probably persist even after receiving training in the topic of evolution at tertiary level. A study undertaken by Lovely and Kondrick (2008:174) drew the same conclusion that even when more evidence is provided to students for the mechanics of evolutionary processes, it did not necessarily move their beliefs towards a scientific point of view.

Comparable to Chinsamy and Plagányi's (2007) study, Abrie's (2010) study also found that those students who were more religious, that is, who practised their religion more, "were more likely than their less observant counterparts to find evolution incompatible with their belief system and to renounce the theory of evolution" (Abrie, 2010:102). This view is shared by Trani (2004:423) who proposes that even when legally prescribed, teachers with strong religious convictions will be less likely to teach evolution. However, Trani (2004:425) counters his proposition by also stating that these teachers are often only a minority and that the majority of teachers with strong religious convictions have a sound grasp of both evolution and the nature of science.

Abrie (2010:106) concludes that the majority of student teachers polled in her study “are unwilling to teach evolution as a compulsory part of the curriculum.” If they do teach it they will probably give it only a cursory mention and may instead focus more on the aspect of creationism which they are biased towards. The issue of creationism may be raised by learners and if the biased teacher spends more time on it, it will perpetuate misconceptions in the learners’ minds since creationism “does not meet the criteria necessary for it to be considered a scientific theory” (ibid.). Such a situation has also been found to occur in American schools where teachers share a religious leaning towards creationism (Rutledge and Mitchell, 2002; Trani, 2004).

2.3.2.3. The impact on my study of excluding evolution during apartheid

Abrie (2010) provides a sound historical background for the exclusion of evolution from school curricula during the apartheid rule in South Africa. According to her, the hidden curriculum at school indoctrinated learners with ideas of religion, race, patriotism and creation. The theory of evolution was not even mentioned, thus instilling the ideas of creation and “a reverence for the Creator” (*Cape Education Department syllabi 1973 to 1996*, cited in Abrie, 2010:102) nationally for all schools in South Africa.

This means that Hindu people were also subjected to this Christian, creationist doctrine by attending the Indian-only schools during apartheid – thus having an implication for my study as well. The Hindu belief system was usually ignored in favour of Christian values and principles in an undemocratic country where the values of a white minority marginalised other ethnic and cultural groups’ values. Further impetus for my study lies in a concluding remark at the end of the second paragraph by Abrie (2010:102) that “... neither curricula designed for Bantu Education nor those intended for the education of whites made any reference to the theory of evolution” – thereby once again effectively excluding any reference to the minority groups to which South African Hindus belong and restating the need to investigate how Hindu people regard the theory of evolution.

When evolution was introduced into South African schools in 2008, many Life Sciences teachers were ill-equipped and reluctant to deliver the topic to learners. Because of the Christian ethos in an apartheid South Africa, many institutions of

higher learning did not include evolution in their teacher training curricula, and many teachers today have insufficient PCK regarding the teaching of evolution. One of the reasons for this was the overwhelming influence of teachers' religious views that clashed with the theory of evolution. This and other reasons were brought to the fore in a study carried out by Sanders and Ngxola (2009) who conducted a series of workshops to assist teachers with the topic of evolution that could be regarded as in-service educator training (INSET) for Life Sciences teachers in Gauteng. Several causes for concern emerged from the teachers attending the workshops and these will be discussed in paragraph 2.4 of this chapter which examine the pedagogical content knowledge of teachers (PCK).

2.3.2.4. Religious views in South Africa relating to evolutionary theory

However the researchers concluded that the major source of conflict stemmed from the misconceptions between religion and evolutionary theory where many teachers did not recognize that many key religions “do not see evolutionary theory as conflicting with their beliefs” (Sanders and Ngxola, 2009:124). Individual religious beliefs seen in isolation from the respective religious authorities therefore seem to be the greatest stumbling-block in the effective teaching of the topic of evolution. In the first year of its inception into the South African curriculum teaching the topic of evolution already seems to bring with it similar concerns expressed by teachers in international schools, particularly in America. These concerns are chiefly of a religious nature and pertain directly to the Christian idea of creationism.

The South African-based studies about the teaching and learning of evolution described above reveal different levels at which research were conducted. Dempster and Hugo's (2006) study examined the necessity of including the topic of evolution into school curricula that were previously devoid of this topic. Chinsamy and Plagányi (2007) as well as Abrie (2010) investigated the attitudes of first year university students on the topic of evolution while Sanders and Ngxola (2009) looked at the concerns facing teachers who had to teach the topic for the first time. Each of these studies revealed similar results pertaining to the strong religious influence of the participants. None of these studies looked at secondary school learners – my study therefore contributes to addressing this gap as well.

De Beer and Henning (2010) surveyed 310 Christian and Muslim teachers and eleven grade 12 learners of Life Sciences in Gauteng in an attempt to study the complexity of conceptual change in teachers and how their religious convictions contribute to this. They found that most of these teachers (many of whom are under-qualified to be Life Sciences teachers) hold misconceptions that are shared even by some well-qualified American teachers and that these arise from strong religious convictions. Furthermore, both Muslim and Christian teachers' religious views contributed substantially to how they taught the topic. Many of them believed wholly in their religious doctrine about the creation of life on earth and they attached no credibility to the scientific nature of evolution as De Beer and Henning (2010:21) state in their conclusion, "Hiervan blyk godsdiensstige oortuigings die belangrikste te wees." [*Translation: Of all of these the religious convictions are the most important*].

The above researchers are of the opinion that there remains a mammoth task in uniting religious views with evolutionary theory amongst both teachers and students of the Christian and Muslim faith especially. As an interim measure, it is probably more important to allow learners to understand the scientific method and to develop their cognitive skills rather than believing in the theory of evolution (De Beer and Henning (2010:8). They state "Inteendeel, al moet ons dan, soos so baie van die onderwysers gesê het, twee parallele werklikhede in gedagte hou, moet die wetenskapsdata aanhoudend voorsien word" [*Translation: In fact, if we then, like many of the teachers said, have to consider two parallel realities we have to promote scientific data*] (ibid: p.21).

In the absence of any reconciliation between the two, it seems therefore that the only solution is to get them to maintain two separate dimensions, that is, a religious and a scientific belief system. This study therefore implies that keeping the two fields separate while focussing on the correct scientific method is more desirable than merging the two and not teaching evolution and the nature of science correctly. This is also in keeping with the NCS and CAPS therefore, which seeks to promote critical thinking and inquiry-based skills.

2.3.3. Conclusion for the teaching and learning of evolution

In conclusion, the teaching and learning of evolution has been met with relentless controversy in the democratic USA where teachers of science are confronted with public and personal religious bias against this topic. The largely Christian-based country consists of the conservative southern states where the teaching of evolution is ostracized in favour of creationism and/or intelligent design; and the more liberal northern states where teachers appreciate the value of teaching their students the topic of evolution in order to dispel scientific illiteracy. As many researchers have stated, the topic of evolution faces the harshest criticism in the USA compared to any other western country.

Scottish students generally accept the theory of evolution and do not find a conflict between it and their religious beliefs as a result of the evidence available to support evolution. Lebanese students who can either be Christian or Muslim seem to share this attitude with their Scottish counterparts. Pakistan which is a deeply religious and conservative Islamic country is making concerted efforts to reconcile the scientific processes of evolution with relevant verses from the Qu'ran, thus offering some kind of religious authority to the people to accept evolution without fear of contradicting Islam.

South Africa, having had the topic of evolution only since 2008 in school curricula is slowly beginning to show signs of conflict between religion and science. These cracks are mainly as a result of the CNE that dominated South African education for almost sixty years by enforcing the belief in reverence for the creator. Many teachers are therefore still entangled in this indoctrination which prevents them from moving forward to being more receptive of evolutionary theory. The conflict that exists between religion and science has therefore been ignited in South Africa since the inception of evolution into the curriculum. Much work remains to be done in this field in order to remedy the situation.

The teaching and learning of evolution is relevant to my study because it examines the manner in which other countries and South Africa deal with this controversial topic. However the shortcoming of the preceding review (paragraph 2.3) is that it lacks any

reference to how the topic is dealt with by Hindus, particularly in South Africa. Hence my study is necessary to fill in this gap in this research field.

Many of the studies reviewed under paragraph 2.3 also revealed other problems facing the teaching of evolution besides the religion-science conflict. Teacher competence is a broad issue that needs careful scrutiny in order to provide effective teaching and learning on the topic of evolution. One aspect of teacher competence concerns teacher pedagogy which is the next aspect that will be discussed in this chapter.

2.4. PEDAGOGICAL CONTENT KNOWLEDGE (PCK):

One of the aspects that my topic deals with is the teaching of evolution. Teachers' ability to convey this topic to learners is therefore a crucial aspect in how evolution is received by learners. If teachers are poorly qualified and lack either the knowledge or the ability to teach, then this forms a barrier to how the topic will be taught. This has direct bearing on the CHAT model which looks at tensions in an activity system. Since pedagogy plays an important role in this process of teaching and learning, it is necessary to include the intermediate theory of PCK in my literature review in order to better understand how teachers' knowledge and skills can facilitate or hinder the teaching of this topic.

It has been mentioned in the previous paragraph that South Africa is a fledgling democracy with an education curriculum that is constantly changing – the more recently the NCS and now most recent, CAPS. As a result of the scourge of apartheid, South Africa has a legacy of inequality in many facets of society with schools being one of the most obtrusive. At the dawn of democracy in this country, the majority of teachers in the African township schools were under-qualified or not qualified especially for Mathematics and Science subjects. Most of them taught topics using the pedagogy that they were exposed to as learners – mostly by teachers at the same level of expertise as they were presently at (Rogan and Aldous, 2005).

Of particular relevance to my study is the impact of this type of teaching practice on the topic of evolution. According to Parle and Waetjen (2005) the apartheid era saw the replacement of some evolutionary theory with Biblical creationism in totality for Biology. This then resulted in this subject becoming “fragmented and content-driven, and also theoretically impoverished” (Parle and Waetjen, 2005:532). These authors continue by stating that science in schools under Bantu education was being “taught by teachers who themselves were increasingly inadequately prepared to convey its coherency and meaning” (ibid.). This once again reinforces the claim made by Rogan and Aldous (2005) in the previous paragraph that many teachers in South Africa teach their learners according to how they themselves were taught as learners by their teachers.

When the NCS was introduced, these teachers continued to use the same techniques. Rogan and Aldous (2005:332) state that “... teachers have attempted to make sense of C2005 in terms of their past experiences, which in most cases could not be further removed from the intended curriculum.” This means that C2005 which stressed a learner-centered, outcomes-based pedagogy and proposed an integrated knowledge system (Harley and Wedekind, 2004), was instead being taught by teachers who used their own experiences as learners as a frame of reference and this was in direct contrast to what the new curriculum wanted to achieve.

Research by Dempster and Hugo (2006) and Stears (2006 – cited in Sanders, 2008:94) show “that South African teachers have seldom themselves been taught about evolution and lack content knowledge.” In addition these teachers also lack the curricular knowledge and have their own misconceptions about this topic of evolution (ibid). This absence of a solid foundation in the topic of evolution is further outlined by Shulman (1986:8) who asks “What pedagogical prices are paid when the teacher’s subject matter competence is itself compromised by deficiencies of prior education or ability?” Teachers’ training and their own subject matter knowledge is therefore almost a prerequisite for good pedagogy.

In South Africa, many science teachers lack good teaching skills because their own education and training was inadequate to begin with (Rogan and Aldous, 2005). This perpetuates a vicious cycle since they in turn will impart poor science knowledge and

skills to their own learners – thus keeping the level of science in South Africa at a sub-standard level globally. It is therefore important for science teachers to receive adequate training before and during their teaching career in order to continually improve and enhance their existing knowledge base. It is also necessary for them to dispel any misconceptions that they may have from their own time as learners.

Good teaching skills are an essential part of teaching together with the knowledge and understanding of subject matter content. (Barnett and Hodson, 2001; Hanuscin *et al*, 2010:148). De Deer and Henning (2010:6) reiterate this view about education authorities wanting to have knowledge of their subject and know how to teach it – “onderwysers moet weet “van” en weet “hoe” [*Translation: teachers must know “from” and know “how”*] – particularly with regard to the topic of evolution. This duality was originally highlighted by Shulman (1986, 1987) who referred to it as Pedagogical Content Knowledge (PCK).

According to the earlier article, Shulman outlines the change in emphasis in American education since the 19th century up to the 1980's with regard to pedagogy. In the 19th century, the emphasis seemed to be on teachers' knowledge of the subject matter that they taught with the theories and teaching methods having secondary importance. However towards the 1980's this emphasis on subject matter knowledge was replaced with an emphasis on procedures and teachers' abilities to teach effectively (Shulman, 1986:5).

Shulman (1986:6) questions this dichotomy between subject matter knowledge and method of pedagogy and whether such a distinction ought to exist. This author cites a text which reveals that in medieval universities,

“.... instead of separating content and pedagogy (what is known from how to teach it), no such distinction was made at all. Content and pedagogy were part of one indistinguishable body of understanding.” (ibid)

Thus, it appears that even before the 19th century there was integration between subject matter knowledge and how to teach it. The separation emerged later on. In

South Africa, the Life Sciences curriculum prior to 1994 emphasised content knowledge that both teachers and learners had to know – the **product** of knowing the syllabus was more important than the **process** of learning it (*emphasis to be noted*). However, with the inception of the NCS, the emphasis for teaching and learning shifted from the product of content knowledge to the processes and skills that allowed learning to occur. Teaching the topic of evolution in South African schools requires a substantial amount of content that teachers have to know and understand before they can teach it. In addition, teachers have to be aware of cognitive and cultural differences amongst the learners in order to facilitate teaching a controversial topic. Thus, the PCK of teachers is essential. Sanders (2008) lists five problems that teachers encounter in the teaching of evolution including their misconceptions; lack of adequate teacher training; and the conflict of evolution with teachers' personal religious beliefs.

Shulman (1986:9) differentiates three types of content knowledge that make up one area in teaching. These three types are:

- I) Subject matter content knowledge
- II) Curriculum-related knowledge
- III) Pedagogical Content Knowledge (PCK)

Subject matter content knowledge deals with the actual content knowledge of a specific topic – in the case of my study this would be evolution and includes aspects such as natural selection, speciation, biogeography and human origins. **Curriculum-related knowledge** is concerned with teachers knowing how much detail the topic is to be taught in, as well as knowing about cross-curricular links with other subjects in the grade (“lateral curriculum knowledge” p.10) and knowledge of prior learning of that topic in earlier and later grades (the vertical curriculum). Shulman uses a fitting analogy to explain the versatility that a good teacher should have: Just as a good physician should be knowledgeable about different options that are available to treat certain ailments, similarly, good teachers need to know what resources to use in order to best convey the content to learners, as well as alternative resources that could be used if the prescribed ones are inadequate (Shulman, 1986:10).

According to Shulman (1986) good, skilled teachers use **PCK** in order to facilitate learners' understanding of the topics they teach. PCK has three facets that teachers need to know in order to be effective in the classroom, (Shulman, 1986:9):

- i) Typical difficulties faced by learners based on their age and background when learning a particular topic.
- ii) Likely preconceptions and possible misconceptions of students of different ages and backgrounds in the classroom.
- iii) Appropriate strategies for teachers to present the topic to the learners to ensure their understanding of it.

My study includes how Hindu teachers regard the teaching of evolution. These three facets will therefore play an important role in analysing how Hindu teachers use their PCK to teach the topic of evolution to their classes. My study will also contribute to how Hindu learners view the topic of evolution, thereby giving teachers a broader perspective of how learners of this background regard the topic – facets (i) and (ii). Barnett and Hodson (2001) reinforce this notion by stating “that individual teachers also draw on a store of *collective* teacher knowledge.” This means that my study will add to this collective body of knowledge. In my study I will also compare these three aspects of PCK with the PCK of Hindu teachers in teaching the topic of evolution.

According to Barnett and Hodson (2001:438), PCK is a subtle, complex kind of professional knowledge that is required of teachers and that is obtained mainly through “experience, discussion with more experienced colleagues, imitation, reflection on things seen and heard”. In their research they draw interesting differences between experienced and novice teachers in terms of their PCK. The latter are driven by content-loaded syllabi and external examinations which compromise their ability to teach based on the situation and background of their learners – instead they rely on didactic methods which lead to them having “simplistic views of teaching and learning” (Barnett and Hodson, 2001:433).

The former, on the other hand, are able to use their experience to give their learners “situationally appropriate learning experiences” (ibid) by using four types of PCK, i.e. the knowledge of:

- i) Learners' existing understanding.
- ii) Effective teaching/learning strategies.
- iii) Alternative ways of representing subject matter.
- iv) Curricular saliency.

These four types of PCK are seen to be an extension of Shulman's (1986) explanation of PCK mentioned earlier. These authors recognise Shulman for coining the phrase PCK whereby teachers have to both know and understand the subject content as well as how to teach this specific content effectively. Experienced teachers can teach subject matter in ways that are more easily accessible to learners by adapting their knowledge of teaching and learning methods (pedagogy) to the particular content. In this way, they are developing their PCK (ibid). Therefore pedagogy, as well as the nature of the subject matter, impact on successful science teaching together making up PCK.

Among many South African Life Sciences teachers who have only been teaching the topic of evolution since 2008, there is a lack of PCK concerning this topic. The main reason is due to the conflict that exists between their religion and evolution. Many teachers therefore ignore teaching the topic altogether or they "skim" through the content without delving into the details and depths of this topic (Sanders and Ngxola, 2009:123). This compromises learners' understanding of the topic and may also serve to compound existing misconceptions both for the teacher and for the learner.

In a study conducted by Abrie (2010) with university students training to become Life Sciences teachers, it was found that many of them "have deeply held religious views that are in conflict with the theory of evolution," that they will most probably retain these beliefs regardless of the training they have received and that these beliefs may interfere with successful teaching even after they have qualified (Abrie, 2010). This is a situation not unique to South Africa. Moore *et al* (2011) found that several biology teachers in America allowed their personal beliefs rather than science to determine the curriculum. The concern with this is that students who are taught evolution accept evolution more readily than students who are taught creationism which stems from their teachers' personal beliefs.

2.4.1. Conclusion for PCK

In summary, PCK, a term coined by Shulman (1986), is an important tool that teachers need to have in order to be effective in conveying knowledge to their learners. PCK includes subject matter knowledge, the skill of how to teach it to learners to ensure comprehension, and the ability to use resources and alternate resources if necessary in order to enhance this comprehension. Hindu teachers teaching the topic of evolution need to display adequate PCK just as teachers of other faiths ought to. Their PCK is examined in my study.

The influence of teachers' religious views specifically of Hinduism and their impact on how they teach the topic of evolution will also be analysed in my study. Religious views constitute part of the belief systems and worldviews that people have and these often impede the acceptance and understanding of a theory such as evolution. This aspect of worldviews and controversial conceptual change will be discussed in the next section in my literature review.

2.5. WORLDVIEWS AND CONTROVERSIAL CONCEPTUAL CHANGE (CCC):

My study which includes (the Hindu) religion would be incomplete without detailed reference to worldviews in my literature review. Discussion of the controversy between religion and science has not diminished since Darwin published his theory of evolution by natural selection (Rudolph and Stewart, 1998:1085). Religion plays a key role in establishing worldviews that people hold and as is seen, this influences how and what is learned both for learners and teachers. This has also allowed the inclusion of worldviews and religious beliefs into the science domain – allowing for warm conceptual change (De Beer and Henning, 2010) rather than cold objective knowledge.

Controversial conceptual change (CCC) is another intermediate theory that is framed by the over-arching CHAT because conflicts and tensions in allowing effective teaching of evolution do also arise from the worldviews of people. My literature study on teaching the topic of evolution (Paragraph 2.3) internationally shows much conflict

between it and religious views particularly Christianity and Islam. The influence of worldviews and how people internalise knowledge that conflicts with these can become a focal point of my study since it entails the Hindu religion instead of these two Abrahamic religions.

Worldview, according to Schilders *et al* (2009) is a concept that has its roots in German philosophy. It refers to a framework of beliefs and ideas through which a person interprets the world and interacts with it. This then allows an individual to formulate a comprehensive picture against which meaning is made of new experiences and phenomena in the world.

The preceding paragraph on PCK (2.4) focuses on the importance of teachers having both the subject matter knowledge and the expertise to deliver this knowledge effectively to their learners. One of the problems facing South African Life Sciences teachers is that many of them are not properly trained to teach the topic of evolution adequately. A great number of South African Life Sciences teachers only have teaching diplomas, without a BSc degree, and were trained at colleges with limited human and other resources (De Beer and Henning, 2010:6).

However, these authors point out that the lack of training is not the only problem facing the effective teaching of evolution. Even amongst American teachers it was found that despite almost ninety five percent of them being BSc graduates, they had many alternative concepts about evolution that contradicted the available evidence. For example, “Evolution cannot be proved. It is only a theory”; “transitional organisms are missing in the fossil record”; “people and dinosaurs co-existed” (De Beer and Henning, 2010:6). The authors found that many South African teachers also, often the less qualified ones share the same type of erroneous concepts as these American teachers. Thus, it appears that the personal worldviews and belief systems of the teachers supersede their training. Van Dijk (2009:260) qualifies Shulman’s definition of PCK by stating that “PCK refers to a teachers’ personal and private knowledge” thus linking teachers’ worldviews to their teaching.

Of particular relevance to my study is the comment by Cobern (1994) that “Nowhere in science is the overlap between scientific ideas and other ideas more clear than with

the theory of evolution.” This overlap is then taken into the classroom where both teachers and learners are influenced by their socio-cultural backgrounds which in turn could hamper the proper teaching and learning of evolutionary theory (Hokayem and BouJaoude, 2008:396). My study will attempt to explore the influence of Hindu society and culture on the teaching and learning of the theory of evolution in the classroom. It remains to be seen in my research whether the Hindu influence impedes the teaching and learning process as these authors have observed in their research.

Cavallo and McCall (2008:523) state that individuals view the world based on their beliefs and that this then influences how they learn. Therefore, worldviews can ultimately influence learning. According to S  ther and Maridal (n.d:10) social pressure can overpower attitudes if the person is easily influenced by the social viewpoint, whereas if a person is strong-willed and not easily influenced by society then personal attitude can overpower social pressure. Personal attitudes are a subjective norm and their conflict with societal influence reflects the conflict that exists in the CHAT model between individual thought or behaviour and society. These authors quote Ajzen who defines subjective norm as referring “to the perceived social pressure to perform or not to perform the behaviour” (S  ther and Maridal, n.d:7).

These authors also formulated the conceptual change model which includes “students’ capacity to live with unsolved conflicting views” (ibid). This shows that teachers who were students once may also be unable to change their worldview. In the previous paragraph on PCK it was mentioned that many South African Life Sciences teachers were themselves exposed to poor pedagogy that was often rife with misconceptions that may have led to them developing their worldviews. Thus it is important to resolve conflicting views in learners to prevent them from continuing with “such inharmonious thinking” (ibid) as they grow into adulthood.

It would therefore also be a challenge to teach learners the topic of evolution since they too come into a classroom with their own beliefs, worldviews and misconceptions – each of these needs to be addressed by good pedagogy so that the topic can be understood effectively. Van Dijk (2009:259) is of the view that learners have pre-scientific conceptions and that it is the goal of high school teaching to

develop these ideas into the “scientific viewpoint.” This author continues by explaining that both the learners’ “pre-scientific conceptions” and the teachers’ “knowledge and beliefs” should be studied in science teaching, specifically with regards to the teaching of evolution.

The notion of pre-scientific conceptions is discussed at great depth by Howe (1996:38). Vygotsky referred to this notion with the term “everyday concepts” while Piaget referred to it with the term “spontaneous concepts.” To re-cap earlier discussion on these two constructivists, Piaget regarded individual maturation as internal where the brain matures physically according to different ages giving rise to progressive age-related cognitive development. Vygotsky, on the other hand, regarded the social component as central to an individual’s cognitive development such that children interact with more competent adults or peers to develop their knowledge using the Zone of Proximal Development (ZPD). Howe (1996:42) summarises this with a succinct statement that “Piagetian thought is characterized by the view that the driving force in development is internal while Vygotskian thought is characterized by the view that the driving force is external.”

Piaget differentiated between spontaneous and non-spontaneous concepts but focussed on the former. Vygotsky referred to the former as “everyday concepts” and explained them as those that were formed from a child’s personal experiences and independent thinking, while he referred to the latter as “scientific concepts” that were learned in school (Howe, 1996:38). According to Vygotsky, conceptual change occurs continually where the child constantly integrates his/her everyday concepts into a coherent system of related scientific concepts by interacting with more capable others.

The influence of other people, including teachers, in the child’s environment therefore plays a crucial role in allowing the development of scientific concepts. Therefore, teachers need to have substantial pedagogical content knowledge (PCK) in order to allow this development to occur coherently. Learners’ worldviews can also influence the development process. In a study conducted by Panofsky *et al* (1990 – cited in Howe, 1996:44) it was found that children continue to entrench scientific concepts “in the context in which they were encountered in everyday life” regardless of how carefully they received classroom instruction on science concepts.

This reinforces the idea that everyday experiences and children's worldviews contribute significantly to how they learn and understand scientific concepts. According to Blackwell *et al* (2003:63), biology teachers should aim to blend, "into existing backgrounds, an understanding of and openness to consider evolutionary theory." In other words, good teachers should be able to use their PCK together with their learners' worldviews in order to draw acceptance of the theory of evolution. These teachers should not present their learners with a choice between accepting this theory and their religious beliefs (*ibid*).

One of the explanations of this dependence on everyday experiences to build up scientific concepts is offered by Vygotsky. He concluded that children develop their spontaneous or everyday concepts by progressing in a linear fashion from concrete or tangible situational events to abstract events. Non-spontaneous or scientific concept development, on the other hand, occurs "through the mediation of already acquired everyday concepts" (Howe, 1996:39). In other words, in the learning process, the known is used to help understand the unknown. Rudolph and Stewart (1998) refer to the journey from the known to the unknown as being an inductive process, just as Lovely and Kondrick (2008) regard the scientific process. Thus, the known can also include the worldviews and experiences that people have which they are exposed to from a socio-cultural perspective from an early age.

Instead of the linear fashion of scientific concept development, an alternate view is that children learn in a zigzag or back and forth manner between their everyday experiences and the scientific concepts learned, "fitting them together, discarding some ideas and accepting others" (Howe, 1996:48). This means that children therefore apply the scientific concepts they are taught to concrete events that they have experienced. This will allow them to assimilate and understand these concepts since they will be using what they know in order to understand the unknown.

In my study on how Hindu teachers and learners view the topic of evolution, it is expected that there will be an absence of conflict because of this process of assimilation where the Hindu culture has elements that will allow an acceptance of evolution. Aspects of the Hindu religion will be outlined later on in this chapter, in paragraph 2.8.

The topic of evolution in Life Sciences is controversial because of its clash with many religious fundamentalists who often confuse their religious texts with the scientific principles of evolution. This then contributes to the formation of misconceptions which necessitates conceptual change in children. Cavallo and McCall (2008:523) strengthen this idea by their statement that “Secondary school biology students have likely been exposed to some opinions about evolution from parents, religious leaders or the media before entering the classroom.” Since this is usually the first exposure that children have towards phenomena around them, it is also the reason they allow such explanations to become entrenched in their cognition and is difficult to replace with scientific explanations at school.

In the case of people of the Abrahamic religions with a strong creationist standpoint, it is accommodation rather than assimilation that must happen in order for the theory of evolution to be accepted. People of these faiths who usually hold a fundamentalist position are against the theory of evolution because it clashes with their religious beliefs of creationism. They require but will often not experience radical conceptual change in order to understand evolution because of their firm religious views. Radical conceptual change is essentially where people have too little knowledge to extend a concept or build on it and have to therefore completely re-structure and accommodate the new, often conflicting concepts (De Beer and Henning, 2010). However, teachers need to realise that rather than expecting to change students’ worldviews these should be respected and accepted (ibid).

According to researchers cited in Howe (1996), the conceptual change model entails the following: learners have their own ideas about natural events, some of which may be misconceptions. The teacher’s role is to find out what these ideas are and to then present learners with evidence in order to make them realise why their ideas are not correct. They are then in a better, more informed position to accept the scientific explanation rather than their initial idea which they must be able to see is no longer logical in the light of the available scientific evidence. Duschl (1991 – cited in Cobern, 1996) notes that conceptual change teaching and learning is about how students change their view of the world. Students can only do this effectively if their worldviews are considered as contextual factors in the teaching of scientific concepts.

This model has therefore been criticised because it does not consider learners' contextual factors and is therefore regarded as cold conceptual change where, new knowledge is expected to be built into existing knowledge frameworks objectively and purely from a cognitive level as advocated by Piaget (De Beer and Henning, 2010). Other researchers also testify that it is not sufficient to deal with learners' ideas "from a merely rational conceptual change perspective that ... assumes the superiority of scientific concepts over other ideas" (Cobern, 1996). These other ideas refer to the personal experiences, emotions and socio-cultural influence that humans have during their interaction with their family and others in their communities. This influence leads to warm conceptual change as opposed to the rational cold conceptual change discussed above.

Warm conceptual change, according to De Beer and Henning (2010), is however more difficult to accomplish than cold conceptual change because of this human input of emotions, worldviews and belief systems which is difficult to measure and which influence how conceptual change occurs. Human beings are holistic complex creatures so although cold conceptual change is easier to use due to its relative ease in measuring, it will not work because it does not consider the human elements which have a substantial influence on how learning and understanding occurs.

The benefit, specifically, of warm conceptual change is that it has a "potential influence on learning" so teachers need to understand what their learners' worldviews are and "what version of reality they hold upon entering the classroom" (Cavallo and McCall, 2008:523). These writers therefore acknowledge that the successful teaching of evolution requires that teachers know the personal worldviews of their students and any misunderstandings they may have (p. 524).

However, Reiss (2008) states that several science teachers would rather keep science knowledge separate from worldviews or religious knowledge while teaching. One of the reasons for this is to allow the strongly religiously-minded people to avoid any conflict with any aspect in science that may be disturbing them. I disagree with this reasoning since teachers will invariably be biased by their worldviews even if they are not teaching these views directly. I am therefore in favour of integrating worldviews with scientific knowledge especially with regards to teaching the theory of evolution

in order to also provide learners with the means to examine how the theory relates to their religious beliefs or worldviews.

Researchers Hokayem and BouJaoude (2008) found similar results in their study with Lebanese college students that personal beliefs should not be underestimated when the theory of evolution is taught. Cobern (1996) also states that students' worldviews must not be seen as an obstacle to science conceptual development – thus emphasising the value of learners' worldviews in the science classroom which in turn contribute to warm conceptual change. Cobern (1996) also believes that when teachers consider conceptual change in the classroom then learners will develop a scientific outlook of the world. With reference to the successful teaching of the theory of evolution, other researchers conclude that “the personal views of the world along with potential misunderstandings need to be understood and considered” (cited in Cavallo and McCall (2008:522).

In an earlier study, this author acknowledges that different cultures in society influence their people into having a common worldview. However, individuals within a culture have personal differences that allow them to have their own worldviews regardless of the specific culture to which they belong, e.g. the Hindu culture has specific tenets by which all Hindus ought to live by but these tenets may be open to interpretation by individual Hindu people. This perception is also indicative of constructivism which regards every individual as having the ability to construct their own meaning, thus making learning an individual process.

According to Cobern (1996:586) students will apply scientific concepts if it fits their understanding of how the world truly is, thereby giving them “a scientifically compatible worldview.” This type of worldview emerges when learners understand and appreciate common scientific concepts and methods, an aspect that will be reviewed in the ensuing paragraph on the nature of science.

2.6. NATURE OF SCIENCE

In my study which looks at how the topic of evolution is regarded by Hindu Life Sciences learners and teachers, it is essential to look at the value of developing an understanding of the nature of science (NOS) in learners. Of equal importance is the understanding that teachers have of the NOS because, ultimately, it is their understanding of how the NOS is used to gather scientific knowledge that enables learners to also understand. Particularly in the teaching of the topic of evolution researchers Dagher and BouJaoude (1997:429) suggest that if students are taught “about the nature of scientific facts, theories and evidence” then they are in a better position to understand the theory of evolution.

Cavallo and McCall (2008) hold the view that learners are more accepting of the theory of evolution if they have a sound understanding of the NOS and receive formal instruction in the NOS. This is because learning about the NOS has allowed them to understand the processes of science and how scientific theories are grounded. Vhurumuku (2011) also states that learners need to extend an understanding of the NOS to enable them to develop scientific literacy. As such, it is necessary to include a literature review on the NOS and its influence on my topic of teaching the theory of evolution.

There are several ways to interpret the NOS. Lederman (2002) states that just as scientific knowledge is tentative and dynamic, so are conceptions of the NOS. Vhurumuku (2011) provides a brief history of how the meaning of the NOS has changed since 1960. According to this author, initially, the NOS was regarded exclusively as an understanding of scientific knowledge. Later on this picture of the NOS changed to include the ability to practise science process skills such as being able to observe, infer and predict. However both of these notions of the NOS are no longer viewed as accurate since they do not consider the personal “views, ideas, beliefs and assumptions of the nature of scientific knowledge” (Vhurumuku, 2011).

In other words, the NOS depends on the worldviews of the scientist which has reference to the warm conceptual change discussed in the previous section (2.5). It is therefore also necessary to consider how different religious views, such as Hinduism,

influence scientific thought, specifically the topic of evolution – reinforcing the relevance of discussing the NOS in my study. The NOS also includes “an awareness of how scientists work and how scientific knowledge is developed” (ibid).

It is necessary to understand the NOS for scientific literacy amongst all people in order for them to “make reasoned and informed decisions” (Vhurumuku, 2011) on technological and environmental issues. For example, if people are educated on why it is essential to complete a course of antibiotics even if they start feeling better, then the development of drug-resistant strains of pathogens will be prevented; people also need to be scientifically literate so that they understand why it is important to conserve our natural resources and to use fossil fuels wisely. The citizens of a country also must be scientifically literate so that they are in a more informed position to understand and debate how scientific research is conducted and the amount of funding it needs – funding that is generated from their taxes. If the citizenship of a country is educated in this way, it prevents ignorance which can otherwise give scientists free reign to conduct experiments that may be potentially harmful to the people.

As a result of the need for scientific literacy, one of the Learning Outcomes (LO 3) or Specific Aims (SA 3) in the National Curriculum Statement (NCS) and CAPS respectively for Life Sciences states that the learner should be “able to demonstrate an understanding of the nature of science, the influence of ethics and biases in the Life Sciences, and the interrelationship of science, technology, indigenous knowledge, the environment and society” (NCS, 2005). Thus LO 3 or SA 3 has direct relevance to the aspect of the NOS and its necessity for people in society.

2.6.1. The Tenets of the NOS

There are several lists of tenets that constitute the NOS but only seven are most easily accessible for school purposes (Vhurumuku, 2011; Lederman, 1999; Khishfe and Lederman, 2006):

- 1) Science is empirically based
- 2) Scientific knowledge is tentative, yet durable
- 3) There is a difference between observation and inference

- 4) Scientific knowledge is theory-laden, yet partly subjective
- 5) Imagination and creativity play a role in science
- 6) There is no single scientific method
- 7) There is a difference between law and theory

Each of these tenets will now be discussed in more detail with particular reference to my topic of how the theory of evolution is regarded by Hindu teachers and learners:

1) Science is empirically based

This tenet means that for a scientific claim to be accepted, it requires evidence that was obtained through observation or experiments. In evolutionary terms, observation was used to identify the process of microevolution in the peppered moths (*Biston betularia*) in Manchester, England. However, this kind of evidence does not imply that the scientific claim is absolutely irrefutable and static. It can change if new evidence comes to light that upsets the claim as is shown by the next tenet (Vhurumuku, 2011; Lederman *et al*, 2002).

In addition, empirical data obtained shows that the hypothesis is only the best available answer at the time considering this data. For example, the empirical basis of scientific knowledge in evolution is seen in the use of tangible evidence such as fossils, molecular studies (DNA), embryology, etc and as technology or further study unearths new evidence, existing information changes. The results after analysing this data will therefore always be tentative and will be subject to change if different empirical evidence becomes available. This tentative nature of scientific knowledge is the next tenet discussed. There exists a myriad of evidence for evolution, from the fields of palaeontology, comparative anatomy, embryology, biogeography and molecular biology. However, in the studies of Naudé (2012) and Yalvac (2011) many teachers indicated that there is very little evidence to support evolution – showing that they have an underdeveloped PCK.

2) Scientific knowledge is tentative, yet durable

Scientific knowledge is often regarded by many new tertiary students as being “unquestionable truth passed on by authority” (Nelson, 2008:218). It is instead made up of claims that are put together after rigorous empirical evidence has been gathered

and is open to change when new evidence emerges that contradicts these claims. Although models or theories are put forward by scientists to explain what is observed or how matter behaves, these are not absolute since it is not known for sure whether they would apply to every situation in the universe.

However, these models and theories are the best explanation of phenomena at the time – they are durable in that they are true for most of the time but may not be the “exact representation of reality” (Vhurumuku, 2011). This aspect also echoes the theory of constructivism that suggests how knowledge is constructed based on the individual’s perception of a phenomenon as well as the influence of their worldview. It also implies that scientific knowledge is not merely a body of static knowledge waiting to be discovered – as the realists may believe.

It is therefore necessary to have a full understanding of the NOS in order to make learners aware that scientific knowledge is tentative, has great influence to make predictions, to explain and that these changes “usually builds upon and expands previous findings” (Nelson, 2008:220). This in turn results in hypotheses becoming better each time new evidence is unearthed (ibid) and reaffirming that scientific knowledge is not static. An example that can be used in the Life Sciences classroom in this regard, is the theory of Ernst Haeckel of ‘ontogeny recapitulates phylogeny’, that was extremely controversial, and that later resulted in this German biologist being charged with fraud. Once again, such robust discussions in the Life Sciences classroom, would expect a good PCK from teachers.

In the topic of evolution, this tenet is further illustrated by the discovery of hominid fossils. Each time a new fossil is found, it changes the timeline for human evolution but at the same time the new discovery is added to the existing body of knowledge. This also depends on the interpretation of the discovery by scientists and the inferences they make based on that. A more specific example is that of the fossils of the Taung child and Mrs Ples who were discovered in 1924 and 1947 by Dart and Broom respectively. At the time these fossils were thought to be the earliest evidence of human evolution. The rigorous analysis of the fossils cemented their reputation as such – attesting to the durable NOS. However, in 2001, Brunet discovered the Toumai fossil in Chad (Isaacs, 2007). This fossil was found to be at least 4-5 million years

older than the Taung child and Mrs Ples. The tentative NOS is therefore illustrated by this revision of the timeline for hominid evolution.

3) There is a difference between observation and inference

Observations are made using the five senses while inferences are deductions or conclusions made from these observations to try and explain them. Many different inferences can be made from a single observation (Vhurumuku, 2011). Inferences and deductions can only be made effectively if there is background knowledge and prior experience based on the observation. According to this author, there is usually “a logical link between the scientist’s observations and the inferences they make” (ibid). Therefore, a three-way interplay exists between observations, inference and background knowledge where each element informs the other in a cycle as shown in **Figure 2.8**.

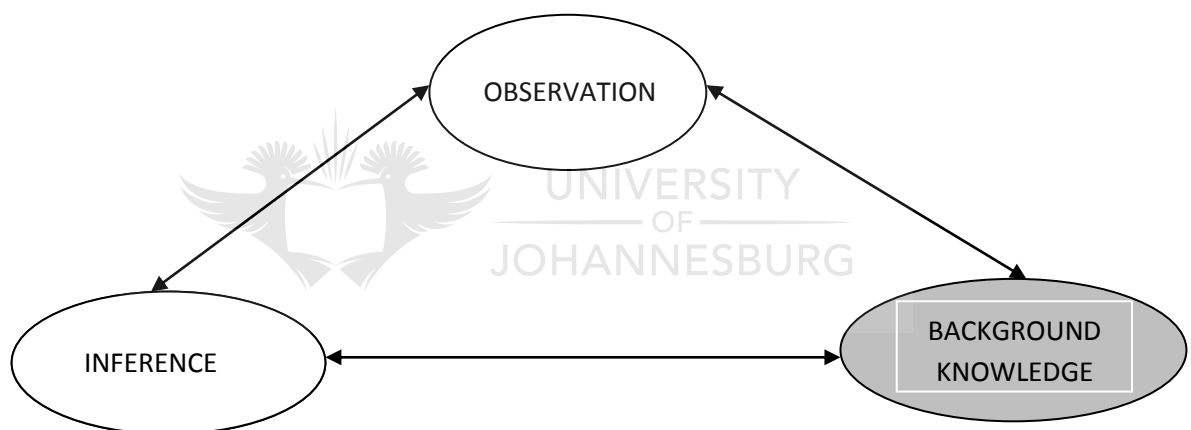


FIGURE 2.8 – THE RELATIONSHIP BETWEEN OBSERVATION, INFERENCE AND BACKGROUND KNOWLEDGE (Vhurumuku, 2011)

Darwin made several observations that he did not understand but he used them to make inferences that led to his theory of evolution. He observed that certain individuals have the ability to survive better than others and that their favourable variations are often preserved in that population while the unfavourable ones disappear. It was not clear to him how this happened but he used this observation to infer that species can change or evolve over time. Later on, Mendel’s work with genetics allowed other scientists to use the background knowledge provided by Darwin to realise that the favourable traits were actually passed on to offspring by

genes. This is also of essence in evolutionary biology, for instance in making sense of an incomplete fossil record.

4) Scientific knowledge is theory-laden, yet partly subjective

The subjectivity arises because scientists are human with their own biases and prior experiences which invariably influence their observations. They choose what to observe to align it with these prior experiences. Individual scientists can therefore arrive at different inferences based on their own experiences even if they are faced with the same set of data or observations.

Lederman (2002) provides an example of human evolution to illustrate this subjectivity of interpretation by scientists depending on their culture and even gender in this case: early evidence on hominid evolution was analysed by white male scientists who dominated the science field, and proclaimed that man was the hunter and played a definitive role in the evolution of man. However, as more female scientists came on to the scene, they interpreted the available evidence to show that females were the gatherers and that they played a vital role in human evolution.

Nelson's (2008) study with first-year university students shows how they soon realise that much of the existing scientific knowledge can be contested by experts and that more than one answer can exist for a question. They realise that these answers arise subjectively depending on how the experts feel about them (ibid). According to the author, teachers need to firstly show their learners that many different hypotheses were available for each question; and secondly teachers need to guide their learners into using suitable criteria to decide why a certain hypothesis was chosen over the others.

If these two processes do not occur, then students will fail to develop critical thinking – instead an understanding of the NOS will merely entail an emphasis on content knowledge memorisation – a view of the NOS that was held in the 1960's. Such pedagogy is especially significant in teaching the theory of evolution where many lines of evidence are available together with a strong influence from one's worldview and religious beliefs.

5) Imagination and creativity play a role in science

The performance of scientific experiments, making observations and subsequent inferences are not a cold objective process that scientists engage in. Instead, scientists have to use their imagination and creativity in order to draw conclusions and arrive at answers (Vhurumuku, 2011). According to Lederman (2002:500), science is anything but “a lifeless, entirely rational, and orderly activity.” Most models and theories are actually conceptions that arise from scientists’ creativity and imagination rather than being “faithful copies of reality” (ibid).

Bell, Lederman and Khalick (2000:570) found in their study with pre-service secondary school science teachers that most of them realised the value of creativity and subjectivity in the building up of scientific ideas. According to these researchers, this subjectivity also includes the “individuality of scientists, their backgrounds and their beliefs” (ibid). This once again alludes to the constructivist notion that knowledge, including scientific knowledge, is not a fixed body of objective information awaiting discovery. Niaz (2004:406) also elaborates on this link between constructivism and the inquiry method of science learning. This researcher states that these two “approaches seem to share many educational objectives” including how learners build up scientific knowledge in their minds as well as the link between how they acquire scientific concepts and how these concepts were modified by scientists through the ages.

The creativity and imagination of the NOS is evident from ancient times when humans practised artificial selection in order to obtain crops or animals with desirable qualities. There must have been many mistakes during this process but their desire to obtain a specific result stemmed from them being able to imagine what this was and to then find creative ways to achieve it. Reference must also be made to the creative work of Phillip Tobias, who has been nominated three times for the Nobel Prize for his work in palaeoanthropology. The critical question arising from this is whether Life Sciences teachers really venture beyond the curriculum, or whether they are content to simply focus on preparing learners for an examination.

6) There is no single scientific method:

Many science textbooks portray the scientific method as a single sequential linear progression of steps that all scientists follow in order to perform their research. These steps are usually as follows:

Observation of phenomena → formulation of problem/ question based on this observation → formulation of hypothesis → experiments designed for data collection → relevant observations made → interpret these observations or analyse results → draw conclusions → report results (*Adapted from Vhurumuku, 2011 and Popper, 1934/1972*).

However, this method and the linear fashion of these steps is a fallacy since in reality, all scientists do not work as if they are following a recipe (Bell, 2000). Very often they work in a back-and-forth manner where they constantly try out new methods, ask different questions, re-interpret results and sometimes discover new answers by sheer chance. In addition, the individual personalities, beliefs and values of scientists also play a significant role in how they come up with their deductions as described in tenet 5.

According to Lederman (2002), there is no single scientific process or sequence of activities that will guarantee the development of certain, true or infallible knowledge. Although all scientists perform the same functions of observation, designing experiments, collecting results, making inferences, etc, there is no fixed order in which these tasks have to be conducted to enable the generation of reliable knowledge.

7) There is a difference between law and theory

Researchers Dagher and Boujaoude (2004:380) regard theories and laws in science as “two of the most complex constructs in the philosophy of science.” They differentiate between scientific theories that are “defined as overarching explanations that have been well substantiated” and scientific laws that describe “generalisations about how some aspect of the natural world behaves under stated circumstances” (ibid).

Expressed quite simply, theories are explanations and laws are observations of phenomena in nature.

According to Vhurumuku (2011), “a scientific law describes what happens, and a theory explains why and how things happen.” Laws are based on observations and measurements, are always held to be true and are verified by experimental evidence. They also describe relationships between variables, behaviours and activities e.g. the inversely proportional relationship between pressure and the volume of a gas. The author suggests that many theories can be used to explain one observation because theories are created by scientists to explain their observations (ibid).

Bell, *et al* (2000) reiterate this view that laws are declarations or descriptions of distinct patterns developed to explain observable phenomena. Theories, on the other hand, are inferred explanations for these phenomena. Scientific theories are formulated by scientists in order to serve the two main purposes of “explanation and exploration – to make sense of what is known and to guide future inquiry” (Rudolph and Stewart, 1998:1085). They illustrate their view with Darwin’s theory of evolution which provided an explanation for the variety of life on earth and also allowed questions to be asked about this biodiversity that were not previously considered.

Other researchers share this view about theories serving to clarify “large sets of seemingly unrelated observations in more than one field of investigation” (Lederman, 2002:500), whilst also playing an important role in producing research problems and guiding future studies into related fields. Theories cannot be tested directly because they are based on a set of assumptions that are used to speculate on whether unobservable elements exist. They are actually “inferred explanations for observable phenomena” (ibid). Laws however, as mentioned earlier, are based on directly observable evidence and phenomena. According to Bell *et al* (2005) therefore, theories and laws are separate types of scientific knowledge.

2.6.2. The Need to Understand the NOS

Bell, Lederman and Khalick (2000) reaffirm that a central element of scientific literacy is to understand the NOS. Students need to understand the NOS so that they can make more informed answers to questions, particularly if these are steeped in

controversy as is the case with the topic of evolution, since “much of the student’s resistance is framed in religious terms” (Nelson, 2008:219).

According to this author, students were more accepting of the theory of evolution when they were presented with both scientific and creationist views – they were then able to weigh both sides rationally to arrive at a decision. It seems that when students analyse why intelligent design or creationism for that matter, is not science, they then have a greater appreciation of the NOS itself (ibid). Some researchers even believe that the evolution/creation controversy is beneficial because it emphasises that science is a process of critical thinking (Reiss, 2008).

The NOS therefore also affords students the opportunity to consider all possible answers based on the available evidence and to then choose an answer that is closely aligned with their worldviews. This is especially beneficial when learners are taught the theory of evolution and they have to consider scientific evidence in conflict with their personal views. Understanding the NOS can then allow them to make a rational decision independent of their religion and beliefs while still using their prior experience to help them assimilate the new information. This notion was also revealed in Verhey’s (2005 – in ibid, p.22) classes where “many students who initially doubted evolution changed to an approach that combined science and religion.”

In addition, the science pre-service teachers in Bell, *et al* (2000) study shared their reasons for believing in the importance of teaching their learners the NOS. These included that it made science more interesting; that it provides the means for critical thinking and problem solving; that it is a more reliable method for understanding scientific knowledge and its construction; and that the NOS enables scientific literacy so that people in a highly technological society can make better decisions (ibid).

One of the means of promoting the NOS and increasing the understanding of science content in schools is to use the **inquiry method** of teaching science (Khalick *et al*, 2004). However, it must not be assumed that using this method to teach science will make learners understand the NOS. Instead, Lederman *et al* (2004) suggests that it is more important for people to understand *about* scientific inquiry rather than about how to *do* science. In other words, using the scientific method is not as important as

understanding how scientific inquiry works, once again alluding to the necessity for learning the NOS.

Researchers Mamlok-Naaman and Hofstein (2004:404) believe that students should be taught **explicitly** about the NOS and scientific inquiry rather than **implicitly** where they only perform the scientific method of designing and conducting experiments, making observations and drawing conclusions. In addition students should also be taught how to reflect on these activities and on the nature of the resulting scientific knowledge – this reflection would contribute to them learning about the NOS and the inquiry method of science.

2.6.3. The Implicit versus the Explicit method of teaching science

This notion of teaching the inquiry method of science and the NOS explicitly rather than implicitly has been researched extensively by many authors (Lederman, El-Khalick, 2004; Khushfe and Lederman, 2006; Mamlok-Naaman and Hofstein, 2004). They believe that students must be taught clearly as part of their syllabus, how scientists construct knowledge that is tentative even though it arises after rigorous experimentation and testing – in other words learners need to understand that scientific knowledge is characterised by the seven tenets of the NOS discussed already.

The NOS “should be an independent topic taught within a science course and not left to emerge implicitly through exposure to science concepts” (Scharmann *et al*, 2005a:28). Lederman *et al* (2004:403) provides a fitting analogy in trying to illustrate the importance of the explicit rather than implicit teaching of the NOS and inquiry method of science. He explains that “Students do not develop such understandings simply through experiencing inquiry any more so than we would expect them to develop understandings of photosynthesis simply by watching plants grow.” Just as learners have to be taught explicitly about the process of photosynthesis, so too would they need to be taught explicitly about scientific inquiry.

In South Africa, the explicit teaching of the inquiry method of science and the NOS has been introduced formally into the Life Sciences curriculum since 2008 with the topic of evolution. For the first time, grade 12 Life Sciences learners were taught

about scientific theories and how they come to be. However, one of the prescribed text books – *Understanding Life Sciences Grade 12* (Isaacs *et al*, 2007; 2010) deals with scientific theories only briefly as part of the Introduction to the topic of evolution. A more detailed description of the activities scientists engage in, including a flow chart with steps for controlled experiments (**Figure 2.9**) is provided only in the introduction to the textbook. This implies that it does not form a compulsory part of the syllabus and it does not compel teachers to emphasise it in the classroom. Anecdotal evidence however shows that when learners are exposed to these details prior to learning about evolution, they are more receptive to the topic.

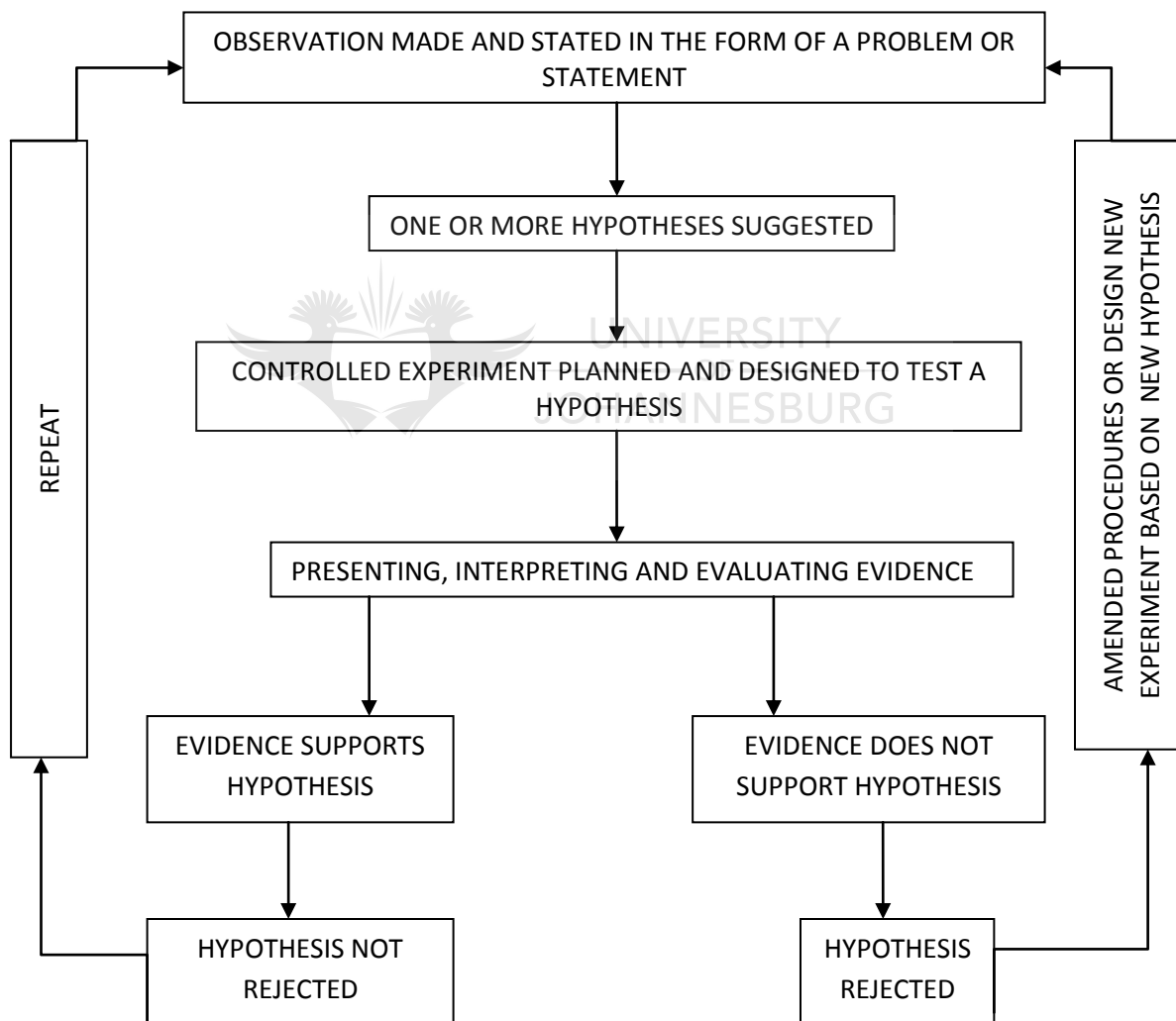


FIGURE 2.9 – SCHEMATIC REPRESENTATION OF CONTROLLED EXPERIMENTS (Adapted from Isaacs *et al*, 2007: xii)

Since 2009, some of these aspects of the NOS and the inquiry method of science teaching have been introduced into the Life Sciences curriculum from grade 10. Learners are therefore taught the scientific process with repeated emphasis on an assessment technique known as “Hypothesis Testing” (ibid, p. viii). This is also aligned with the misconceptions associated with the sixth tenet of the NOS that “There is no single scientific method” (see (6) above). This linear flowchart conveys the erroneous message to learners about the inquiry method of science knowledge construction. It also fails to acknowledge the significant role played by the cultures and beliefs of scientists. In addition, the seven tenets of the NOS discussed at length earlier in this chapter, are not taught explicitly. Possible consequences of this in the classroom will be discussed further in Chapter 4, especially with regard to the topic of evolution.

Teaching science using the inquiry method has the benefits of conveying the tenets of the NOS to students, thereby allowing them to develop (amongst others) an appreciation for science, the ability to think critically and to recognise that science knowledge is influenced by the culture and beliefs of scientists. Very often however, teachers are constrained by a lack of time in trying to complete syllabi packed with science concepts and facts that are required for summative assessment purposes. Less time is then available for teaching science through inquiry since lecturing styles are more efficient in delivering these concepts to students. This observation was made in Taiwanese schools in a study conducted by Hsiao-Lin Tuan *et al* (2004).

A similar situation exists in South African schools as well where the Life Sciences curriculum is crammed with several topics and concepts that have to be learnt for summative assessment purposes. The time-consuming, but far more beneficial, inquiry method of teaching science then falls by the wayside. The perfunctory inclusion of hypothesis testing in the Life Sciences curriculum as an introduction to the topic of evolution is a small step towards teaching science using the inquiry method and introducing learners to some of the tenets of the NOS. However, the inclusion of this aspect of the NOS, albeit perfunctorily, has the benefit of allowing both learners and teachers to appreciate the development of scientific knowledge and thought processes. This in turn may afford them greater understanding and even

acceptance of a controversial theory such as evolution – due to the potential conflict that exists between it and people’s worldviews.

2.7. THE THEORY OF EVOLUTION

“Evolution is the backbone, the beautiful and efficient explanation for why organisms today are different from organisms in the past and why there is such an amazing diversity of fascinating biological organisms with an awe inspiring lifestyles and body plans”

(Lovely and Kondrick, 2008:165).

This statement provides a succinct and apt description of what evolution entails. However, the beauty and necessity of evolution and its acceptance by society is often muddied by the influence of individual worldviews and religion. Very often, these influences fail to consider the overwhelming evidence available to verify that evolution is a valid process that occurs regardless of what popular opinion holds. The validity of the theory of evolution is as a result of its formulation using the seven tenets of the NOS as discussed in the preceding paragraph (2.6).

According to researchers Dagher and BouJaoude (2005:379) evolutionary theory is actually made up of “five main theories: non-constancy of species, common descent, gradualism, speciation and natural selection.” Since it is a system of theories, it can only be tested “indirectly by testing its component parts” (ibid). Therefore, any worthwhile understanding of evolutionary theory can only be realised by considering three types of evidence together – “circumstantial, direct and historical” (ibid). This shows that the theory of evolution is very broad and is made up of different parts, each of which requires separate strands of evidence to verify it.

Dawkins (2009: vii) states “The evidence for evolution grows by the day, and has never been stronger.” He presents evidence in his book “that the ‘theory’ of evolution is actually a fact – as incontrovertible a fact as any in science” (ibid). According to this acclaimed writer, many biologists believe that evolution is a fact but what drives

it remains a theory. This drive can be Lamarck's theory of "use and disuse" or Darwin's theory of natural selection.

Blackwell *et al* (2003:59) compare the theory of evolution to a very sturdy 'house of cards' that "will not fall (regardless of opinion)." This sturdiness owes itself to the stringent analysis and interpretation of the available evidence for evolution. Dawkins (2009) comments that very often thorough inference is more reliable than first-hand observation. This thereby establishes a strong case for the information that can be obtained from evolutionary evidence. He draws a fitting parallel with this inference for evolution and detectives who enter a crime scene sometimes long after the crime has been committed with only traces of the crime to guide their inferences towards catching the culprit.

In order to illustrate the possibility of evolution occurring, he uses the example of the different breeds of dog. Humans have been able to genetically sculpt the vast and varied dog breeds from a wolf ancestor over a relatively short geological period of a few centuries through the deliberate process of artificial selection. It therefore stands to reason that given the long periods of deep geological time and the "non-random survival" of wild organisms, a similar result can be generated producing the immense array of biodiversity that exists and has existed on Earth since life began. Dawkins (2009) cites an interesting example to prove the predictive nature of evolutionary science. An orchid in Madagascar had an unusually long nectary that meant it could only be pollinated by a moth with an equally long proboscis. Darwin and Wallace independently predicted that such a moth must exist in order to pollinate this flower whose reproduction depended on insect-pollination. Nearly forty years later, a previously unknown moth with a long enough tongue was indeed discovered in that environment!

Radioactive clocks, tree rings and the layers of sediment (called varves) laid down in glacial lakes are cited by Dawkins to work out the geological age of fossils and the time when certain events occurred, for example ice ages, mass extinctions, meteor crashes, etc... He also describes an experiment with lizards on two islands off Croatia that demonstrates how evolution can occur in a relatively short space of time: Five pairs of lizards belonging to one species were relocated from their habitat on one

island to the other island where no lizards were found. Thirty seven years later, the scientists found a thriving lizard population on the previously uninhabited island.

However, these lizards had marked differences found to be due to the disparities in available food. These lizard descendents were evolving towards a herbivorous diet in order to survive on the new island whereas their ancestors were insectivorous. The differences were visible after only 37 years – a period well within the lifetime of the scientists conducting the study. The implication of this is that if significant changes can occur in such a “short” period, then the possibilities of change over longer periods of time must be endless. Dawkins also recounts similar experiments with other organisms including bacteria and guppies in order to show that evolution can indeed be observed in our lifetime (ibid).

Dawkins also responds to creationists’ criticisms regarding gaps in the fossil record or missing links or of the absence of intermediate organisms like “crocoducks” or “fronkeys” (ibid, p. 152). He explains that modern species are not descended from any other modern species thus discounting the presence of intermediate organisms. Instead he emphasises the idea of shared ancestry where every one of the millions of species shares a common ancestor with every other species. Therefore, there will be a common ancestor that gave rise to the frog family and to the donkey family – in this example it will be a common ancestor that gave rise to amphibians and mammals. He also reaffirms that evolution is a gradual process and that it will be statistically unlikely for an animal to give birth to an instant new species.

The entire book is replete with a plethora of well-thought out examples and explanations that provide ample evidence for evolution. His ability to express facts like a story make for fascinating, convincing reading and only serve to enhance ones views on the certainty of evolution occurring. Sceptics of evolution would be hard-pressed to remain so after reading Dawkins’ mesmerising account of the overwhelming evidence that supports evolution!

Mounting evidence for evolution has therefore changed its status from being “only a theory” in Darwin’s time to being considered a fact nowadays. Darwin was aware of the emphasis placed on evidence in his time and he therefore “worked hard to ground

his hypothesis firmly in the preponderance of evidence he and others had collected” (Rudolph and Stewart, 1998:1075). Scientists, including Darwin, therefore used the available evidence to make inferences about how evolution occurs. Darwin’s dependency on the evidence for evolution is also regarded by Dempster and Hugo (2006) as crediting natural selection “as a far more plausible explanation than creation.” Evidence for evolution comes from, among other avenues, fossils, biogeography, biochemistry and genetics, comparative anatomy and embryology (Isaacs, 2007; Lowder, 2000).

Scientists therefore employed the tenets of the NOS discussed at length in the previous paragraph (2.6) since they use evidence to confirm or refute particular hypotheses. The use of these tenets allows evolution to be acknowledged as “a major construct” made up of related claims such as variation, adaptation, extinction, speciation, etc (Blackwell *et al*, 2003:59). They are of the belief that “to regard evolution as ‘just a theory’ shows a misunderstanding of the nature of a scientific theory” (ibid). The NOS as well as the historical nature of biology plays a key role in allowing learners to appreciate the process of evolution. However, in order for learners to be taught as such, their teachers also need to be familiar with these aspects. It is essential therefore for these aspects of the NOS and the historical nature of biology to “be given more attention in teacher education” (Van Dijk, 2008:265).

Despite explicit views from Dawkins about the certainty that evolution is a fact in the scientific community, it remains a contentious and under-researched topic in science education (Rudolph and Stewart, 1998). One of the reasons put forward by the writers is that the idea of evolution is rejected by large numbers of people mainly due to their religious convictions, and secondly that the science education fraternity has done little to improve this situation. Blackwell *et al* (2003) are of a similar view in that college professors have not done much to promote the topic of evolution among their students, many of whom are studying to become teachers themselves. This then has a direct bearing on how these teachers will present the topic of evolution to their own high school learners. These authors are of the opinion that university professors have a highly significant role to play in promoting the value of evolution to biology.

Nehm and Schonfeld (2007) echo these sentiments and even refer to science teachers as a “‘missing link’ between scientists’ understandings of evolution and the general public’s ignorance of or resistance to the idea.” They believe that the NOS helps to understand the theory of evolution and at the same time, teaching the theory of evolution helps to increase teachers’ knowledge of the NOS. Therefore the NOS and the theory of evolution contribute reciprocally to each other’s increased knowledge and understanding – the one aspect cannot be known without the other.

A conclusion reached by these authors is that in order for some harmony to occur in the understanding of the theory of evolution, it is necessary for students to be taught the tentative nature of science including the inquiry method of learning science as well as for them to recognise “the social nature of scientific inquiry” (Rudolph and Stewart, 1998:1083). These three aspects of science teaching once again are based on the tenets of the NOS discussed in paragraph 2.6 which serve to emphasise the importance of teaching it to learners explicitly in the classroom.

Papacosta (2010) holds the view that the “outside the box” thinking that Darwin and Wallace engaged in during their investigations should be integrated especially into science education so that society can achieve the “maximum creative potential of which we are capable.” The author based this statement on the interdisciplinary research that Wallace and Darwin used to develop their theories of evolution. Both these evolutionists invoked the writings of a geologist (Charles Lyell) and a political economist (Thomas Malthus) to arrive independently at their theories where natural selection played a major role. Although their studies were based exclusively on the natural world and biology, they were open-minded enough to consult with research in other disciplines and to apply relevant ideas from there in the development of their own theories.

Their actions therefore also reflect the tenets of the NOS – that science is empirically based; uses imagination and creativity; and that there is no single scientific method. Such historical details should be brought to the attention of learners so that they appreciate that the discovery of scientific theories and laws are not the exclusive domain of one scientist. Instead if learners engage in critical, creative thinking and

use the NOS as a guide, then they can also find significant answers to research questions and problems.

2.7.1. The topic of evolution in the South African curriculum

According to several grade 12 Life Sciences text books published in South Africa for use in 2008, the topic of evolution includes the following aspects:

- I) Early theories of evolution – including theories of early evolutionists and some discussion of Theories and Hypotheses.
 - II) The origins of life on Earth; sources of genetic variation; microevolution (including natural selection and genetic drift); speciation and macroevolution; mass extinctions; evidence for evolution – fossils, molecular biology, homology, embryology; biogeography and phylogenetic trees.
 - III) Human origins – characteristics we share or that make us different from other primates; Cradle of Humankind; Out of Africa hypothesis.
 - IV) Alternatives to the theory of evolution – creationism and intelligent design.
- (Adapted from Isaacs et al, 2007)

These aspects of the topic of evolution were presented in the text books as fact. There was very little discussion on their tentative nature, the human element or any other tenet of the NOS. For example, some of the elements of human nature printed, involved a brief background to the young Darwin's foray into evolutionary biology as well as the fraudulent Piltdown Man discovery. How scientists analysed and interpreted the available evidence was not always shown to learners.

However, in defence of the authors, the text book included the basic aspects of evolution and described them in a simple, easy to understand manner – especially since the topic was introduced for the first time in South African schools. Anecdotal evidence suggests that the text book dealt with the topic in a satisfactory manner and served as an adequate guide for both teachers and learners who were encountering the topic for the first time in school.

Dempster and Hugo (2006) believe that since the topic of evolution is new to South African schools, it should be introduced such that learners are taught basic concepts to enable their understanding of evolutionary principles. According to these researchers, a properly structured Life Sciences curriculum will allow a paradigm shift for learners from faith-based to science-based. This would in turn facilitate learners to adopt “an evolutionary understanding of life” (ibid, p. 107). Based on this, Dempster and Hugo state that “an ideal school biology curriculum” should be based on Darwin’s experiences that led him to develop his theory of evolution by the process of natural selection.

These experiences began with Darwin’s understanding of “deep time” when he came to realise that the age of the Earth was to be measured in terms of geological time, rather than biblical time which he was exposed to in his early life. Darwin realised that a timescale extending into the millions of years would enable “even the tiniest biological change ... [to] produce a major evolutionary transition” Papacosta (2010). His understanding of the age of the Earth then led him to understand how the changing Earth brought about extinctions of some organisms and survival of others. This then allowed him to arrive at the notion of natural selection as the mechanism for this differential survival. He also used this idea to explain “vertical and horizontal evolution” among organisms (Dempster and Hugo, 2006:107).

Dempster and Hugo (2006), regard the analysis of evolutionary theory by Mayr (1997) to be the most suitable basis on which the South African Life Sciences curriculum should be structured. Mayr (1997) identifies the following five sub-theories of Darwin’s theory of evolution on which to base the curriculum:

1. Life steadily evolves over time – evidence from fossils and biogeography debunk the notion that species are constant as created by God.
2. Common descent of organisms – common ancestors giving rise to more modern organisms by an ongoing process of branching – evidence for this is obtained from fossils, biogeography, molecular studies and careful observation of related species to derive the patterns among them.
3. Multiplication of species or speciation (horizontal evolution) – due to the long periods of geological time and the presence of adaptive radiation which

enables the development of several different species from an ancestral species – examples are Darwin’s finches on the Galapagos Islands; the 500 species of cichlid fishes of Lake Malawi which have the highest speciation rate amongst all taxonomic groups; and in South Africa, the approximately 18 000 endemic plant species.

4. Gradualism – Darwin believed that evolution was a gradual process and his evidence was the presence of intra-specific variation in populations which he interpreted to be evolution in progress.
5. Natural Selection – regarded as Darwin’s primary contribution to the theory of evolution and its understanding. This sub-theory is described in more detail below.

(Adapted from Dempster and Hugo, 2006 – citing Mayr, 1997)

2.7.2. Natural Selection

After observing animal breeders engage in artificial selection with certain domestic animals, Darwin applied these principles to devise his theory of evolution by natural selection. He regarded natural selection as “the engine” that drives the adaptation, survival and acquisition of new characteristics that are eventually transmitted to their offspring. Darwin attributed the complex diversity of life on Earth to one bacterial cell that mutated gradually over long periods of geological time (Beckwith, 2004-5:425). This became known as the law of common descent. South African school Life Science text books offer a simplified version of this process of natural selection as follows:

- Organisms usually produce a large number of offspring – more than can possibly survive (referred to as super-fecundity)
- These offspring display a great deal of variation.
- As a result of the high number of offspring in a certain environment, competition occurs between them for a limited supply of resources.
- Only those offspring with favourable characteristics will survive in that particular environment and will then be able to reproduce and pass on these beneficial characteristics to their own offspring.

- Darwin called this natural selection which occurs from one generation to the next, resulting in a gradual change in populations, and ultimately leading to the evolution of a new species – a process termed “speciation.”

(Adapted from Isaacs et al, 2007: 247)

Although Darwin realised that variation existed amongst offspring, he was not aware of exactly what caused this variation. It was only after Mendel’s experiments with pea plants that the discrete unit of a gene was identified. According to many scholars, since Darwin was not aware of a genetic basis for inheritance of characteristics he was unable to produce a more refined view of evolution (in Bizzo and El-Hani, 2009). These scholars are of the opinion that had Darwin known about Mendel and his study on genes he would have been able to make greater progress in his theory of evolution by natural selection.

Bizzo and El-Hani (2009) however disagree with this viewpoint. According to them, even though Darwin did not know about genetics, he was able to devise his own understanding of inheritance which he termed “pangenesis” (ibid). Darwin even went as far as using the terms “prepotent” and “latent” which correspond with the respective terms used in genetics – dominant and recessive alleles. Eventually, it seemed that Darwin did perform his own experiments using snapdragon plants and arrived at the same conclusions that Mendel did.

This is a phenomenal occurrence in the history of science, because as stated by Papacosta (2010), it implies that “under the proper conditions, the birth of new ideas becomes inevitable.” This means that both Mendel and Darwin were able to reach the same conclusions because they were thinking along the same lines. Bizzo and El-Hani (2009) are therefore of the opinion that Darwin did not need to be aware of Mendel’s work in order to refine his theory of evolution by natural selection. They believe that the concept of natural selection merely requires the presence of abundant variation in a population and that the origins of this variation are not really important (ibid, p.113).

The implication of this situation for Life Sciences in schools is that many curricula position the topic of Genetics before the topic of Evolution. Indeed this is the case in

South Africa as well. The reasoning behind this is that high school learners will have the advantage of knowing genetics before learning about evolution unlike Darwin who did not. However, according to Bizzo and El-Hani (2009:111) this is a “fallacious” argument since no sound evidence exists either on a historical or a cognitive level to prove otherwise. In fact, these researchers even suggest that evolution should be taught before Mendelian genetics because the latter may not facilitate learners’ understanding of evolution and they may actually lead to them “see(ing) contradictions between them” (ibid, p.111).

Anecdotal evidence from Life Sciences teachers, however, shows that teaching genetics before evolution is advantageous since learners then understand that variations come about from a genetic level and they are able to understand the process of natural selection more easily. In fact, many learners then appreciate the need to study genetics since they see it as playing a role in evolution. This conflation of Darwin’s theory of natural selection with modern genetics is referred to as “neo-Darwinism” and it conveys the idea that evolution occurs as a result of natural selection which in turn comes about from the random acts of mutations and genetic recombination (Nord, 1999; Blackwell *et al*, 2003; Beckwith, 2004-5).

The topic of Genetics introduces learners to the events that bring about variation among offspring, i.e. crossing-over of homologous chromosomes during Prophase I of meiosis; random assortment of chromosome pairs along the equator during Metaphase I; and the chance fertilisation of egg cells by sperm cells during fertilisation of gametes. It must also be emphasised to learners that each of these events is random thus increasing variation amongst offspring. In addition, the idea of random mutations whether lethal, fixed or neutral and their contribution to producing variation in populations is also discussed. When learners are confronted with these concepts they are in a better position to accept how nature can select those organisms that are more suited to the environment and the adage “survival of the fittest” makes more sense.

However, they must be reminded that fitness does not refer to the reproductive success of individual organisms but to the reproductive success of the entire population (Beatty, 1992 – cited in Van Dijk, 2008:263). This idea of fitness can be broadened to include individuals in a population that work together to enable survival

of each other, thereby “increasing the chances of their alleles surviving into the next generation” (Dempster and Hugo, 2006:108). The fittest organisms are those that have a set of genes that allows them to produce the most number of offspring in a certain environment (Lowder, 2000).

Closely linked to this is the common misconception amongst learners that changing environmental conditions allow individual organisms to change (almost a Lamarckian perspective of evolution) rather than allowing only those that are most suited to that environment to survive and pass on their characteristics via genes to their offspring to enable them, in turn, to survive. Students therefore need to appreciate the importance of intra-species variation for the evolutionary process to continue and they also need to believe that chance plays a pivotal role in achieving biodiversity on Earth (Van Dijk, 2008:263).

Several authors place a great deal of value, almost to the point of veneration, on the crucial role that evolutionary theory has in biology. Drawing from Dobzhansky’s (1973) often quoted phrase, Blackwell *et al* (2003:60) state that the absence of evolutionary theory removes from biology a vital “theme, coherence, understanding, and interpretation of relationship.” Nehm and Schonfeld’s (2007) statement about evolution being the unifying concept of biology is an echo of Rutledge and Mitchell’s (2002) view that the theory of evolution “is the central and unifying theme of the discipline of biology ... and serves as an underlying framework of the discipline.” Bybee (2002) regards it as “among the most powerful and significant scientific contributions of the 19th and 20th centuries.”

Many of these researchers therefore emphasise the importance of including the topic of evolution in the Life Sciences curriculum. According to Dempster and Hugo (2006:106) Darwinian evolution is “the central concept in modern biology” that provides an explanation for the “highest level of questions in biology” – the “why” questions. These questions relay why structures and their functioning are a certain way in terms of evolutionary and historical reasons. These researchers cite a curriculum developer, Isaac, who states categorically “that the worldviews of all South African learners needs to be respected” (p. 111). The theory of evolution therefore needs to be taught to learners in a carefully structured manner that also

considers the background of each learner. Many learners come into the classroom with pre-existing worldviews that may or may not be in conflict with evolution.

After reading two books on the topic, Andrews (2005) gives a student's perspective about how the theory of evolution should be taught. One of the books presented the theory of evolution as fact but it was written as a smooth-flowing story; the other book was written with the intention to be story-like but Andrews (2005) regarded it as being more "text-like and factual" making it "less of a read and more of a chore." His overall view is that evolution should be taught "as a story, rather than as cold, hard fact" (ibid). Since stories are "simple to understand and digest" (ibid), they would make the topic easier to understand and would also allow those learners with worldviews against evolution, "a more lenient mechanism through which to learn about and accept evolution" (ibid). The story-like narration of Dawkins (2009) also affirms this view (paragraph 2.7).

An academician, Bybee (2002) also advocates the use of historical case studies and narratives to teach the topic of evolution. According to this researcher, this method would allow learners to follow how theories are developed and would help them to understand one of the most important activities in the construction of knowledge in science. Theories are tools to biologists just as diagnostic aids are to medical doctors (Scharmann, 2005b). He proposes that it is more important for people to understand the theory of evolution than for them to believe in it and his view is that "we should not be interested in whether a theory is 'true,' only whether the theory works" (ibid, p. 13). By regarding theories as such, learners must not be made to feel that their religious views are threatened – a stance shared by Andrews (2005). This teaching method would also reinforce the NOS and its tenets of making inferences, using human imagination and creativity, and developing the ability to make predictions based on past experience and findings (Bybee, 2002).

Another method that should be used in the classroom is for learners to see how the theory of evolution works in everyday life. This would make the workings of the theory more relevant and practical to their lives thereby stimulating interest in the topic regardless of their worldviews. Some of the reasons that teachers could use to illustrate how evolutionary thought contributes to human life are:

- The use of antibiotics and the need to take them strictly in the dosage and duration prescribed.
- The need to rotate pesticides and the consequences of using the same one repeatedly.
- Maintaining the viability of different varieties of cereal crops.
- Identification and treatment of novel diseases caused by “new” pathogens.
- The development of vaccines in the serum of other animals.
- The pro’s and con’s of using “anti-bacterial” products.
- Biotechnology; bioremediation; and environmental clean-up operations such as oil spills

(Adapted from Scharmann, 2005b and Chinsamy and Plagányi, 2007)

By incorporating these examples as well as by making lessons more interactive where learners can share their opinions and views, teachers will be adding relevance and excitement to their lessons on the theory of evolution (Chinsamy and Plagányi, 2007). These researchers also concur that lessons should have a strong emphasis on the scientific method of inquiry as this would provide learners with the necessary tools and understanding to decide why the theory of evolution is scientifically valid.

2.7.3. Human Evolution

The acceptance of evolution is not always complete since many people accept only parts of it that they feel comfortable with and that their worldview is compatible with. One of the aspects of evolutionary theory that is not always accepted is that of human origins. The main source of conflict with this topic is “the vanity of the conception that we are somehow God-like, or closer to God than other animals, i.e. that we humans are ‘special creations’” (Blackwell *et al*, 2003:63).

This notion stems from a creationist perspective that attempts to counteract the naturalistic evolutionary origins of man. The other mistaken reason for this conflict is due to the widely-held belief that man evolved from monkeys – a misconception arising from “an incorrect description of scientific conclusions” (Chuang, 2003:673). The correct description is that humans and monkeys share a common ancestor. Even Downie and Barron (2000) found in their twelve year study with medical students in Scotland that many of them who accepted the theory of evolution only did so if it

excluded human evolution. On the South African front, Parle and Waetjen (2005) also found that the topic of human evolution produces the most amount of debate.

There are two main reasons for this debate: firstly, since Africa is regarded as being the Cradle of Humankind and as such is at the centre of human origins but at the same time, the erroneous use of social Darwinism to justify racialised politics worldwide became a point of contention; and secondly, because it draws objections from students' "overwhelming fundamentalist Christian beliefs" (ibid, p. 523). Social Darwinism was a philosophy that originated in the nineteenth and early part of the twentieth centuries. It was an irresponsible effort to apply the principles of biological evolution, especially that of natural selection, to society. Western, white colonialists used this principle to justify them taking over "black" countries that apparently "deserved" their fate because they were weaker, less fit, and deserved to be oppressed – a complete misuse of Darwin's theory of natural selection where nature chose the most well-adapted individual to survive and pass on these adaptations to their offspring (Sanders, 2008:96).

Naledi Pandor, Minister of Education in South Africa from 2004 to 2009 was able to see the value of including the topic of evolution in school curricula more especially because she believed that if the topic was not, then matters of race would continue to exist because the origin of racial variation would not be understood (Parle and Waetjen, 2005:526). Precisely for the reason of Africa being at the centre of human origins, the topic also needs to be an integral part of the Life Sciences syllabus in South African schools so that learners and teachers alike can take pride in the rich natural history that our country and continent has to offer to a global market.

In a study conducted with college biology or zoology students before and after being taught evolution, Lovely and Kondrick (2008) observed that human origins statements to students were the most controversial and displayed the most unrelenting creationist views. They also found that the evolution of non-humans elicited the fewest number of problems from the students. The response to the statement "Human beings evolved from earlier species of animals" showed that many students did not understand Darwin's concept of common descent with modification as referring to humans as

well as to other organisms. Very few students were adequately convinced to effect a change from their initial views even after attending the course.

In response to the statement “Man, gorilla and chimpanzee shared a common ancestor” the majority did not see that man and other primates belong to two separate families that descended from a shared ancestor (Sherrer, 2005). The third statement on human origins revealed the most shocking results “God created human beings pretty much in their present form at one time within the last 10,000 years or so.” The results from this statement showed that the majority of students surveyed believed strongly in creationism particularly pertaining to human origins and once again, were not prepared to change their views even after the course was presented.

Lovely and Kondrick (2008) concluded from their study that regardless of the amount of evidence taught to students about the occurrence of evolution and the processes that drive it, their beliefs did not necessarily change towards a scientific perspective. Their creationist beliefs were therefore stronger than the cold hard facts, once again emphasising the influence of worldviews and warm conceptual change on a controversial topic like evolution. Nehm and Schonfeld (2007:718) drew the same conclusion from their study. They found no correlation between educating people on evolutionary biology and a positive attitude change toward teaching evolution.

Studies conducted at two South African universities mirrored the studies above. Chinsamy and Plagányi (2007) surveyed first year science students before and after a course on evolution while Abrie's (2010) participants were second, third and fourth year biology student teachers. Chinsamy and Plagányi (2007:250) found that the course had a minimal effect on changing students' views that initially resisted concepts such as all life evolved on earth through the process of evolution and that natural selection is the means by which this process is driven. Their study also revealed that first year university students have a very scant understanding of these concepts and that “adult's views on evolution are remarkably impervious to instruction” (ibid, p. 252), a conclusion that Abrie (2010) also drew based on the results of his study.

Abrie's (2010) study also revealed that even though 70% of their respondents claimed to be prepared to teach evolution, the data showed instead "that they neither had a satisfactory knowledge of the theory of evolution, nor did they understand the nature of science" (ibid, p. 104). Shockingly, only 40% of the participants claimed that they accepted the theory of evolution. This is an interesting result because it shows that although there is almost a three year gap between the two studies – the one conducted a year before evolution was to be first taught at schools and the other two years after the topic was introduced into schools – the students appear to be just as ignorant about basic evolutionary concepts. The point of concern is that these students are training to become biology teachers and once they have qualified, their lack of knowledge and misunderstandings will be reproduced in the classroom thereby perpetuating this cycle of ignorance toward the theory of evolution,.

Although their study did not deal directly with students' perceptions of human origins, Chinsamy and Plagányi's (2007) results imply that if students believed strongly in creationism then they would also be convinced that man was created in God's image approximately 6 000 years ago. The study by Abrie (2010) however explicitly asked questions pertaining to human evolution. Out of the 52% of students who accepted the general statement that organisms evolved over millions of years, only 35% of them believed that modern humans resulted from evolution over millions of years.

This once again indicates that the majority of students do not believe that humans are also subjected to the same evolutionary laws governing other organisms on Earth. Alternatively these results could show that the students "do not know how to evaluate the evidence for human evolution" (ibid, p.104). Nehm and Schonfeld (2007:718) cite the results of Sinatra's (2003) study that there is "no relation between knowledge of animal and human evolution and its acceptance." These conclusions from the various studies at different times therefore achieve consensus in terms of acceptance versus evolutionary knowledge.

The recurring reason for much of this dissension once again comes down to existing worldviews that these students hold before being exposed to the theory of evolution. Abrie (2010) attributes this directly to the absence of evolution from their schooling

as well as to the conflict between their deeply held religious views with the theory of evolution. This conclusion is also concurrent with that raised by Chinsamy and Plagányi (2007) as well as by Lovely and Kondrick (2008) who attribute the unchanging attitudes of adults who are taught the concepts of evolutionary theory but persist in not accepting it, to the conflict with their worldviews and religion.

2.7.4. The Biology of Human Evolution

However, these ingrained worldviews can be dispelled if a slightly different stance is taken. They are usually a unique product of our culture and remain our private beliefs, whereas scientific knowledge is public and has been established through rigorous processes and scrutiny. According to Alles and Stevenson (2003), “scientific knowledge of human origins need not replace faith in the moral teachings of any belief system,” implying then that people can hold their religious beliefs alongside the scientific knowledge even if the two oppose each other. They believe that it is important for people to have “self knowledge” because this will enable people from diverse races and cultures in our “increasingly pluralistic societ[ies]” to share commonalities – that is where we come from and what we are from a scientific (biological) point of view.

Table 2.1 provides a succinct chronology of events that prompted the possible stages in human evolution starting from the late Miocene period, nearly 8 million years ago (MYA) up to 100 000 years ago (Adapted from Alles and Stevenson, 2003:334):

TABLE 2.1 – POSSIBLE STAGES IN HUMAN EVOLUTION

PERIOD IN TIME	EVENT IN HUMAN EVOLUTION
Late Miocene – 8-5 mya	East African climate changed from dense tropical rain forest to more open, dryer grassland.
Late Miocene to early Pliocene – 6-4 mya	Development of bipedalism – probably in response to the more open habitat – mainly in eastern part of Africa
4-1.7 mya	Climate in east Africa became drier – adaptive radiation of the hominins occurred.
1.7 mya – present	<ul style="list-style-type: none"> - Brain size of hominins almost doubled. - Explosive geographical expansion and rapid divergence of <i>Homo</i> genus. - Species diversity reduced – first hominins and then regional species of <i>Homo</i> became extinct. Resulted in only one species surviving – <i>Homo sapiens</i>.

An interesting perspective of these researchers is that they relay the topic of human evolution in a story form thereby making it easier to understand because it is not written as “cold, hard fact” (Andrews, 2005). This method of writing has been discussed at length earlier in this paragraph (2.7.2) when Andrews (2005) and Bybee (2002) also advocate for the use of stories, historical case studies and narratives to tell the tale of evolution. This will also allow people with conflicting worldviews to be more receptive to the facts of evolution. Van der Mark (2012) conducted a comprehensive study on the value of using concept cartoons as an alternative to teaching the topic of evolution to secondary school learners.

2.7.5. Conclusion to evolutionary theory

From the preceding discussion it is clear that the topic of evolution is a necessary part of the school Life Sciences curriculum. Regardless of the private beliefs that people hold as a result of their religion and culture, the science of evolution, including human origins, and the nature of science must remain an integral part of secondary and tertiary science education. At the same time, people need to realise that accepting the theory of evolution does not have the reciprocal effect of belittling their religion and faith (Alles and Stevenson, 2003:333). The next aspect that will be reviewed is that of the Hindu religion particularly with regard to its stance on evolution.

2.8. HINDUISM

Several writers agree that worldviews of learners remain unchanged regardless of the quantity or intensity of factual knowledge presented to them (Dagher and BouJaoude, 1997; Reiss, 2009; Schilders *et al*, 2009; Cavallo and McCall, 2008). Many of these studies therefore showed that science and religion are often a separate means of being acquainted with the world and they do so from diverse frameworks of understanding (Cavallo and McCall, 2008). Science and religion therefore each have a platform from which to understand the world. A teacher in a study summed this up by stating that evolution and creationism should not be treated as if they are right or wrong but as “belief systems that can never be truly or fully proved or discredited” (Berkman and Plutzer, 2011).

Nord (1999:29) refers to this as the “two worlds” approach because science asks the objective “how” questions while religion asks the subjective “why” questions. This writer regards religion as being about our existence rather than the physical reality – it is about the meaning of life and not the chemical make-up of life. The purpose of religion is deemed to provide mankind with a moral compass by which they can regulate their daily conduct and interactions with other humans (Berger, 2006). Although religion and science are separate domains, their teachings are very often in opposition to each other. This is especially significant with regards to the scientific topic of evolution which appears to counteract the religious teachings of creation as portrayed in the Bible or the Qu’ran. This Abrahamic and especially Christian perspective of evolution seems to dominate the teaching of evolution in western countries like the USA, the UK and more recently, South Africa as well.

However, it is important for learners to be aware that different worldviews exist in society – particularly in a heterogeneous society like South Africa. By learning about other religious worldviews children can be made to feel that their own point of view, stemming from their religion in most cases, is not unusual and this can in turn assure “them that they are entitled to hold onto it” (Schilders *et al*, 2009:119). Students will then not feel forced to change their worldviews, thus enabling them to be more accepting of the topic of evolution. In turn this can also foster greater understanding of the evolutionary concepts which form the cornerstone of biology and the nature of science.

This is also especially significant in South Africa where the spectre of apartheid crushed the religious and cultural beliefs of minority groups. The Christian beliefs of the white Afrikaner ruling group were imposed on the whole country specifically in schools in the form of Christian National Education. The Hindu religion of the minority Indian group in South Africa was therefore suppressed to such an extent that even seventeen years after the demise of apartheid many South Africans, including some Indians, remain ignorant of Hindu teachings and tenets. In fact even when India was ruled by the British colonialists, Hindu religious traditions were subjected to humiliating denigration by Christian missionaries thus displaying the brutal realities of imperial domination (Brown, 2007a:424). With the inception of the topic of evolution in South African schools since 2008 it is important for learners to receive a

well-balanced view of this topic including how it is perceived by different cultural groups.

Hinduism is practised by only 1.2% of South Africans but almost 47% of South African Indians are Hindu – making it the predominant religion among South African Indians (South Africa’s population, 2010). Globally, Hinduism is practised by almost 17% of people while in India alone, Hinduism is practised by over 600 million people or 80% of the population (ibid). In the past 150 years, there has been a mass emigration of Indians from the subcontinent to other parts of the world, thus bringing the tenets and teachings of Hinduism to the West (Lipner, 1998). Many westerners have learnt to “esteem the Hindu way of Life... even going so far as to adopt Hindu ideas and ideals” (Swami Nirvedananda, 1957:16).

The Hindu perspective will therefore provide an interesting and significant dimension to the body of knowledge of a fundamental topic such as evolution. Fort (2006) ascribes that the worldview every person is born into moulds their thought and religion and that this is a continual contribution to social construction. This author also states that religious thought and practice is a rich and complex part of Indian history. Religion is regarded as a human construct that allows us to make meaning of our existence particularly to explain evil and suffering as well as to deal with “questions about ultimate reality, human destiny, and the ultimate meaning of existence (where are we from and going?)” (ibid).

2.8.1. A Brief History of Hinduism

Hinduism is a vast and complex religion that encompasses a way of life as well as a way to worship and realise God. Fort (2006) describes the Hindu religion as being made up of a group of related traditions and that as a whole it is as broad as all the Abrahamic religions put together. However, historically, “Hindu” was merely a geographical term with Persian origins used to describe the inhabitants around the area of the Sindhu (Indus) River – it therefore did not have any religious connotations. The Persians mispronounced the word Sindhu as Hindu and this was the name that has since been used (Swami Nirvedananda, 1957; Fort, 2006). Actually, the more fitting term to describe the spiritual culture of India would be “Sanatana Dharma”

which means “the Eternal Religion” and that we are all spiritual beings in material bodies with an immortal spirit soul (Daley, n.d; Swami Nirvedananda, 1957).

Hinduism is regarded as one of the major world religions and is several thousand years older than any other major religion. Its exact age is unknown (Swami Nirvedananda, 1957; Das, n.d) but it is thought to exceed 5000 years old (Sarma, 1955; Daley, n.d). Throughout history, Hindus abided by the principles of peace, love, tolerance, truth, non-violence, sympathy and service to mankind never imposing their religion upon others through force or ploys (Swami Nirvedananda, 1957; Das, 2009). Lipner (1998) describes it as a way of life that is also free from any “dogmatic affirmations concerning the nature of God.” Hinduism includes the tenets of *dharma* (ethics and duties), *Samsara* (re-birth), *Karma* (right action) and *Moksha* (liberation from the cycle of *Samsara*). The Hindu way of life stems from eternal truths that have largely withstood the vast passage of time as well as periodic invasions by many different races such as the Moguls, Persians and more recently the British (Swami Nirvedananda, 1957).

The reason for this steadfastness is that although Hinduism is built on a solid foundation of constant, fundamental spiritual truths it also allows a certain degree of flexibility in how it is practised. This is especially important because as time passed, society changed and the Hindu way of life adapted accordingly – it is not a rigid religion that does not accommodate change. This elasticity therefore ensured its survival over time (Swami Nirvedananda, 1957). To assist this survival, Hindus also believe in the appearance of *Avatāras* through the ages. These are incarnations of the divine that manifest on Earth from time to time particularly during times of strife and discord to restore righteousness and to ensure that mankind adheres to the path towards God-realisation (Bhagavad-Gita, Ch. 4 verse 7-8).

2.8.2. Hindu Scriptures

Unlike the one religious text that forms the cornerstone of the Abrahamic religions, Hinduism has a range of scriptures that detail the many facets of righteous living, worship and the pathway to God-realisation – the Bhagavad-Gita being one of the more well-known of these. The Hindu holy texts that contain these details are collectively referred to as the *Shāstras*. These have originated from the different seers

and sages who have attained God-realisation using various methods and paths – once again alluding to the flexibility of practising the Hindu religion (Swami Nirvedananda, 1957:24). Many of these holy men (*Rishis* in Sanskrit) were so deeply engrossed in reaching God-realisation by discovering spiritual truths that they were not concerned with affixing their names to these discoveries. The Hindu scriptures were recorded in the Sanskrit language and have since been translated by several different people into English and other languages.

The Vedas are the oldest of the Hindu scriptures and they mean the “knowledge of God.” They include both the ancient and universal revelation of God to mankind (Brown, 2007:427). The Vedas – which are referred to as *Shruti* because they are based on direct revelation that was passed on through oral tradition – gave rise to all other Hindu holy texts which were then memorised and are called *Smriti* (Swami Nirvedananda, 1957:25; Das, 2009). There are four collections of texts that comprise the Vedas. It is stated that the Vedas contained the essential elements of all modern sciences in addition to “complete moral and spiritual insights” (Brown, 2007:427).

In addition, there are portions of each of the four Vedas that contain their essence and are known as the Vedāntas or Upanishads. They answer questions such as “Where and how does God exist? How are man and the universe related to Him? How and why should one try to realise God? What does exactly happen when one realises Him?” (*sic*) (Swami Nirvedananda, 1957:27). According to Swami D. Saraswati, the Vedas are all truth and were revealed to man by God, who is all Truth, just after mankind was created, almost two billion years ago. The Vedas are therefore eternal because they contain truths from the source of all truth – God (in Brown, 2007:718).

The Upanishads reveal three fundamental teachings amongst others: firstly, they show a development from multiple Gods to an ultimate reality, called Brahman that the human mind cannot understand. Secondly, that the core of our being, referred to as *Atman*, is identical to this ultimate reality. Thirdly, that the material world including our personalities is just an illusion or not completely real – the power that the Divine used in order to create this illusion is referred to as *maya* (Rood, 2008). Nevatia (2007a) however provides an alternative viewpoint by interpreting this teaching of the Upanishads as the universe being real, not an illusion and our inability to recognise it

as a revelation of God is *maya*. Whichever idea is accepted, the concept of *maya* refers to the veil of illusion that clouds man's intellect and prevents him from seeing the spiritual reality which is the Divine and vice versa i.e. the Divine which is the spiritual reality.

The Purānas are another class of *Shāstra* that originated so that Hindu teachings could be accessible by the common people who in ancient India were often not literate. Hindu teachings in the Purānas were illustrated using stories, histories and parables that people could easily relate to (Swami Nirvedananda, 1957). They therefore contain some of the oldest materials passed down through oral traditions. Five sections make up a typical Purāna, viz. Cosmogony, creation at the start of each age, genealogies of the gods, the ages of the world and the dynasties of the kings (Sarma, 1955). Two very useful and well-known *Shāstras* are the *Rāmāyana* and the *Mahābhārata*.

The former is written by the ancient sage Valmiki and narrates the epic story of the adored Indian prince, Lord Rama of Ayodhya who was exiled to the forests for fourteen years as a result of his jealous step-mother's wishes. Lord Rama was the epitome of the ideal son, husband, brother and friend and it is his actions and reasons for them that make up the crux of this epic text. Hindus are supposed to use his life as an example for their own in order to live righteously. Even today, Lord Rama is worshipped with much devotion and reverence by Hindus worldwide. The *Rāmāyana* also introduces us to *Sri Hanuman*, the most devout of Lord Rama's devotees. Sri Hanuman's devotion and loyalty to Lord Rama is also an example that devotees of the Lord should aspire to follow. The easily-recognisable feature of Hanuman is His monkey-like visage which often gives him the misnomer of the "Hindu Monkey-God" especially in Western media. Some researchers attribute this feature to evolution and the existence of hominids and modern humans around the same geological time span [See *Appendix K* for a colour picture of this Hindu god].

The *Mahābhārata* is another epic that took place many thousands of years after the *Rāmāyana*. It describes the great battle of Kurukshetra between two sets of cousins the Pandavas and the Kauravas over sovereignty and the right to rule. This battle represents the fight between good versus evil. Contained within the *Mahābhārata* is

the much-revered Bhagavad-Gita – a discourse by Lord Krishna on the eve of the battle to one of the Pandava brothers (good) regarding righteousness or *dharma*. Once again, Hindus ought to use the teachings of Lord Krishna as a guide to following right conduct in their daily lives. Worship of Lord Krishna has resulted in the formation of movements such as ISKCON (International Society for Krishna Consciousness) or the Hare Krishna following which is highly active in many countries even today [See *Appendix K* for colour pictures of this Hindu god as well as a battle scene].

Both Lord Rama and Lord Krishna are regarded as *Avatāras* of Lord Vishnu who manifests among humanity during times of discord and evil in order to restore and reinforce righteous living and ultimately God-realisation.

2.8.3. Avatāras and Avatāric Evolutionism

Hinduism believes in the Holy Trinity of Gods – Brahma the Creator (not to be confused with the ultimate being or Supreme Soul mentioned above), Vishnu the Preserver and Shiva the Destroyer. According to the Purānas Lord Vishnu is believed to have incarnated ten times in the form of ten different Avatāras in different epochs of the history of the world whenever humanity was in grave danger of losing sight of reaching the ultimate reality and needed divine intervention. In the Bhagavad-Gita, Lord Vishnu in the form of the Krishna-Avatāra says:

“Whenever there is a decline of Dharma and a rise of Adharma, then I embody myself, O Bharata. For the protection of the good, for the destruction of the wicked, and for the establishment of Dharma, I am born from age to age” [Ch. 4, verse 7-8]

For Hindus this verse therefore substantiates the appearance of the Divine on Earth among mankind from time to time especially when evil predominates over goodness and man needs guidance to return to the path of God-realisation. The reason for the incarnations to assume different forms each time is because the demands of mankind are different each time. As man’s understanding of the world changes, so does his desires and concepts of order resulting in the corresponding adaptation of these rules so that order is not just re-established but re-defined (Pattanaik in Das, 2009), thus reinforcing the flexibility of the rules that maintain order according to Hinduism

These manifestations are the mortal forms of Lord Vishnu, who is immortal, timeless and infinite (Das, 2009).

The appearance of the ten Avatāras of Lord Vishnu throughout man's time on Earth is of particular relevance to my study on evolution because it appears to foreshadow biological evolution and has given rise to a branch of study called "Avatāric Evolutionism". This theory originated in the last quarter of the 19th century in an attempt to merge traditional Hindu myths with the latest discoveries in science (Brown, 2007). **The advent of this theory therefore shows the willingness of Hindu academics and theologians to merge science and religion rather than to keep them as separate domains.** This is a very important point especially for my study since it could explain why Hindus do not experience much conflict with the theory of evolution. Keshub Chunder Sen (1838-1884) was the earliest Indian proponent of this field of study, further showing that the notion of evolution was acknowledged by an Indian who was able to assimilate it into the Hindu culture.

Keshub regards creation as an ongoing evolutionary process – "a ceaseless emanation of power and wisdom from the Divine Mind" rather than a single act (Brown, 2007:432). Keshub therefore seems to subscribe to the idea of Intelligent Design (ID) which has recently come to the fore in the West – an idea that the process of evolution is controlled by a higher power and is not a random event. A similar observation was also made by another Indian scholar, Pavgee (1854-1935), who found that for the ancient people of India, there was no separation between science and religion and the geological evolution of the planet was attributed to a Creator God or the Self (*Atman*) (in Brown, 2007:721).

These views that lean towards ID are shared by another unnamed Indian writer. He believes that evolution is a fact and that "God could have used evolution as the method of creation" (ibid, p. 738). Keshub also believed in the spiritual evolution of man rather than in biological evolution which he leaves to the evolutionary scientists such as Huxley and Darwin (Brown, 2007:431). This spiritual evolution is an internal battle that mankind has concerning his instincts and passions and depending on his choices advances to a higher level of spiritual development until ultimately he reaches divinity and his evolution is complete.

There are opposing views on this topic since some writers like Kachapilly (n.d cited in Brown, 2007b) fully support the notion that there is unity in life on Earth and that all life forms are related. This view also supports the idea that man evolved gradually from the lower life forms and was not created in a single moment to dominate them. Other writers such as Swami P. Saraswati (cited in Brown, 2007b) are against the idea of Avatāric evolutionism mainly because it appears to be a theory that is mere speculation based on the Western influence of the theory of evolution.

On the other hand, Swami Vivekananda (1863-1902) is described by Brown (2007b:716) as being “a key evolutionary thinker” and he is credited with taking “a modernised, scientized version” of the Vedas to the west. He was able to see that evolutionary theory actually had Vedic roots and therefore recognised that the idea of evolution was present in the ancient Vedas long before Christianity arose.

Others who believed in the idea of evolution existing in the Vedas include the Hindu scholar Pavgee (1854-1935) and the English Sanskritist, Sir M. Monier-Williams. The latter stated in 1912 that Hindus were “Darwinians many centuries before Darwin and evolutionists many centuries before the doctrines of evolution had been accepted by the Huxleys of our time” (in Brown, 2007b:720). In fact some writers believed that “India was the fountainhead of all civilization, including science” even when the Vedic notions of evolution were regarded as “mere Hindu superstition until Darwin said it was true” (Brown, 2007b:716; 717).

Once again, this shows that no value was placed on Hindu knowledge until it was ratified by Western scholars – then only was the theory given credibility. However, “Hindu pride in India’s ancient scientific accomplishments received a special boost when endorsed by Western scholars” (Brown, 2007b:717), thus implying that instead of feeling slighted by being ignored, Indians were proud of their history which existed long before modern science.

Another religious scholar, Swami D. Saraswati in the 19th century, acknowledged that both science and religion had a place and could coexist. However he was rather dismissive of Darwinism – a theory that had just started becoming known in India at the time – and therefore was against the notion of Avatāric evolutionism. His one

criticism of Darwin's theory was that he made the common mistake of thinking that man descended from monkeys and so this process of evolution should be continuing and monkeys should no longer be on Earth (Brown, 2007b). He therefore did not understand Darwin's theory of gradualism with common descent about monkeys and humans sharing a common ancestor that gradually split into different lines, giving rise separately to monkeys and to man.

2.8.3.1. The Story of Avatāric Evolutionism

Keshub draws a parallel between how Christianity and Hinduism “believe(s) in the continued evolution of the Logos” (spirit) (in Brown, 2007a:432). He goes on to describe “Indian Avatarism ...[as]... a crude representation of the ascending scale of Divine creation. Such precisely is the modern theory of evolution” (ibid). This is a clear statement of the link between evolution in Hinduism (with the advent of the avatars) and biological evolution.

Darwin's theory of gradualism was therefore echoed by Keshub, an Indian scholar. Furthermore, Keshub provides details on “the evolution of life from gross matter through the vegetable, animal, and human, realms thus emphasising “the progressive nature of evolution itself” (Brown, 2007a:433). He also describes how successive kingdoms were formed by improving the one before it and that this improvement culminated in the formation of mankind. Keshub therefore believed that evolution occurs to always produce a more improved organism and that this process has reached “its completion in humankind” (Brown, 2007a:433). However, he also realises that the process of evolution is not really over at this point but continues on a spiritual level until all people have reached God in the form of Christ. Even Darwin seemed to acknowledge this spiritual progress coupled with physical improvements in his book *Origin of Species* when he wrote “And as natural selection works solely by and for the good of each being, all corporeal and mental endowments will tend to progress towards perfection” (cited in Brown, 2007a:434).

Natural selection is regarded by many theologians, including some Hindu ones, to be independent to God. They therefore disregarded this process because of its random mechanism that did not seem to be directed by God and neither did it seem to have a purpose (Brown, 2007a:434). According to later Hindu evolutionists, Western science

only explains physical evolution, which is half of a cycle while Hinduism deals with both physical and spiritual evolution, a full cycle.

In the early twentieth century another proponent of avataric evolutionism – K. Narayanswami Aiyer – realised that there were different ways in which to understand the stories in the Purānas. He then understood that the ten Avatāras of Lord Vishnu represent the various stages of evolution of different life forms starting with life in the oceans. These animal and human forms seem to correlate with the organic evolution of species from the oceans to amphibians to reptiles, mammals, higher primates and finally to physically and spiritually evolved humans (Brown, 2007a).

The following is a highly abbreviated outline of the advent of the ten Avatāras on Earth as described in the Purānas: *[Adapted from Yoga Lessons for Children, 1984, Vol. 22]*. See *Appendix K* for colour pictures of the various Avatāras described below:

Matsya Avatāra – this first incarnation of Lord Vishnu and appeared during the Satya Yuga was in the form of a fish and is a story reminiscent of the biblical tale of Noah’s ark. An ancient king, Manu, encountered this fish who instructed him to build a ship and take on board seven Rishis (holy men) with the Vedas and all the “seeds of life” (p. 35) in preparation for a great flood that would purify the world. Once the world was flooded, the fish pulled the ship to the only dry land available, the highest peak of the Himalayas and the occupants including the holy Vedas were saved.

Kurma Avatāra – the next incarnation was in the form of a tortoise, also during the Satya Yuga. One of the Hindu gods, Indra was cursed by a sage for disrespecting him. Indra and the other gods lost their powers causing the world to die. The gods were instructed by Lord Vishnu (the preserver in the Hindu trinity) to churn the ocean of milk in order to obtain *Amrita*, the nectar of immortality, which would restore their powers and revive the Earth. The churning rod was the Mandara mountain whose weight caused it to sink while the ocean was being churned rendering the job impossible. Lord Vishnu then assumed the form of a tortoise and used his back to support the mountain while the gods continued to churn until eventually the nectar emerged.

Varaha Avatāra – the third incarnation assumed the form of a boar. This Avatāra rescued the Earth which was submerged in the ocean by a vain and wicked demon Hiranyaksha in the Satya Yuga who was seemingly invincible by any enemy that he named. However, he neglected to name the boar which was then able to defeat him thus saving the Earth.

Narasimha Avatāra – the fourth incarnation of the Satya Yuga was in the form of a man-lion. The demon Hiranyakasipu was the brother of Hiranyaksha and he wanted to avenge his brother's death at the hands of Lord Vishnu. After many years of austere penance, sacrifice and prayer, he was granted the ability to also be invincible to any man or animal. His son, Prahlad, however was an ardent devotee of Lord Vishnu and did not have any of his father's demonic tendencies. His father was angry that his own son had such deep faith and reverence in his enemy and proceeded to try and kill his son. However, Lord Vishnu appeared in the form of a man-lion, a form that the demon had not been granted invincibility from, and was able to kill Hiranyakasipu thereby protecting his devotee Prahlad from his evil father and ridding the world of another evil demon king.

Vamana Avatāra – this was the fifth incarnation and was in the form of a dwarf during the Treta Yuga. Prahlad's grandson Bali was ruler of the Earth but his greed caused him to want to possess the heavens as well. The other gods appealed to Lord Vishnu to prevent this. At a great prayer ceremony, Lord Vishnu took on the form of a dwarf and asked Bali to grant him dominion over any area that the dwarf could cover in three paces. Bali agreed, thinking that this was a small request given the puny size of the dwarf. Vamana then grew in size until with one step he was able to cover the whole Earth and with a second step, the heavens. Because there was no place left for the third pace, Bali was banished from Earth, thus allowing his greed to bring about his own downfall.

Parasurama Avatāra – this Avatāra was born in the Treta Yuga at a time on Earth when the Kshatriyas (warrior-caste) were terrorising the people endlessly. When he was a little boy, he was trained to use weapons expertly by Lord Shiva Himself and was given an axe as his characteristic weapon. Later on he avenged the death of his

father, a sage, by killing all the wicked Kshatriyas on Earth, thus restoring peace once again.

Rama Avatāra – the seventh Avatāra has been discussed previously under the paragraph on Hindu scriptures (2.8.2). In addition to appearing on Earth to make His life an example that mankind should imitate, Sri Rama was also responsible for ridding the world of many demons that were preventing the sages and Rishis from performing their prayers and meditations. His main objective was to defeat the demon king Ravana who kidnapped Sita, Rama's wife, and held her captive in his island kingdom of Lanka for almost a year. Rama's exploits and adventures in locating and eventually rescuing her make up a major portion of the epic Ramayana. Sri Hanuman, mentioned earlier (in paragraph 2.8.2), played a significant part in the location and rescue of Sita. Lord Rama appeared on Earth in the Treta Yuga.

Krishna Avatāra – the eighth Avatāra of Lord Vishnu has also been described earlier in paragraph 2.8.2. He was also born on Earth in the Dwapar Yuga to rid it of demons that were tormenting the people. The second purpose of Lord Krishna's appearance was to play a considerable function in the great battle described in the epic Mahabharata and to deliver the divine message of the Bhagavad-Gita to mankind.

Buddha Avatāra – as recently as 500 BC (during the Kali Yuga), this ninth Avatāra of Lord Vishnu made his appearance in north-east India originally in the form of a Hindu prince. His role was to teach people the forgotten religion of the noble and pure Vedas and Upanishads. In his time, these scriptures and their teachings were no longer observed and were replaced instead by the empty, meaningless rites and ceremonies that offered no spiritual sustenance for the people. Thus the religion of Buddhism was born which stems from the Hindu teachings of the Vedas and Upanishads.

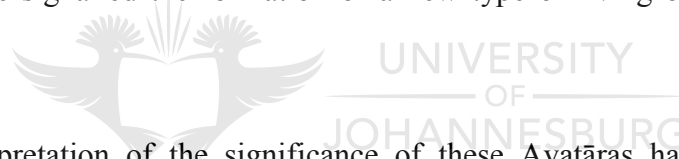
Kalki Avatāra – this is the tenth Avatāra of Lord Vishnu and is yet to appear. It is said that Kalki will have the head of a horse and the body of a man and that when Kalki appears it will mark the end of the present age (Kali Yuga) in which we live. Some researchers compare this Avatāra to the appearance of Christ on a white horse

at Armageddon. More will be said about the ages (Yugas) of the Earth in paragraph 2.8.4.

2.8.3.2. The Interpretation of Avatāric Evolutionism in the Light of Evolution

It is clear from the account given above about the ten different Avatāras that they appeared on Earth whenever there was great calamity among mankind. Lord Vishnu, in his divine role as Preserver, took on the task of ridding the world each time, of the cause of such suffering and evil.

To reiterate the quote by Lord Krishna in the Bhagavad-Gita “Whenever there is a decay of righteousness, then I Myself come forth. For the protection of the good, for the destruction of the evil-doers, and for the sake of firmly establishing righteousness, I am born from age to age” – thus confirming the need for the advent of the Avatāras during different times of discord on Earth. In terms of evolution, it is thought that the Avatāras appeared on Earth each time a new life form was being produced and so their appearance signalled the formation of a new type of living organism (Brown, 2007b).



Extensive interpretation of the significance of these Avatāras has been made by Brown (2007b) who relates their appearance to the theory of evolution. His analysis is largely based on the writings of the Indian nationalist-geophysicist, Pavgee (1854-1935) who placed much emphasis in recognising the Vedas as being a repository of scientific knowledge and on accepting Darwinism to such an extent that he even acknowledged its presence in the Vedas. Pavgee was able to extract from the Upanishads the origin and structure of the Earth and the evolution of life forms in relation to the geological periods of Earth’s history. He found that the formation of the Earth started with the Self (*Atman*) who gave rise to space, which then gave rise to air, which in turn formed fire, then formed water, then earth, then plants, food and finally man.

The scientific explanation or verification of this sequence of events in the “geological evolution of the Cosmos” (ibid, p. 721) is as follows: infinite space gave rise to the atmosphere which then produced violent wind currents that led to the formation of fire. The heat remained for some time before cooling and resulting in condensation of

water vapour which fell as rain forming thermal oceans. As these oceans cooled, they resulted in the formation of land and mountains and then life forms became visible. Plants and seaweeds arose initially and then progressed to more complex and organised types, culminating in the formation of man. This explanation therefore seems to be echoed in the western theory of how the Earth and life on it began and it is an account that existed in ancient Indian scriptures aeons ago, long before scientific thought began in the West.

2.8.4. Correlation between the advent of the Avatāras with geological time

Pavgee interpreted the Purānas to provide details of the correlation between the geological ages of the Earth with the evolution of life forms. According to these texts, the Matsya (fish) Avatāra came about in the Paleozoic Era which is when the first fishes arose – in the Grade 12 Life Sciences textbook, this event is stated to have occurred specifically during the Ordovician Period (Isaacs *et al*, 2007:265). The Kurma (tortoise) Avatāra came about during the Mesozoic Era – an era characterised by the appearance of the first reptiles, the dinosaurs.

The next few Avatāras appeared during the current Caenozoic Era which is marked by the domination of the mammals viz. the Varaha (boar) Avatāra followed by the Narasimha (man-lion) Avatāra, the Vamana (dwarf) Avatāra, the human Avatāra – Rama, Krishna and Buddha, and finally the Kalki Avatāra which is yet to appear. The man-lion Avatāra is seen by Pavgee to be the link between man and beast (Brown, 2007b). The futuristic Kalki form is open to many interpretations, one of which is that it represents genetic engineering and cloning to produce a more superior hybrid being that is better able to bring about the destruction of evil and corruption in the present age.

As mentioned earlier, according to some Indian scholars, the emergence of the ten Avatāras actually marks turning points in the formation of new life forms in the evolution of the world (ibid). Together with the appearance of these Avatāras is also the occurrence of major geological disturbances. For example, the fish Avatāra commanded the ancient King Manu to rescue his people from a great flood which many Indian myths have interpreted to be actually great sheets of ice rather than water during the last Ice Age about 8000 years ago.

When the tortoise Avatāra appeared, it was accompanied by the disturbance (churning) of the ocean and the appearance of the Himalayan mountain range. The period of the boar Avatāra which required the lifting of the Earth from the ocean may also represent the movement of the sea bed at some point in the Earth's history. The large size of the man-lion Avatāra may hint at a species of *Anthropithecus* that emerged during the Miocene period while the dwarf Avatāra may suggest Neanderthal man. The next four Avatāras represent a different stage of human civilisation in Indian history (ibid, p. 738).

However, post-colonial (i.e. post-1947) Indian thinkers such as Bhagavan Das regard the ten Avatāras as mere allegories of the Purānas and therefore only have a symbolic significance in the scriptures. Furthermore, Das recognises two other main themes that emerge from the theory of Avatāric Evolutionism:

- I) Spiritual evolution goes together with physical development
- II) Physical or spiritual continuity exists between humans and other animals (Brown, 2007b).

The first of these two themes implies that as physical evolution occurs to produce more complex organisms, it is accompanied by spiritual growth which becomes more possible as the physical form is more capable of enabling this type of psychological evolution. He feels therefore that the physical body prepares the organism to attain higher spiritual levels.

The second of these two themes implies that Das regards all organisms on Earth to be both physically and spiritually connected. The physical connection has direct reference to Darwin's theory of evolution by common descent and that all life forms arose from a common ancestor while the spiritual connection refers to the Hindu belief that all life is part of the Supreme *Atman* or life force – more of which will be said under the paragraph on reincarnation. Brown (2002:99) asserts “that all manifestations of form are generated by the Supreme person.”

Raman (2003 – cited in Nevatia, 2007b) asserts that Avatāric evolutionism goes beyond science and implies that divinity is apparent in all life forms, not just in humans, once again referring to the unifying spirit (*Atman*) amongst all life. Both the

themes are encapsulated in the Upanishads as “The universe is a manifestation of God. All matter contains innate divinity and evolution is the process of realizing that divinity.” **The idea of evolution is therefore present in ancient Hindu scriptures and is not a concept that is foreign to Hindus who are aware of their teachings.**

2.8.5. The Concept of Creation in Hinduism

The creation of the universe by Lord Brahma is described at length in one of the scriptures, the Bhagavata Purāna, and is divided into ten different types of actions. The first six refer to the creation of material energy from the “Om” sound, the primordial energy regarded as the essence of Brahma or the Supreme Being. The last four actions concern the creation of plants, animals, humans and the immortals (Nevatia, 2007b). These scriptures describe six types of plants, twenty eight types of animals, one type of human being and eight types of immortals.

Remarkably, these scriptures were thought to have been written around the 7th century BCE while the notion of humans belonging to one species was only realised in the West much later. The immortal beings include four sages and the eleven sons of Brahma. A few important points are raised by this author concerning the account of creation in the Upanishads – that God and the universe are not separate; that “creation and destruction are the changing manifestations of God;” that these changes are continuous as is evident by births and deaths of humans as well as of galaxies in space; and that creation is not an event that “happened” but is continually happening.

Although various versions of creation abound in other Hindu scriptures (in O’Connor, 2008), this description is of particular relevance to my topic of evolution in Hinduism. Important to note is that in Hinduism the presence of these different accounts of creation ensure that there is no single story like in the Abrahamic religions, thus allowing more flexibility in how Hindus view the development of life forms on Earth. This could be a reason why Hindus may be more open-minded about accepting scientific explanations such as the theory of evolution.

2.8.6. The Concept of Time in Hinduism

Another possible reason for Hindus being more accepting of evolutionary theory is probably as a result of the manner in which time is dealt with in many of the Hindu

scriptures. According to the Abrahamic religions, time is described in a linear fashion that began with Creation and will end with the day of judgement as described in the Bible and the Qu’ran. Hinduism however, regards time and creation as occurring in cycles (Das, 2009; Nord, 1999; Brown, 2002; Rosen, 2002; O’Connor, 2008).

Each cycle of time is created by the Divine and is called the *Kalachakra*. In Sanskrit, *Kal* means “time” and *chakra* means “wheel;” hence the “wheel of time” which is divided into four expanses of time or epochs beginning with the Satya Yuga, then the Treta Yuga, followed by the Dwapara Yuga and lastly the Kali Yuga, in which we are presently. At the end of the Kali Yuga, the cycle ends and then starts again. *Yuga* is the Sanskrit term for an age or epoch. Nord (1999:31) states that “Some Hindu texts tell of vast and endless cycles of creation and dissolution.” There are many calculations to find the human equivalent for the actual duration of these ages. The most acceptable of these shows that one cycle of these four ages which is referred to as a *Kalpa* or one Mahayuga (*Maha* = great), is equivalent to 10 000 parts in one day of the Divine. This is in turn equal to 4 320 000 human years. The duration of each Yugam (singular) is as follows:

TABLE 2.2 – THE AGES OF THE EARTH IN HINDU SCRIPTURE

AGE/ YUGAM	DURATION	
	HUMAN YEARS	PARTS
Kali Yuga	432 000 years	1000
Treta Yuga	864 000 years	2000
Dwapar Yuga	1 296 000 years	3000
Satya Yuga	1 728 000 years	4000
TOTAL	4 320 000 HUMAN YEARS	10 000 PARTS

The concept of divine years stems from the creator God, Lord Brahma one part of the Hindu Trinity of Gods mentioned earlier in this paragraph. According to the Mahabharata, one day of Brahma is divided into 10 000 parts, each of which equals

432 000 human years. Therefore, one day of Brahma actually contains 1000 Mahayugas which is in turn equivalent to 4 320 000 000 years or 4.32 billion years – also referred to as one *Mahakalpa*. It must be noted that these periods of time are so vast that they go beyond the scope of the human imagination (Rosen, 2002; Santucci, 2008). Western scientists and evolutionists estimate the age of the Earth to be 4.54 billion years old – a figure very close to the above calculation from Hindu scriptures (O'Connor, 2008; Rosen, 2002). This contrasts sharply with the Christian notion that regards the age of the Earth to be roughly 6 000 years old.

The Hindu concept of the age of the Earth does not stop at the mere physical number of years instead there is a deeper explanation to the differing length of each age or Yuga. According to Das (2009) these four Yugas symbolise the four phases of involution of man as he gradually lost the awareness of his inner spiritual self and descended into awareness of only his gross or physical body. As each age diminishes in length, virtues and righteousness also declines progressively (Rosen, 2002:82). The first age (Satya) was that of 100% truth – in fact in Sanskrit, the word for truth is *Satya*. This was also known as the Golden Age when man was spiritually most advanced with great psychic powers, was fully aware of his inner divinity and was in direct contact with the Divine. In this age, worship to attain absolution was only achieved through long and deep meditation. The first six Avatāras appeared on Earth during this yuga.

The Treta yuga (Silver Age) saw mankind losing $\frac{1}{4}$ of this truth or knowledge of spiritual awareness although they remained righteous and followed the moral ways of living (Das, 2009). Worship to attain absolution during this age was only obtained through making lavish sacrifices. The seventh Avatāra, Lord Rama appeared on Earth in this age. The third age, Dwapara yuga (Copper Age) was when man lost half of the truth of his spiritual awareness and began the descent into immorality and loss of virtue. Worship for absolution was only possible through deity-worship. Lord Krishna, the eighth Avatāra manifested in this age.

Kali Yuga is the fourth and last age (Iron Age) and sees mankind losing $\frac{3}{4}$ of the truth. Evil and dishonesty prevail making it the most degenerate of the Hindu ages of mankind. Attainment of absolution however, appears to be the simplest – mere

repetition or chanting of the holy name of the Lord is said to be sufficient (Rosen, 2002; Das, n.d). Lord Buddha, the ninth Avatāra appeared at the start of this age. We are presently a little more than 5 000 years into the Kali Yuga. The scriptures predict that at the end of the Kali Yuga (another 427 000 years to come!) signalled by the appearance of the tenth and final Kalki Avatāra, the universe will be destroyed by Lord Shiva (the destroyer component of the Hindu trinity). This destruction will be followed by Lord Brahma recreating the universe for a new Satya Yuga to start.

Hence from this explanation, as mentioned earlier, two important observations can be made. Firstly, Hindu scriptures reveal the vast age of the universe, the Earth and mankind – an age that far exceeds the claim made in the Bible. Secondly, Hindu scriptures reveal that the concept of time occurs in a cycle rather than following a linear fashion as laid out in the Bible. Hindus therefore may not have difficulty in accepting the concept of geological time and therefore the process of evolution unlike people of Christian or Muslim faiths whose religion describes the concept of time differently.

2.8.7. Reincarnation and the Law of Karma

The cyclical concept of time in Hinduism discussed in the previous section (2.8.4) is suggested by the endless cycles seen in nature – by the alternation of the seasons, day and night, revolution of the planets around the sun, etc... Hindus also believe in the cycle of births and deaths which gives rise to the concepts of reincarnation and the law of Karma. Reincarnation refers to the cycle of repeated births and deaths that the soul undergoes and the law of Karma states that for every action there is a corresponding reaction (Rosen 2002) – almost identical to Newton's Third Gravitational Law. As will be shown in this section, this belief could be another reason that makes evolutionary theory more easily acceptable to Hindus – a pertinent point for my study.

2.8.7.1. The Hindu Concept of the Soul

According to Hindu scriptures, every living creature is actually a soul (subtle body) within a material (gross) body (Rosen, 2002). Human beings as well, are composed of two aspects, spirit and matter: the spirit is the soul and it is the real Self which arises from the Divine; matter or the material body, on the other hand, is the mind, intellect

and the physical body. The mind is the means by which our emotions act, the intellect is the equipment by which we can discriminate and make judgements, the physical body is the machinery by which we perceive and act. Without the spirit, these three parts are inert and insentient. The spirit is therefore the life spark and is the true Self – referred to as the *Atman* in Sanskrit (Parthasarathy, 1986).

The *Atman* is essentially the same in all living entities because it arises from the all-pervading, infinite Divine being which is therefore known as the Supersoul or in Sanskrit, the *Paramatma*. This idea of oneness that Hinduism proclaims is also mentioned by Nord (1999:31), who points out that in “Eastern religions – particularly Hinduism – all of reality is understood as being in some sense one with God or the Divine.” Unfortunately, once the soul is trapped in the cycle of births and deaths, this important connection to the Divine and in turn, to all other living beings is forgotten and is hidden under the veil of *maya*.

Specifically, human life on the material plane (Earth) is then clouded by the endless pursuits of material gains and sensual pleasures in an attempt to find happiness and satisfaction in material wealth. However, the sages describe how futile his efforts are because man is really the Infinite Self and this true nature cannot be expressed or satisfied using his finite, material body, mind or intellect. Instead, man must shed the veil of ignorance that muddies his true self and attain self-realisation. Once man realises his oneness with the *Paramatma* and the shackles of earthly bondage are broken, his soul can then be liberated from the cycle of births and deaths and he would have attained *Moksha* (Prabhavananda, 1967).

The Upanishads describe the state of *Moksha* as the release of the *Atman* from the bondage of the gross body in order to realise or merge with the *Paramatma*. This Hindu scholar states that *Moksha* “implies freedom from all limitations, bondages and imperfections, as well as release from birth and death” (ibid, p.81). The definitive purpose of human life is to “harmonize or unite” with the ultimate reality in the universe called Brahman (in Brown, 2007:729). Thus liberation should be the ultimate goal of all living beings but man alone is said to be capable of possessing the means to actively seek this path towards *Moksha* (Prabhavananda, 1967:79).

2.8.7.2. The Cycle of Births and Deaths (Reincarnation) or *Samsara*

As mentioned above, the soul is present in every living being and the purpose of the soul is to eventually reach the state of *Moksha* so that its attachment to the material world is over. Hindus believe that the soul is immortal and that it is able to pass from one physical body into another when the one dies and the other is born. In order to do this, the soul must go through several trials and experiences almost a developmental process that will allow it to attain self-realisation. Brown (2007b:732) regards this process of re-birth as soul evolution and offers it as an explanation for how Hindus “resolve the problem of suffering in this world.” Of further relevance to my topic, the soul’s struggle for liberation is compared to the organism’s struggle for survival in its environment (ibid).

In the Bhagavad-Gita, Lord Krishna says to Arjuna “Just as a person casts off worn-out garments, and puts on others that are new, even so the embodied soul casts off worn-out bodies and takes on others that are new” (Ch. 2, v. 22). Hindus believe that because the soul is immortal, it can enter many different gross bodies to use them as vehicles to reach *Moksha*. This process of being re-born into new bodies is called reincarnation and it is one of the fundamental tenets of Hinduism. Alluding to the cyclical concept of time described earlier, births and deaths also occur in a cycle because Hindus believe that the one cannot occur without the other. If a soul is born in a new body, death is inevitable and when that body dies, rebirth for that soul is inevitable until *Moksha* is reached (Prabhavananda, 1967; Rosen, 2002).

The scientific theory of evolution describes organisms’ physical development to reach a more advanced state that ensures the survival of that species in changing environments. Science states that organisms have no control over how this evolution occurs it depends on chance and the genetic make-up of that organism to survive in a specific habitat. Hinduism however, states that individuals have conscious control over the evolution of their soul because they have the power to decide or discriminate on how to act. Since humans have the mind, intellect and the body, they are in possession of the tools to advance the development of their soul towards God-realisation.

Despite this difference, the concept of evolution or development towards a higher plane is a concept that has existed in Hinduism for aeons. **The physical evolution of organisms described by Darwin and other evolutionists is therefore not a strange concept to Hindus who have prior exposure to this kind of thinking in their religion.** In fact the concept of evolution is referred to in many scriptures and treatises on the Hindu religion e.g. According to Parthasarathy (1986:72), “*Atman* is the final goal of evolution..... it is a state of absolute accomplishment, completion and fulfilment in human evolution.”

Along the path to *Moksha* man is faced with many temptations and base instincts that can distract him from this journey. Using the tools mentioned above (i.e. mind, intellect and body), man has the means to either resist or succumb to these distractions and in so doing, decides the progress of his soul towards the Divine. His actions therefore play a major role in the path of his soul and ultimately it is these actions that decide whether and how that soul will be re-born or if it has reached the state of *Moksha*, in which case, re-birth will no longer occur.

2.8.7.3. The Law of Karma

In Sanskrit, *Karma* means action and reaction or right action. It is man's actions in his life that decide his next birth just as the actions of his past lives determine his current birth. Daley (n.d) regards *Karma* as accountability because humans have the opportunity to improve their life so that they can become more spiritually conscious and enlightened. If they abuse their human birth by engaging in evil deeds and animal-like behaviour then they have given up their responsibility to reach the *Paramatma*. They will then lose the privilege of having another human birth and will be re-born into a lower life form. A biblical phrase that conveys the same message is “As you sow, so shall you reap.”

In Hinduism, the concept of “eternal damnation” does not exist. Instead, the soul is able to either elevate or degrade itself on the basis of the actions (*Karma*) of their physical body. The soul is given several opportunities to redeem itself and progress to a higher level by changing the actions of the body into which it is born. The law of *Karma* is therefore intertwined with the concept of reincarnation. The soul undergoes spiritual evolution in its quest for the *Paramatma* by striving to perform good deeds

and achieving self-realisation. Knowledge of this process of striving for perfection is echoed by the physical process of evolution – once again showing that the concept of evolution is not new to people of the Hindu faith.

2.8.8. Conclusion of Hinduism

To summarise this section on Hinduism, the following points need to be reiterated:

- 1) Hindu scriptures record that the Earth is 4.32 billion years old – an age very close to the 4.54 billion years that scientists have calculated – and that time exists in a cyclical rather than linear form.
- 2) Hindu scriptures reveal that during this period there were ten Avatāras that manifested on Earth in different forms in order to rid the world of evil and restore righteousness to mankind; and that the order in which they appeared mirrors the evolutionary theory of how life evolved on Earth.
- 3) One of the main tenets of Hinduism is the law of Karma and reincarnation which propound spiritual evolution of the soul inherent in every living being until it reaches the ultimate state of *Moksha* or liberation from the cycle of births and deaths and merges with the Divine Supersoul.

These three points are the main aspects of Hinduism that are most relevant to my study which deals with the lived experiences of Hindu teachers and learners on the topic of evolution in schools. Their discussion implies that the idea of evolution is closely linked to the Hindu religion and it is therefore possible that Hindus do not experience many conflicts between their worldview and the topic of evolution. This will be analysed in Chapter 4.

2.9. SUMMARY OF CHAPTER TWO

This chapter started with an explanation of the theoretical and conceptual framework in which my study is grounded. The “grand theory” of social constructivism was used to place the study in context of how learning takes place. The learning theories of Piaget and Vygotsky were then described and their pertinence to this study highlighted. This was followed by the over-arching third-generation CHAT model proposed by Engeström which brings to the fore a series of inter-related conflicts and

interactions between various role-players in the learning process. These tensions will receive further discussion in later chapters of this dissertation.

Since my study deals with the teaching and learning of evolution in a South African context, it was to delve into how this topic was received in other countries. An in-depth discussion followed of countries where evolution was taught – USA, Pakistan, Lebanon and Scotland. It became apparent that the most amount of conflict between the topic and people's religions came from the southern American states where Christianity was the dominant religion. These studies focusing mainly on Christianity and Muslim perspectives, highlights the “gap” that my study addresses: a Hindu perspective on evolution. Since my study focuses on teaching evolution in South African schools, it was necessary for a discussion on this topic in schools here. Evolution is a topic that was only recently introduced in South Africa so not much research has been done in schools. Most of the research therefore centres on university students and their views on studying evolution.

In addition to CHAT, there were three intermediate theories that needed to be discussed for their contribution towards my study: PCK of teachers – because of the fundamental role that teachers play in disseminating knowledge to learners and the influence of their training and personal experiences on how they taught; worldviews and CCC – because this has a vital influence on how teaching and learning takes place; and the NOS – because both teachers and learners must understand how the theory of evolution came to be in order to better understand and accept it as a valid scientific theory.

My topic deals with the theory of evolution so it was highly appropriate for me to provide some information and discussion on this theory and its proponents such as Darwin and more recently Dawkins. The aspects of evolutionary theory that are included in the South African school syllabus are also mentioned. I also include a review of human evolution because in many of the studies conducted internationally and locally, the greatest amount of conflict in people comes from them not accepting that humans have also evolved rather they believe that they were created by God in their present form.

Finally, I present Hinduism in a nutshell – the religion which forms the cornerstone of my study. Three basic tenets of Hinduism are discussed that are particularly significant to the theory of evolution: Avatāric evolutionism; the cyclical concept of time; and the law of *Karma* and reincarnation.

These eight aspects of my literature review (Chapter 2) were selected to provide a substantial background into my study and they are used to analyse the qualitative data gathered. The methods used in collecting this data will be the basis of Chapter 3 which follows.



CHAPTER THREE

RESEARCH METHODOLOGY

3.1. INTRODUCTION

The methodology of a research study is defined as the philosophical framework that relates to the entire process of research and its essential suppositions (Cresswell and Plano Clark, 2007:4). Research design refers to the actual steps taken to connect these philosophical suppositions to specific methods while the latter refer to the particular techniques of gathering data and their analysis (ibid). The methodology, research design and specific methods have to be carefully considered when embarking on any research study and are guided by the research questions of the study.

My study looks at the lived experiences of Hindu Life Science teachers and learners towards the topic of evolution and the research questions guiding this investigation are therefore based on this title. The methodology, design and research methods employed to best address these questions are discussed in this chapter. It also includes details on how the sample groups were selected, how the data was collected and the techniques used to analyse this data. Triangulation of data, their reliability, validity and ethics involved are also discussed in this chapter (adapted from Cronje, 2011).

3.2. RESEARCH QUESTIONS AND OBJECTIVES

The following research questions inform the methodology and will direct the data collection and analysis of this study:

- 4) What are the lived experiences of South African Hindu teachers on the teaching of evolution in Life Science?
- 5) What are the lived experiences of South African Hindu learners on the learning of evolution in Life Science?
- 6) How do Hindu people view the process of evolution?

The objectives of this study are based on these research questions and can be identified as follows:

- 1)

- The experience of Hindu teachers with the topic of evolution personally according to their own worldviews.
- The experience of Hindu teachers as professionals with the topic of evolution in the classroom.
- The PCK of Hindu teachers specifically with regard to teaching evolution.
- The notion of the NOS of Hindu teachers.

2)

- The experience of Hindu Life Science learners with the topic of evolution according to their own worldviews and belief systems.
- The NOS for Hindu Life Science learners.
- The Hindu religion according to these learners.

3)

- The ideas that Hindu parents and Hindu priests have about evolution.
- The knowledge that Hindu parents and priests have about their religion.
- The influence of these two aspects together in establishing a complete picture of the topic of evolution being taught in schools.

3.3. RESEARCH DESIGN

The research design plays an essential role in an investigative study since it provides an outline of the route that will be followed in order to perform the study (Cronje, 2011). It includes the hypotheses made at the start of the research, the methods of data collection and the manner in which these will be analysed (Cresswell, 2009). It is a plan of action that links the philosophical assumptions of the framework of the study to specific methods that will be used to conduct the study (Cresswell and Plano Clark, 2007:4).

The research questions and objectives outlined in 3.2 above require a detailed investigation into the lived experiences of Hindu people (learners, teachers, parents, priests) towards their religion, the topic of evolution and the influence of the one on the other. This investigation would therefore be optimally conducted using a qualitative research design with elements of phenomenology, where such techniques as interviews and questionnaires are employed. Qualitative research design allows an understanding of the world from the perspective of the people being studied, in this case, Hindus. It does not attempt to impose preordained concepts, rather hypotheses or theories are created as the research is conducted as meaning is made from the data (Perumal, 2011). The worldviews, feelings and belief systems of people are closely intertwined with the knowledge and information that they learn and they each influence the other profoundly. Qualitative research aims to allow an understanding of the social and cultural aspects of people (Toloie-Eshlaghy *et al*, 2011). In the case of my study, qualitative research would allow greater understanding of Hindu perspectives towards the topic of evolution since there is a lack of information in this knowledge strand.

It is not possible to conduct a quantitative study to gauge these aspects because some of the shortcomings of this type of research are that it is impersonal, there is limited understanding of the context of the participants and it is largely driven by the researcher (Cresswell, 2010). Qualitative research on the other hand provides the detailed perspectives of a few people whose voices and feelings are heard within their own contexts and it is driven by the people under study rather than by the researcher conducting the study. The latter is therefore able to contribute towards warm conceptual change whereas the former alludes to cold conceptual change that is dry and objective.

In addition, because qualitative research is open to several different interpretations, it allows this study to extend its ties to the overarching lens of Cultural Historical Activity Theory (CHAT). This is a system of tensions between different role-players in an activity system which in the case of my study could involve Hindu Life Science learners or teachers. As discussed in considerable detail in Chapter 2 (**2.1 and 2.2**), CHAT is rooted in constructivism, a worldview that revolves around understanding, multiple participant meanings as well as social and historical construction (Cresswell, 2010). Cresswell (1998) identifies six different traditions in qualitative research such

as case studies, ethnographies, grounded theories and biographies. My study uses a generic qualitative research design with elements of phenomenology, one of the six traditions named by Cresswell (1998).

Phenomenology focuses on understanding the essence of experiences of a phenomenon experienced by several individuals (ibid). In this case, the phenomenon is the lived experiences of Hindu Life Science learners and teachers towards the topic of evolution. This type of qualitative research seeks to make detailed meaning of these experiences as reported by the participating individuals. These meanings are then classified, categorised and analysed in order “to reduce them into a general pattern of description of those experiences” (ibid, p.31).

A significant technique that the researcher should use in a phenomenological investigation is that of “bracketing.” This is when the researcher must try to keep his/her own thoughts, opinions, assumptions and feelings separate from the comments of the respondents (Amos-Hatch, 2002). This is very often difficult to do since the researcher, being human does have their own preconceptions and worldviews that can influence the discussion heavily but must resist the urge to impose these personal opinions in the interview. As a grade 12 Hindu Life Science teacher, I shared most of the criteria of all the interviewees so it became rather challenging not to become a part of the discussion and to remain instead an objective observer and facilitator of the interview.

3.4. RESEARCH METHOD

It has been ascertained that the research design chosen was a generic qualitative research design with strong elements of phenomenology. The next aspect to consider was then the selection of the most appropriate strategy that could be used to achieve this design. In order to delve into the lived experiences of the participants, it was necessary to use the methodological tool of both individual and focus group interviews.

The method of interviewing subjects is a widely used tool in qualitative studies and is in fact a key method in social research (Amos-Hatch, 2002). This author goes on to describe an interview as “a conversation that has a structure and a purpose determined

by one party – the interviewer – and is a “construction site for knowledge” (ibid). The interview process in qualitative research is one in which the researcher probes the responses given by the participants in order to understand them in relation to the study under question. It is further described as being a “powerful method of producing knowledge of the human situation” and this has in turn “changed the ways of understanding the human situation and of managing human behaviour throughout the twentieth century” (ibid). In my study, interviews enabled me to better understand how Hindus view the topic of evolution relative to their religious worldviews and this will in turn contribute towards the generation of knowledge to fill the gap in this field of research.

There are different types of interviews including focus groups and individual within which there are structured and unstructured types. In my study, I used both focus group interviews and individual interviews. Both of these were loosely structured since I had a set of questions pre-planned and used them as a guide to keeping the interview on track. However, I also used unplanned probing questions depending on the responses received from the participants to obtain further clarity and understanding of their comments.

Further triangulation of data specifically with regard to the nature of science (NOS) was achieved by questionnaires that the teachers being interviewed were asked to complete (*Appendix F*). These questionnaires served to verify the verbal responses of the teachers on the NOS. It was anticipated that they would have had more time to think about their responses before writing them rather than being expected to verbalise an answer in a shorter time. Hence, more lucid explanations were expected in the questionnaires. The analysis was incorporated into that of the teacher comments and was not indicated in a separate section in Chapter 4.

3.4.1. Individual Interviews

Since my study has elements of phenomenology, it was necessary to conduct individual interviews with Hindu Life Science learners to gauge responses without any pressure from peers. This pressure is one of the limitations of focus group interviews because it seems that often, the respondents feel intimidated or encouraged by their peers. Individual interviews were also conducted on Hindu parents of Life Science learners, Hindu Life Science teachers and a Hindu priest.

These interviews were semi-structured and made up of many open-ended questions that were prepared in advance so that the same information was obtained from each participant to facilitate data analysis (Cronje, 2011). A total of nine individual interviews were conducted, transcribed and analysed in detail.

The respondents were purposively chosen based on predetermined criteria that met the rationale of my study. Literature suggests that the most frequently used sampling procedure used in qualitative research is that of purposive sampling (Vaughn *et al*, 1996). This type of sampling is when the researcher selects participants based on a set of “predetermined criteria about the extent to which [they] could contribute to the research study” (ibid). Purposive sampling aims to understand a topic in sufficient detail “to investigate how representative different views are and how strongly these views are held” (Amos-Hatch, 2002).

3.4.2. Focus Group Interviews

As the name suggests, focus groups are interviews of between 5 to 10 people at the same time within the same group and a large amount of information on the focal topic can be obtained in one session (McNamara, 2011; Hatch, 2002; Vaughn *et al*, 1996). Since participants are free to express their thoughts, opinions and feelings, focus group interviews are important because they generate responses from people that would not be available if individual interviews were conducted. The group dynamics and interactions between the participants stimulate discussion and insights among the individuals that may not arise if they were alone (Amos-Hatch, 2002:24).

The focus groups in my study consisted of purposively selected grade 12 Hindu Life Science learners in four different high schools in the Gauteng-Tshwane metropolis. It was difficult to locate many learners that met these criteria. Each focus group was therefore made up of between 4 to 5 learners and was confined to one school at a time to ensure that the learners could comfortably discuss the questions within a group made up of their peers. To further increase the quality of data received, the groups were homogeneous, being made up of purposefully selected subjects as mentioned above. Otherwise it is thought that individuals tend to restrict their responses because they are amongst people who differ greatly from them (Amos-Hatch, 2002). However, literature also states that focus groups made up of strangers will yield more truthful

comments since they may never see each other again and will be less inhibited about their experiences and opinions (Vaughn *et al*, 1996).

Once it was decided that purposive sampling was to be used, the next step was to actually recruit the learners for the focus group interviews. This was done easily in the school in which I taught, where the learners who met the criteria were known and approached on an individual basis telling them about the study and asking them if they would be interested in participating. Once their verbal agreement was obtained, consent letters were issued for them and their parents to sign (*Appendix C1*). At the other three high schools, the researcher made use of a contact person – the Life Science teacher there – who selected learners who met the required criteria. This teacher then repeated the steps just described and issued the permission letters. The use of a contact person is a recognised method of participant recruitment (Vaughn *et al*, 1996).

3.5. DATA COLLECTION

The data collection method of conducting interviews was the next step in the research method. It was necessary to employ purposeful sampling since the focus of this study is the lived experiences of a specific group of participants, Hindu Life Science learners and teachers. According to Cresswell (2007), there are five steps or activities in the gathering of data and these steps will be used to guide the lay-out of the remainder of this paragraph:

1. Selection of participants
2. Gaining access and obtaining permission
3. Building rapport with participants
4. Generating and recording data
5. Data analysis

[Adapted from Cresswell (2007:118) and cited in Cronje, 2011]

Each of these five activities in the data collection process will now be described in greater detail

3.5.1. Participant Selection

The aim of this study is to explore the lived experiences of Life Science teachers and learners belonging to a particular cultural group (Hindus) towards the topic of evolution. Hence, it was necessary to locate this particular group of participants. The researcher is based in an area where the demographics consist of predominantly African or White Christian people. It was very difficult to locate large enough groups of Grade 12 Hindu Life Sciences learners in order to perform focus group interviews with them. Eventually, pockets of these learners were found in the researcher's own school and in three other high schools in a district about 30 km away. A total of 17 learners were involved in the interviews.

Grade 12 learners were chosen because according to the NCS curriculum for Life Sciences, these learners would have been exposed to the topic of evolution since Grade 10. They were therefore in a more knowledgeable position to be able to answer questions based on this topic. Hindu Life Sciences teachers were fortunately easier to locate and four of these participants were chosen to be individually interviewed. The basis of their selection was their availability – although there were two other teachers that fit the criteria as well, time constraints on their side did not enable interviews to be set up. This was a minor set-back but it did present me with some disappointment.

The month of May was chosen in which to conduct the interviews. The reason for this is that by this time the topic of evolution ought to have been taught to completion and details of the topic would have been fresh and more easily accessible in learners' minds. The Life Science teacher was consulted -in each case confirming that this was indeed the case.

Once the participants were chosen, it became necessary to then obtain permission in order to gain access to the school.

3.5.2. Gaining access and obtaining permission – ethical issues

Firstly, permission was sought from both the Gauteng Department of Education (GDE) and the relevant district office by means of a completed research request form (*Appendix A*). An application was also lodged with the ethics committee at the University of Johannesburg to ensure all ethical considerations were met (*Appendix A1*). The school principal of each selected school was then approached telephonically

or in person in order to obtain an initial go-ahead for research to be conducted using the learners from his school. Written letters (*Appendix B*) to the principal of each school were then used to formally request for this permission.

These letters formally introduced the researcher, described the study briefly and requested permission to conduct research by means of interviewing the relevant group of Hindu learners. The letters also stated that all interviews would be audio-recorded to ensure reliability of data transcription and asked if there was any objection to this method. None of the principals that were approached had any problems with their learners participating in the interviews or with them being audio-recorded. The participants were also informed that they had the freedom to withdraw from the interview at any time and that their anonymity and that of their schools would be ensured throughout every stage in the study. These aspects of privacy and anonymity were also stated clearly on the consent letters that each participant signed.

Since the interviews were conducted on grade 12 learners, it was assumed that they were old enough to understand the implications of their participation and there was very little chance of their vulnerability to exploitation as is sometimes the danger when interviewing children (Amos-Hatch, 2002). However, to be sure, the researcher explained to the learners the reason for the focus group interview and their rights to privacy and to withdraw at any stage if they so wished. The teachers also were well known to the researcher so there was very little chance of them feeling coerced into taking part. Like the researcher, they were Hindu and grade 12 Life Sciences teachers and were all colleagues belonging to the same community of practice. However, their right to refuse participation at any stage during the study was also made clear to them at the outset of the interviews.

Similar letters were then sent out to learners' parents informing them of their children's involvement and asking them for permission as well (*Appendix C1*). These letters also had room for the learners' own agreement to participate in the study. None of the parents or learners objected to their children participating in the study. Hindu Life Sciences teachers were also approached initially either telephonically or face to face in order to get a verbal willingness to participate. This was then formalised with letters in a similar vein to the other three that were issued (*Appendix D1*). A total of four focus group interviews with learners and four individual interviews with teachers

were accommodated and interview dates were set up in advance during the month of May.

The focus of this study is the lived experiences of Hindu Life Science learners and teachers to the topic of evolution. They are therefore the foundation of the data gathering process. However, in order to increase reliability and trustworthiness of the study, triangulation in the data gathering process was necessary. During the focus group interview, learners may not always present a complete or true reflection of their beliefs or knowledge. It was necessary therefore to interview both Hindu parents of Life Science learners as well as a Hindu priest.

This is true to the philosophy of using CHAT as a lens, since parents and priests are part of the community in the activity system which is the unit of analysis. It was also in order to obtain a more holistic picture of how learners formulated their views by looking at the belief systems of their parents as well as the authority of the community (priest) in sanctioning certain views or beliefs. Three Hindu parents and one Hindu priest were interviewed individually. These different facets surrounding the Hindu learner will be analysed in detail later on (Chapter 4) using the CHAT lens because CHAT is made up of different elements and the views of the various role players must be determined.

Further triangulation of data was achieved by questionnaires that the teachers being interviewed were asked to complete (*Appendix F*). Permission letters were sent out to these teachers and the priest as well (*Appendices D and E*).

3.5.3. Building rapport with participants

In order to establish a connection with the respondents it was necessary for me to first make telephonic contact with the adults. The learners in the focus group interviews were initially approached and briefed by their Life Science teacher who was also known to me. These teachers then played a key role in coordinating the dates for the interview and for the issuing and collecting of the permission letters from the learners.

The focus group interviews were conducted after school hours on school days so as not to infringe on lesson time in any way. It was also established that there were no other commitments from the learners such as extra lessons or sport on the afternoon

selected for the interview. All the interviews whether focus group or individual lasted for approximately one hour.

It was the intention of the researcher to make the learners feel as comfortable as possible without any reluctance for being present at the interview – they needed to have a clear mind so that questions could be answered more easily. The researcher made the learner participants feel more at ease by providing them with light refreshments especially since it was straight after school and they would need some before the interview began. This also served as an ice-breaking session between the learners and the researcher so that they could feel more relaxed to engage in meaningful discussion during the focus group session.

The individual interviews with teachers, parents, the priest and the learner were conducted along similar lines with some small talk before the actual interview started. All interviews were recorded using a digital voice recorder and as mentioned above, all the participants were informed accordingly so that there was complete transparency from the start.

3.5.4. Generating and recording data

The tool used to collect data in this study was that of focus group and individual interviews with various role players in the activity system under scrutiny. These tools, specifically that of individual interviews, would allow the phenomenological aspect of my study to be realised since the lived experiences of a group of people can best be understood from in depth discussions about their experiences. Interviews are regarded as “the face-to-face type of verbal interchange between the researcher and the human objects which are being investigated” (in Pandey, 2009:11).

Focus group interviews are defined as interactions within a group of people with similar or shared experiences who gather with a moderator to discuss a particular topic (Amos-Hatch, 2002:24). One of the advantages of this type of interview is that it enables concentrated discussion involving a group of people on the topic being investigated and can then generate large amounts of data in a short space of time unlike from observations and individual interviews (ibid; Vaughn *et al*, 1996).

I served as the moderator and the participants in the focus groups, as mentioned earlier, were all grade 12 Hindu Life Science learners from each of four different

schools. A set of guiding questions was prepared beforehand in order to give the interviews some structure and to direct the discussion towards the issues that the research questions were addressing. Many of these questions were open-ended. However these questions were only used rigidly when group discussions reached a stalemate and needed further stimulation from the researcher or when the discussion was drifting too far away from the issue being studied.

3.5.4.1 A guide to the formulation of the interview guiding questions

A set of questions was compiled for each interview type that was conducted. There were few questions that were common to all interviews and others that were specific for the role player being interviewed. According to literature, an outline of the questions and the criteria for their formulation is important in order to establish reliability (Thyer, 2001). The table below shows the questions and the rationale for including them in the interviews:

TABLE 3.1: SUMMARY OF INTERVIEW QUESTIONS AND RATIONALE FOR INCLUDING THEM

INTERVIEW GROUP	QUESTION	CRITERION/RATIONALE FOR QUESTION
Focus groups with learners and Individual – learner (Refer to <i>Appendix G</i>)	Numbers 1-3	To establish the extent to which the learners practised Hinduism otherwise they would not be in a favourable position to answer the other questions on Hinduism.
	Numbers 4, 9, 10 and 18	To ascertain at the start and end of the interview whether any conflict existed in their minds between Hinduism and evolution. It was necessary to ask the question twice to check if their stance had changed since the group discussion and to verify if they still felt any conflict.
	Numbers 5-8	To check what the scriptural knowledge of the

	<p>Numbers 11 and 12</p> <p>Number 13</p> <p>Numbers 14-16</p> <p>Number 17</p> <p>Number 19</p>	<p>group was – sound knowledge would have allowed them to be able to answer the questions more meaningfully.</p> <p>To establish if the learners also experienced conflict with other topics – this was almost a control-type question so that the topic of evolution could be compared to other topics in terms of conflict with beliefs.</p> <p>To gauge learners’ opinion about the topic of evolution that had been left out of the syllabus for many years in SA.</p> <p>To see what the learners’ knowledge of the manner in which scientific theories come about and what they thought theories are?</p> <p>To determine if there were aspects within the topic of evolution that conflicted with their beliefs. Perhaps they saw no conflict with some aspects but had problems with other parts e.g. human evolution.</p> <p>Many literature sources discuss the importance of understanding over acceptance – this question is therefore to determine whether this is true amongst the learners I interviewed as well.</p>
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Individual – teachers (refer to <i>Appendix H</i>)	Numbers 1-4	To gauge the experience of the teacher with the subject while also checking the training received specifically for the topic of evolution. The teacher also needed to acknowledge their level of competence to teach the topic (PCK).
	Numbers 5 and 9	To determine whether the topic of evolution conflicts with their worldview and religion and their reasons for saying so.
	Numbers 6-7 and 14	The same as questions 1,2, 5-8 from the focus group interviews. It was necessary to ascertain these aspects for the teachers as well since they were also Hindu.
	Numbers 8 and 10	To establish the level of content knowledge that the teachers had about the topic by expecting a brief overview of the topic.
	Numbers 11 and 12	Similar to questions 11 and 12 in the focus group interviews – a control-type question comparing evolution to other topics in terms of conflict with religion.
	Number 13	To ascertain their views on the coexistence of religion and science – it was intended that a more holistic response would be obtained since teachers are familiar with the entire curriculum.
	Number 15	To explore how Hindu teachers deal with conflict in the classroom – both from a professional stance and as a Hindu.
Individual – parents (refer to	Numbers 1-4 Number 5	To establish level of knowledge as a practising Hindu.

<i>Appendix I)</i>	<p>Number 6</p> <p>Numbers 7 and 8</p>	<p>To determine whether parents are aware of the topic of evolution being part of the school syllabus and their feelings about this.</p> <p>To ascertain what level of knowledge the parent has about the topic of evolution.</p> <p>To see whether parents feel any conflict between their religion and evolution and how they feel about their children learning about evolution.</p>
Individual – priest (refer to <i>Appendix J)</i>	<p>Numbers 1-4</p> <p>Numbers 5-7</p>	<p>To understand what the knowledge of the priest is with regard to Hindu scriptures so that his answers could be used to triangulate the learners’ responses and to get more accurate responses about the Hindu perspective on evolution.</p> <p>To establish whether Hindu spiritual leaders were aware of what their devotees are being taught in schools and how they feel about evolution being taught to the children.</p>

The following guidelines are provided by Amos-Hatch (2002:114-116) to generate data during successful interviews:

- 1) Follow the rules of polite conversation – this will relax the interviewees and convey to them the importance of their contributions to the study. The interviews in my study were conducted respectfully using manners so that the learners felt that their comments were valuable. This was also achieved by making informal small talk with the interviewees before the session began so that they could feel more relaxed.
- 2) Interview in a comfortable place – if the interview room is physically comfortable and private so that comments will not be overheard unintentionally then the interview will not be negatively influenced. In my study privacy was achieved by conducting all interviews inside classrooms or offices and behind closed doors at all times. There was no danger of the

interviews being overheard thereby ensuring that the interviewees felt safe to participate in the interview.

- 3) Plan well before the interview begins – to ensure that the interview is kept on track so that the intended data is gathered. The list of guiding questions (*Appendix G*) was carefully prepared beforehand so that there was no confusion about the direction and focus of the interview. Refreshments were also organised and laid out for the participants in advance so that the interview room felt more inviting to them. The audio recorder and a back-up was checked to be reliable and in working order before the interview started. The researcher also had writing materials available to take down any notes during the interviews.
- 4) Learn how to listen – researchers must talk less and listen more because it is the interviewees' responses that are needed in the study. This was difficult to do at first because it was tempting for the researcher to add personal views and opinions especially when the participants were unable to respond appropriately. However, this was eventually done successfully when the researcher learnt the technique of “bracketing” (Amos-Hatch, 2002; Saldana, 2009) and was able to distance personal opinions from participants' comments.
- 5) Explore participant's understandings – this will ensure that their comments are understood during the interview and if they are not the researcher needs to ask appropriate questions to clarify their points. During the interviews, additional questions were asked in order to obtain clarity and further explanation about certain points. This was possible because of the unstructured nature of the interviews.
- 6) Transcribe the interviews immediately – this will give feedback about how effective the questions are and will also reduce the possibility of finding gaps in the data set before it is too late to rectify them. This view is also shared by Vaughn *et al* (1996:101).

Many researchers regard focus group interviews as “the basic data collection strategy of a qualitative study” (Amos-Hatch, 2002:24). In addition to the four focus group

interviews conducted with learners, this study was supplemented with individual interviews with other role players (parents, teachers, priest) as well, in order to improve validity of the data gathered.

3.5.4.2. Transcription of data

The gist of the interviews were put down on paper immediately afterwards so that the main ideas and key points could remain fresh in the researcher's mind and could be used to stimulate preliminary thoughts to participants' comments (Amos-Hatch, 2002). These formed the initial impressions of the interview which can be found at the start of each interview analysis in Chapter 4. Two transcribers were used in order to transcribe the interviews as accurately as possible about a week after each interview was conducted. It must be noted that the one transcriber was more accurate than the other although this may have influenced the analysis only slightly. The researcher then carefully listened to the audio version while following the transcript on paper. Any corrections or additions were made on the transcripts so that the final copies could be generated for analysis.

3.5.5. Analyzing Data

Once the data was generated the next step was to analyze it with the specific aim of answering the research questions of this study. Data analysis is regarded as “a systematic search for meaning,” a means of processing “qualitative data so that what has been learned can be communicated to others” (Amos-Hatch, 2002:148). It also allows organising and making sense of data so that the researcher can see patterns, themes, relationships and to develop explanations from these (ibid). The interview transcripts in my study were subjected to this kind of analysis in order to arrive at certain generalisations and themes to explain the lived experiences of Hindu Life Science learners and teachers to the topic of evolution.

In order to answer the research questions stated at the start of this chapter, the following four approaches were considered in the data analysis process for focus groups (Krueger, 1988 in Vaughn *et al*, 1996:103):

- Finding the big ideas
- Considering the choice and meaning of words

- Considering the context
- Considering the consistency of responses

These points were used during the analysis of the interview transcripts in my study and will be discussed in greater detail in Chapter 4 when the actual analysis of data using coding methods will be outlined. In addition to the four approaches listed above, Lederman (1990) (in Vaughn *et al*, 1996:104) recognises the following data analytic methods amongst others:

- Coding data into preset categories
- Developing categories based on the data and then coding the data.
- Using the data as a basis for summary statements that capture the key ideas of the interviewer.
- Interpreting the data through an intensive analytic technique

These methods provide a broad guide to the analysis of the transcripts and are also shared by Giorgi (1979) (in Moustakas, 1994:15) who outlines the processes of analysis as follows:

- 1) The researcher reads the complete description of the learning situation to get a sense of the whole.
- 2) The researcher then reads the same description more slowly and demarcates each time a transition in meaning is seen so that the meaning can be discovered and a series of meaning units or constituents is obtained.
- 3) Redundancies are then eliminated by the researcher and the meaning of the units just made is related to each other and to the sense of the whole as obtained in step 1.
- 4) The researcher reflects on the given units such that each one is systematically interrogated for what it reveals.
- 5) The researcher synthesises and integrates the insights achieved into a consistent portrayal of the structure of learning.

In my study, each interview transcript was read completely to obtain a sense of the whole interview. Thereafter, each transcript was dissected piecemeal to get a series of meaning units from the comments made by the interviewees. These units were then related to each other and to the whole study to find common threads and ideas. These commonalities were then interrogated in depth to feedback to the research questions.

The meaning units arise from grouping codes together that share the same idea. In qualitative research, codes are described as “a word or short phrase that symbolically assigns a summative, salient attribute for a portion of data” and that this “data can consist of interview transcripts” (Saldana, 2009:3). In addition, Saldana (ibid) states that “a code represent[s] and capture[s] a datum’s primary content and essence” just as a title captures the same for a book or film. That is an appropriate comparison because the aim of using interviewing in my study is to reveal the main ideas that the participants have about evolution and Hinduism in Life Sciences.

Themes are then formed from the meaning units that arise from codes and these will then enable the research questions to be answered. According to Amos-Hatch (2002) this is inductive analysis as it proceeds from the specific to the general where a meaningful whole is obtained by pulling together particular pieces of evidence. In my study, the specific comments of the participants are coded, then categorised into meaning units which are in turn pulled together into general or broader themes.

Saldana (2009) depicts these steps in Figure 3.1 reproduced below:

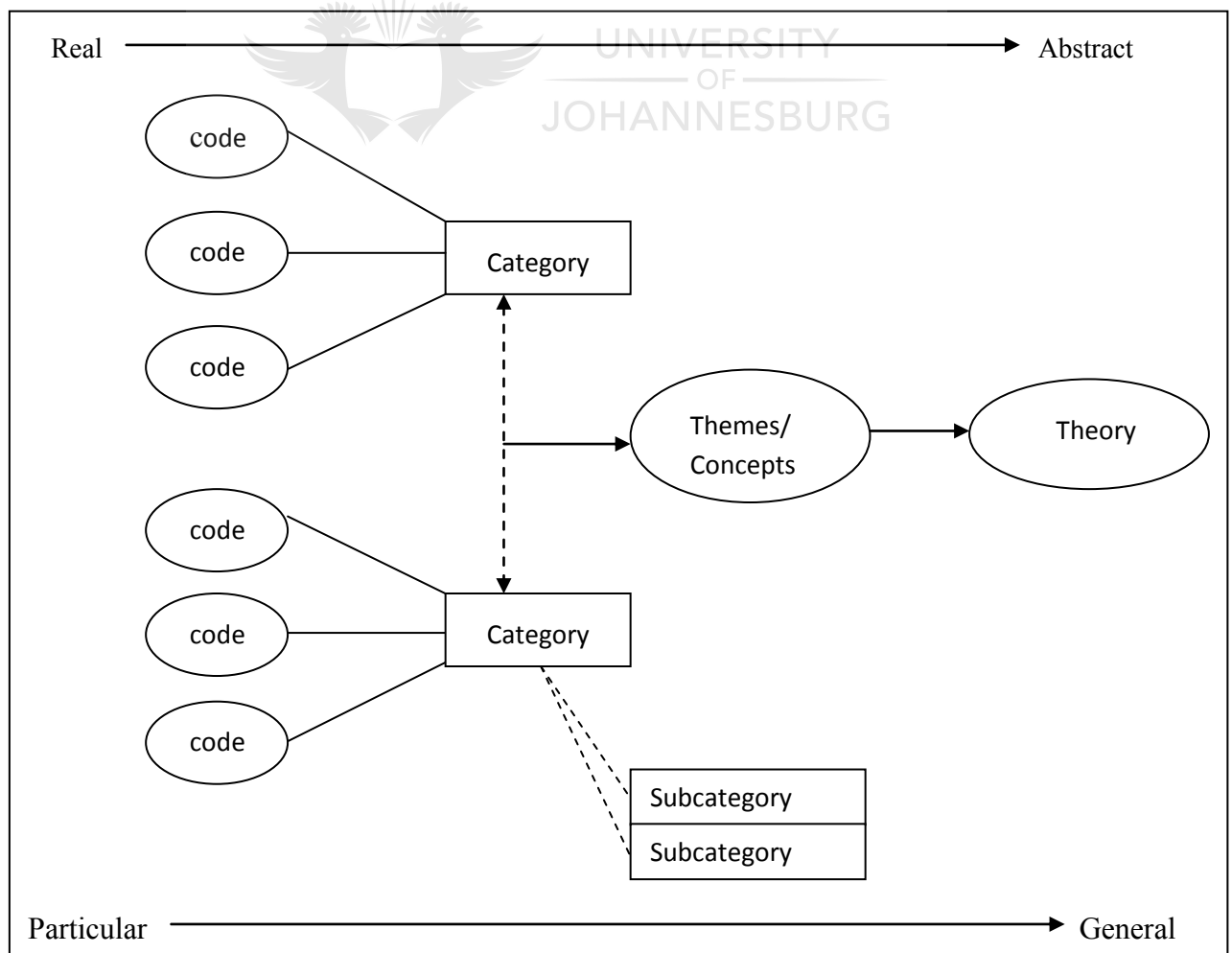


FIGURE 3.1 – Saldana’s streamlined coding model for qualitative inquiry *Taken from: Saldana (2009:12)*

Saldana (2009) distinguishes between several types of coding but the most pertinent ones for my study are in vivo coding, structural coding, descriptive coding, values coding, emotion coding and simultaneous coding. Each of these coding methods will now be explained briefly:

- In vivo coding – this is when the direct speech of the participants is used as codes rather than words or phrases chosen by the researcher (Saldana, 2009). The nature of qualitative research is descriptive and detailed and favours natural language (in Conrad, 2006). In my study this type of coding was often used where the actual language used by the interviewees could sometimes form codes themselves.
- Structural coding – is deemed to be most appropriate for studies involving multiple participants with semi-structured interviews and it is suggested to be most suitable for interview transcripts. It relates specifically to the research questions of a study that serve to frame the interview questions (Saldana, 2009). In my study, the guiding interview questions were directly related to my research questions.
- Descriptive coding – uses one word (usually a noun) or a short phrase to encapsulate the basic idea or topic of a passage of the transcript (Saldana, 2009). This type of coding is sometimes also called topic coding. In the interviews conducted in my study, the participants often explained their responses in long passages, so descriptive coding was used to summarise these.
- Values coding – is used to codify the values, attitudes and beliefs of the participants reflecting their worldview. It is a type of coding particularly used for qualitative research investigating cultural beliefs and individual experiences (Saldana, 2009). This is therefore especially relevant to my study which looks at the lived experiences of Hindu Life Science teachers and learners to the topic of evolution.

- Emotion coding – is used to label the emotions experienced by the participant regarding the questions being asked during the interview. Emotions play an important role in qualitative research because they are a “universal human experience” and by recognising them in a study such as this, deep insight into the interviewees’ perspectives and worldviews will be provided (Saldana, 2009:86).
- Simultaneous coding – in qualitative research is when two or more different codes are applied to a single datum or when two or more codes are applied concurrently to sequential units of qualitative data (Saldana, 2009). Since multiple coding types were used in my study it is therefore appropriate that simultaneous coding is mentioned as a type of coding method.

Several researchers have written about the quantities of codes and emergent themes from a data analysis exercise (Lichtman, 2006; Cresswell, 2007; Wolcott, 1994 – all cited in Saldana, 2009). The consensus seems to be that there is no fixed number of either and that they depend on the actual study and on the contextual factors (Saldana, 2009). The number of codes that can be obtained from a single analysis could vary from 80-100 according to the first source. These can then be grouped into 15-20 categories which can then form 5-7 major concepts or themes. The last source contends that three major themes will make “an elegant quantity for reporting qualitative work” (Saldana, 2009:21).

In my study an average of 3-4 themes emerged from each transcript analysed. Saldana (2009) distinguishes between open coding and a priori coding. The former is when codes and themes are determined as the analysis is being done while the latter are predetermined codes and themes. In my analysis, open coding is used to investigate the transcripts because it allows a more inclusive peek into the participants’ views while a priori coding is more limiting (Cronje, 2011).

This concludes the section on Data Collection and Data Analysis of this chapter.

3.6. VALIDITY AND RELIABILITY OF THE STUDY

Validity and reliability in research are important indicators of the quality of the study. Traditionally in quantitative studies reliability deals “with the replicability and consistency of findings” (in Thyer, 2001) while validity focuses on “the accuracy of findings” (ibid). In qualitative research however, including in my study, validity or credibility is concerned with “truthfulness” of the findings where the researcher ought to be responsible for presenting evidence that is “plausible and credible” (ibid). Reliability or dependability in qualitative study refers to the degree to which data collection procedures and subsequent analysis would yield the same answers to other researchers if they performed the same study (ibid; Conrad *et al*, 2006).

Several researchers differentiate between internal and external validity, both of which need to be considered in the research design of studies (Thyer, 2001; Conrad *et al*, 2006). Internal validity is the level to which researchers’ observations and results “are accurate representations of some reality” (Thyer, 2001). This can be realized in qualitative studies by ensuring that the participants are accurately described and by ensuring that the observations and interpretations of results are convincing to both the participants and to other readers of the report (ibid). In my study, this is achieved by providing a detailed description of all the participants and by providing an accurate analysis using a coding process.

Internal validity is assessed in different ways, one of which is “How context rich and meaningful (“thick”) are the descriptions?” (in Thyer, 2001). The results from my study and their analysis are provided in great detail in Chapter Four which follows – thus contributing to one of the requirements of internal validity.

External validity is also known as transferability and depends “on the degrees of similarity (match) between one sample and its setting events” (ibid). Qualitative research does not aim to formulate generalisations that can be applied to all such situations, instead it attempts “to form working hypotheses that may be transferred from one context to another depending on the” similarity of both contexts (in Thyer, 2001).

My study applies to grade 12 Hindu Life Science teachers and learners specifically in Gauteng and does not aim to formulate a generalisation about the lived experience of

all Hindus to the topic of evolution. However, the outcome of my study can be applied to other similar contexts involving Hindu people and the topic of evolution.

External validity can be assessed by asking various questions such as: “Have narrative sequences been preserved unobscured?” (ibid) and “Do a range of readers report the findings to be consistent with their experiences?” In my study the first question is affirmed by making use of in vivo coding so that the actual language of the participants is used. The second question is also affirmed by the different role players (parents, learners, teachers and priest) who were interviewed and who generally agreed with the overall findings.

This notion of inter-subjective consensus is also necessary for establishing reliability especially in qualitative studies (Thyer, 2001). The various members of the Hindu community were interviewed in order to ascertain their beliefs about evolution and to explore their interactions according to the CHAT model. Internal reliability is described as the extent to which other researchers would make the same interpretations of the data as the original researcher provided they were “given a set of previously generated constructs” as well (ibid). External reliability looks at whether other researchers would arrive at the same result if they conducted a study in the same or a similar setting (ibid).

Reliability in a study can be ensured if the research report contains precise details about the theoretical framework on which the study is based and the exact research design that was used. In addition, details must be provided about the criteria used to select participants, a guide as to how the interview questions were drawn up and the methods of analysis of the results (ibid). For my study, these aspects are all explained explicitly in this chapter on methodology thus ensuring its reliability.

3.7. CONCLUSION TO CHAPTER 3

Chapter Three was an outline of the research methods and research design used to answer the research questions which were stated at the beginning of the chapter. A brief description was provided of the chosen research method – qualitative research, phenomenological study and the tools to conduct such research – focus group interviews and individual interviews. The steps that were followed to analyse the data

in the form of transcripts was also discussed in terms of coding, leading to the formation of meaning units and then themes. The ethics governing the treatment of the interviewees was also described in detail in addition to the reliability and validity of the research study.

A detailed presentation and analysis of the data obtained follows in Chapter Four.



CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

4.1. INTRODUCTION

This chapter is a consolidation of the data obtained in the form of transcripts and their subsequent analysis using the coding methods described by Saldana (2009). Since this was a qualitative study that looked at the lived experiences of Hindu Life Sciences learners and teachers to the topic of evolution, it used elements of phenomenology and it was necessary to obtain in depth accounts of their beliefs and worldviews by means of individual and focus group interviews. A total of thirteen transcripts were analysed, and the data is presented in this chapter. [*See Appendices L to X for transcripts*].

A detailed background is provided for each interview which provides an introduction for each individual interviewee and the learners of each focus group – for example, the school that they attended, the community to which they belonged and the group constitution. It must be reiterated that purposive sampling was used therefore all the interviewees had to be Hindu and all school-based interviewees had to be studying or teaching grade 12 Life Sciences. Each transcript was then analysed according to the inductive method of using codes, meaning units and finally themes and this is presented in the form of tables. A repetition of certain codes occurred in many interviews indicating the importance that the interviewees placed on these concepts. Although this will be stated in the tables to indicate the frequency of their occurrence, this number will not be discussed at length as this is a qualitative study.

The descriptors highlighted in each interview are also clarified to enable an understanding of what they actually mean and why they were chosen from the interview. These descriptors and their explanation in relation to the research questions stated at the beginning of Chapter Three are listed in **Table 4.1**:

TABLE 4.1: List of descriptor codes from all thirteen interviews and their explanation in relation to the research questions

DESCRIPTOR	EXPLANATION IN RELATION TO RESEARCH QUESTION
1. Conflict; No conflict	To find out whether Hindus experience any conflict between their religion and the theory of evolution.
2. Less/More accepting/ Openness to accepting aspects of evolution in religion.	To establish whether Hindus accept evolution or not, based on the principles of their religion.
3. Separation between evolution and Hinduism.	Many interviewees were more accepting of evolution because they tended to separate these two aspects in their mind.
4. Knowledge of Hinduism or evolution.	Some respondents used their knowledge to be able to answer the questions more effectively – those that lacked this knowledge could not answer properly.
5. Ignorance/ Lack of knowledge.	Links to the previous descriptor where many responses are due to the participants not knowing enough about their religion or about evolution.
6. Prioritising the practising of Hinduism/ religion.	This established that some respondents gave first preference to observing their religion above all other daily activities.
7. Lack of commitment	Some interviewees' claim that they did not feel committed enough to practising their religion.
8. Value of learning about evolution.	The participants' opinion about whether the topic of evolution should be taught in schools and why.
9. Belief system	Determines the different aspects that make up the interviewees' worldviews and beliefs since this will influence how they experience the topic of evolution.
10. Creation	A descriptor that indicated what they thought about the creation of life on Earth.
11. No common ancestry/ Misconception of evolutionary theory.	Some interviewees' mistaken belief that the evolution of humans occurs from apes.
12. Intelligent design	The claim from some that evolution was directed by a higher power (a designer) and could not have happened randomly.
13. Fields of knowledge	The absence of the idea of creation in Hinduism

14. No preaching of evolution in temple.	according to some respondents. A response indicating that the Hindu temples do not sermonise anti-evolutionism sentiments.
15. Indoctrination	Links to the previous descriptor that the respondents are not indoctrinated about what to believe.
16. Freedom to choose – not forced to believe in religion.	Hindus interviewed do not feel compelled to remain practising Hindus or to believe in their religion.
17. Antagonism/ Questioning religion	Some experience slight conflict between their religion and evolution.
18. Professional development and Self-Study	An indication from the teachers that they were interested in furthering their professional training and took their own initiative to be informed especially in the topic of evolution because it was recently introduced into the syllabus.
19. Scripture	It was necessary to determine what the scriptural knowledge of the respondents was so that their answers on Hinduism could be validated.
20. Lack of discipline	Many respondents claimed that they did not have the discipline to follow the tenets of Hinduism as they should. This links to the descriptor of indoctrination and no preaching of evolution in the temples.
21. Spirituality and Meditation	This involved a few respondents who believed in being spiritual rather than being religious meaninglessly and in using meditation to achieve this spirituality.
22. Supreme Energy	This referred to the divine energy that some interviewees believed drove the universe and perhaps the process of evolution.
23. Rituals/ Temple/ Fasting/ Prayer/ Lighting the lamp/ Dress culture/ Mythology/ Punishment from God.	Descriptors used extensively by the respondents to affirm their diligence as Hindus by practising or believing in the different rituals associated with Hinduism.
24. Righteous living/ Reincarnation/ Karma/ Tolerance/ Trinity/ Avatars/ Cyclical aspect of time in Hinduism.	These are some of the tenets or beliefs mentioned by the respondents as being what they believe in or practise as Hindus.
25. Prehistoric life/ Age of the	The principles of evolutionary theory that the

Earth/ Fossils/ Natural Selection/ Theory of evolution.	participants could talk about in relation to Hinduism.
26. PCK/ Pedagogy/ syllabus/ Mixed views of learners/ evidence for evolutionary theory.	The skills necessary to be an effective Life Sciences teacher especially with regard to the topic of evolution.
27. Nature of Science	Of both learners and teachers was necessary to establish the degree to which they understood how a scientific theory such as evolution came to be.
28. Understanding evolution	Learners' opinion on the value of understanding evolution rather than believing in it.

Once each interview transcript was analysed in the form of a table of the descriptor codes, meaning units (or categories, according to Saldana (2009)) and themes, the results for each interview were then discussed in great detail using aspects of the literature review (**Chapter 2**) and the methodology of the study (**Chapter 3**). Common themes were then drawn out from the themes of each transcript analysis and these were then used to conclude the chapter as well as the study (**Chapter 5**).

The aim of this study was to contribute knowledge towards the gap that exists as to how the topic of evolution is viewed by the Hindu community. Presently, the only information that exists about religion and evolution is from a Christian and Muslim perspective, hence the themes that emerge from this chapter will add the Hindu perspective to this aspect.

4.2 FOCUS GROUP ONE

4.2.1 Getting to know the learners

This was the first focus group interview conducted by the researcher. The learners attended the school at which the researcher taught but they were not all taught Life Sciences by the researcher. This was a public high school that was regarded as a Model-C school during apartheid. The school is presently multicultural with the majority being African learners. Indian learners make up the next largest race group at this school. Focus group one was made up of five learners, one of which was male.

The learners lived in a multi-cultural community that was rapidly expanding in population size due to an influx of people from other provinces.

Originally the learners all hailed from the predominantly Indian city of Durban in KwaZulu-Natal. At least five Hindu temples are within a 40km radius from where these learners live, the closest being about 5km away. All the learners have studied Life Sciences since grade 10 and have learnt different aspects of the topic of evolution since then (Section 1.2.1). As at the time of the interview, the entire topic of evolution had been taught so the learners had a holistic view of the topic according to the school curriculum.

4.2.2. Initial impressions of interview

Immediately after the interview, the researcher reflected on the discussion that transpired and on the overall learner responses. These reflections make up the initial impressions of the interviews and form the gist of what was discussed. No analysis was done at this stage. It emerged that the learners in this focus group felt no conflict between their religion and what was learnt at school in evolution. Generally, knowledge of Hindu scripture was very poor and almost non-existent. Instead learners value the evidence provided by evolutionists learnt in the classroom and they use this to justify their acceptance of evolution. They had some idea of the Nature of Science (NOS) and this was a valuable aid to enabling their acceptance of evolution. They all seemed to agree that it was more important to understand evolution before they could accept it.

4.2.3. Transcript Analysis for Focus Group 1 – Transcript 1 – APPENDIX L

TABLE 4.2: Table of analysis of focus group 1

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Prayer	Pr	4	Rituals of Hinduism	1. Lack of conflict between Hinduism and the theory of evolution – the
Temple	T	3		
Fasting	Fs	3		

More accepting	A ⁺	4		acceptance of evolution.
Questioning religion	Q	1		
Creation	Cr	5		2. Some conflict between the creationist aspects of Hinduism with the evidence provided by evolution.
Ignorance or lack of knowledge	Ig	12		
Tolerance	To	7		
Belief system	B	5		
Indoctrination	In	2		3. Strong rituals are practised as Hindus but there is a lack of knowledge about Hindu religion and scriptures.
No conflict	C ^{no}	10		
Mythology	My	2		
Scriptures	Scr	2	Belief Systems	
Trinity	Tr	1		
Science and Hinduism or religion in general	Sci	2		
Separation between Hinduism and evolution	S	1	Science and religion	
Age of the Earth	A	4		
Prehistoric life forms	Pre	2		
No common ancestry	NCA	1		
Nature of Science	NOS	3		
Understanding evolution	U	7		
Fossils	F	3	Evolution in the Life Sciences curriculum	

4.2.4. Analysis of Results

4.2.4.1. Explanation of Descriptors used in Transcript 1

Twenty two descriptors were extracted from the transcripts for this interview keeping the research questions in mind. These were then reduced into four meaning units and finally into three themes based on the aims of my study. This pattern of analysis is based on the coding process described by Saldana (2009). Rituals in any religion, including Hinduism, play a fundamental role in worship and in reaffirming one's faith. It was therefore necessary to establish the extent to which the learners performed rituals as Hindus. These rituals included such activities as prayer, fasting and visiting the temple. There was strong evidence of the learners performing these activities and this made them all affirm the first interview question about them being practising Hindus. It seemed that for the respondents the most important aspect of being a Hindu was performing the rituals rather than knowing the reasons behind doing them.

Although they had a scant knowledge of their scriptures they were aware of certain myths that Hindu people recount to their children as reasons for doing certain rituals. However, there was no further reading or enquiry into the validity of these stories from the learners and they seemed content to accept what their parents told them. One of the learners did seem to "question his religion" but this doubt was not explored any further and it did not impede his willingness to accept the theory of evolution without conflict. The descriptor indicating frequent utterances by each of them showed this lack of knowledge and ignorance about Hinduism that the learners have.

However, their lack of knowledge about Hinduism did not deter them from experiencing no conflict between their religion and evolution. Hence the use of the descriptors "no conflict" and "more accepting" in the table. The learners responded overwhelmingly to having no conflict between their religion and evolution. Instead the learners were able to separate their religion from science to enable this to occur – the descriptors "Separation between evolution and Hinduism" (S) and "Science and Hinduism" (Sci) indicate this. The ability for the learners to do this also shows that Hinduism is not prescriptive and does not force its followers to place their religion above everything else. This is unlike in Islam where the first of five pillars of the

Islamic faith is to worship Allah exclusively and to regard him as the only Creator of all life on Earth (Yalvac, 2011).

In addition, the learners in this interview placed a great deal of emphasis on tolerance (To) as one of their beliefs as Hindus, further displaying this value as one of the tenets of Hinduism. This implies therefore that tolerance allows Hindus to be more accepting of other points of view and other possibilities that may exist especially with regards to the science of evolution. The absence of indoctrination in the Hindu religion also gives its followers the freedom to choose an explanation that has the most amount of meaning for them and this is evident in the interview with the descriptor “Indoctrination” (In).

4.2.4.2. Analysis of the meaning units

Four meaning units emerged from the descriptors used in this transcript – the rituals in Hinduism; belief systems that the Hindu learners have; the interplay between science and religion; and aspects of the topic of evolution.

a) The Rituals in Hinduism

All the learners in this group agreed to being practising Hindus and they qualified their status by listing all the different rituals that they engage in at home. Lighting the lamp and praying are two of these rituals. Every Hindu home ought to have a lamp that is lit at least once a day, usually in the evenings when the family is together and prayers are performed. Some families do this in the mornings as well before every one departs for the day. The lamp is usually made of brass and burns with oil and a wick made of cotton wool. It is placed in front of pictures or statues of various deities for worship.

Fasting is another ritual mentioned by the learners. This generally entails abstaining from all meat and meat products (including eggs) and following a strict vegetarian diet for certain days of the week or longer periods in the year depending on the deity being worshipped. Visits to the temple also constitute part of the rituals where special prayer days are observed on a larger scale that families would perform at home. The temple priest also blesses devotees by uttering special mantras (Sanskrit verses) and purely vegetarian offerings of fruit, milk and sweetmeats are made at the main shrine in the temple. It is considered taboo if any non-vegetarian foods are brought into the

temple grounds as these products are considered unclean while the temple is a place of sanctity and cleanliness. This is also why the wearing of shoes is forbidden inside Hindu temples.

The learners also spoke of certain Hindu myths that they know as stories recounted to them by older family members. These myths are often told to young children in order to guide them onto the path of religion and worship. Unfortunately, these myths endure as stories even into adulthood and the true meaning behind them are then lost unless individuals choose to delve into the truth by reading the Hindu scriptures. An example of this is mentioned by learner S and is one of the more widely believed myths in Hindu worship: one of the very important Hindu deities, Lord Ganesha, is depicted as having an elephant head on a human body [See **Plate 4.1**].

The story goes that one day his mother Parvati wanted to take a bath and asked her eldest son (Ganesha) to guard the entrance to the “bathroom” forbidding anyone to enter. When his father (Lord Shiva) came home his son did not allow him to enter the bathroom so his father cut off his son’s head in a fit of anger. Upon realising the folly of his ways, Lord Shiva was full of remorse and regret and ordered his men to cut off the head of the first living being they met – which was an elephant and whose head was then joined to his son’s body.

There are many illogical aspects to this story even upon superficial glance. Firstly, Mother Parvati and Lord Shiva are the male and female form of the destroyer part of the Hindu trinity and are both God, they should therefore have the power to respectively protect themselves and know better than to display anger – regarded as a sin in Hinduism. Secondly, Lord Siva being all-powerful would have had the ability to re-attach Ganesha’s head without asking for it to be replaced with the head of another animal. Thirdly, Lord Ganesha Himself is such a powerful deity that surely He would have had the power to change his appearance if he so wished. These obvious flaws in this story are however, blindly overlooked by many Hindus without doubt.

The learners in the group display this unfortunate trait and also admit to having poor scriptural knowledge. It appears then that their view of being practising Hindus is based solely on their adherence to following rituals and not on trying to find out more about why these have to be done. For these learners, it is also not a priority to make

attempts to read or research on their religion. In fact it has not even occurred to them that they should find out more about Hinduism.



PLATE 1 – VARIOUS DEPICTIONS OF THE HINDU GOD – LORD GANESHA

The learners were aware of certain aspects of Hinduism. They knew that there is a Hindu Trinity but were only able to name one of the three deities forming this important aspect of the Hindu religion – Lord Shiva. However they could not explain their significance in more detail.

b) Belief Systems

Although these learners did not know the meanings behind the rituals or the scriptural knowledge, their responses indicated that their belief systems were based on the tenets of Hinduism. The learners claimed that there was no coercion or indoctrination from their religious leaders and they had the freedom to choose what they wanted to believe. As a result, they experienced no conflict between Hinduism and the theory of evolution, also attaching much importance to being able to understand evolution before believing in it.

Their responses also indicated that they experienced a great deal of tolerance as Hindus since the following were some of the comments made by at least three of the five learners in the group: “...our religion does not state that we should not learn other stuff...;” “...helping us to be more open-minded;” “... every religion has something to say about how they came about;” “... whereas Hinduism is open to everything” (Page 303, Transcript 1). These comments all lean towards tolerance, one of the core values of Hinduism (Swami Nirvedananda, 1957:15).

c) Science and religion

This meaning unit was established in order to see how learners experienced the two major knowledge groups of science and religion. Learner Y (on Pages 308-9, Transcript 1) basically says that people who live strictly according to their religion are ignorant of phenomena that are proven scientifically and she implies that people should be open to hearing about these theories even if they are not in line with their religion. This statement also shows that learner Y is able to link science and religion and she is open to both aspects in her worldview.

Learner H agrees with learner Y and remarks that he doesn't think that “religion should interfere” with the decision to understand a concept before accepting it, thus implying that religion and science should remain as two separate entities rather than allowing one's religion to supersede science or vice versa. According to learner S,

“religion instils morals and values... it shows...right from wrong...a way of life... but science proves...” (page 303). These comments show that Learner S is able to distinguish between religion and science and is able to have both in his life without any conflict.

d) Evolution in the curriculum

This meaning unit has direct bearing on the research questions because it encompasses the theory of evolution in the school syllabus. The learners in this group were able to discuss and answer questions quite easily even though their answers were not always accurate in terms of the theory of evolution. They were able to converse about aspects in evolution such as the age of the Earth, prehistoric life forms and fossils as well as having an opinion about the nature of science, understanding versus acceptance of evolution and the concept of a nearest common ancestor was also alluded to.

The learners also tried to discuss their opinions from a Hindu stance which also made it relevant to the research questions. According to learner S (page 300) life was created by Lord Shiva and originated “by an explosion of the sea.” On the one hand this view has some scientific truth since evolutionists do maintain that life began in a primitive ocean, on the other hand, according to the Shastras (Hindu scriptures – explained in greater detail in Chapter 2, section 2.8.2) Lord Brahma is the creator while Lord Shiva is the destroyer – so learner S misrepresented the Hindu version of creation.

Learner K also has misconceptions about human evolution and speaks of humans having “evolved from our ancestors, apes and monkeys” thus indicating that she did not understand the concept of common ancestors taught in class. All the learners in this group did not see a place for prehistoric life forms in their religion and they could not reconcile how these organisms could be a part of Hinduism. None of the learners believed that the theory of evolution went against their religion (page 303). The overwhelming reason for this seems to be due to the large amounts of scientific evidence for evolution which seems to verify for the learners that evolution occurred without a doubt and therefore cannot conflict with their religion for which there is no proof – “With all our traditions in religion, nobody exists from that time – nobody can really back up or prove these beliefs to be true so I believe in science” (page 299).

With regards to the age of the Earth, most of the learners in the group agreed that it is much older than the 6000 years claimed in the Bible. However, all but one learner could not say how old with any certainty. This learner was able to talk about the different ages that the Earth passes through, she could name the last age in which we are currently – the Kal Yug – and she was aware that after this age the Earth will end (page 300). This was the only learner who could talk about the age of the Earth according to what the Shastras pronounce but there were no other details from her. In Chapter 2 (2.8.7), the age of the Earth according to Hindu scriptures is approximately 4 billion years which also coincides with the age proposed by evolutionists and geologists. However none of the learners in this group were able to provide this answer further indicating their lack of knowledge about their religion.

In terms of the research questions, a dominant theme emerging from this interview was the overwhelming lack of conflict that these learners experienced between their religion and the theory of evolution. Their lived experiences as Hindus have therefore not stimulated any major antagonism towards this theory. Any conflict that a few of them do feel is suppressed by the scientific evidence which they feel is sufficient proof that evolution occurred.

4.3. FOCUS GROUP TWO

4.3.1 Getting to know the learners

This group consisted of five learners: three females and two males. They attended a public school in an area in Pretoria West previously demarcated for Indians only. Presently the school is open to learners of all race groups but is still made up of mainly Indian learners. The school is geographically situated about 500 metres from two Hindu temples. People in this suburb have always lived there – relocations from KZN are very rare. They are therefore established in the community and their cultural habits are passed down from the older generations who are often still in close contact with their families – there are many extended families. Like the learners in the previous focus group, these learners have also completed the topic of evolution in the Life Sciences curriculum after having studied the topic since grade 10.

4.3.2. Initial impressions of interview

Generally the learners come from homes in which Hindu rituals are practised rigidly but they have no idea why they have to be performed. They also have a poor knowledge of Hindu scripture. One learner remembered the story of Lord Rama as being the first man on Earth. However this is a complete misrepresentation of scripture since Lord Rama was an avatar of Lord Vishnu and his life story is recounted in exquisite detail in the Ramayana described in Chapter 2, section 2.8.3.1.

There was no conflict between religion and science although a few found they could keep the two separate while others found it confusing. Many misconceptions about the theory of evolution arose – e.g. humans evolving from apes; evolution is just a theory. A few learners referred to the older generations in their families being against evolution because of the conflicting ideas that they had with regard to the origin of life on Earth and because of the poor knowledge of science held by this older generation. Some of these learners were also able to make a link between reincarnation and evolution. There was also a mixture of responses about whether acceptance or understanding is more important.

The learners agreed that their poor scriptural knowledge contributed to their lack of understanding about how Hinduism regarded the topic of evolution. They felt that many questions during the interview could not be answered because they did not know their religion well enough. Many of the learners acknowledged that most young Hindus made very little attempts to find out more about their religion and that this was a sad state of affairs. This focus group did not have a very good grasp of the NOS.

4.3.3. Transcript Analysis for Focus Group 2 – Transcript 2 – APPENDIX M

TABLE 4.3: Table of analysis for focus group 2

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Rituals	R	1		1. Ignorance of Hindu view of evolution and lack
Temple	T	3		

Scriptures	Scr	1		of knowledge of meaning of rituals and scriptures.
Prioritising the practise of religion	P	1	Hindu rituals and practising the religion itself	
No preaching of evolution in temples	NP	1		
Knowledge of Hinduism	K	2	Ignorance and poor knowledge of Hindu Religion	2. Different perceptions of life on Earth: creation or intelligent design – perhaps due to ignorance. 3. Acceptance of evolution by Hindus by keeping religion separate from science.
Lack of commitment to religion				
Ignorance or lack of knowledge about religion	Com	1		
Lack of discipline to religion	Ig	5		
Fields of knowledge	LD	1		
	FK	1		
Conflict	C	1	Belief systems of Hinduism linked to evolution	
Creationism	Cr	2		
Reincarnation	Re	3		
Belief system	B	8		
Value of learning about evolution	V	1		
Less accepting	A ⁻	2		
More accepting				

	A ⁺	2		
Age of the Earth	A	6		
Prehistoric life	Pre	2		
Fossils	F	1		
Understanding evolution	U	2		
No common ancestry	NCA	2		
Intelligent Design	ID	1		
Theory of evolution	Th	1		
Syllabus	Syl	1		
Nature of science	NOS	3		
			Life Sciences curriculum regarding topic of evolution	

4.3.4. Analysis of Results

Many of the descriptors in this interview (Transcript 2) are repeated from Focus Group 1. Only the ones not already mentioned will be analysed here to avoid tedium of discussion in this chapter.

4.3.4.1. Explanation of Descriptors used in Transcript 2

The descriptor for “Syllabus” is used once when learner Yt mentions that the topic of evolution should be included in the syllabus. Even though a few of the learners experience some conflict, they are able to admit that they want to learn about the topic. This shows that they are not completely antagonistic towards the topic unlike some orthodox Christian-based schools, mainly American, which ban the topic entirely from their syllabi.

A descriptor that did not appear in Transcript 1 is “Fields of Knowledge”, which refers to the comment by a learner that Hinduism does not try to explain the origin of life and therefore evolution provides an alternative for that question. Another

descriptor that is encountered for the first time is the “Lack of discipline” and together with the “lack of commitment” descriptor are mentioned as possible reasons for why Hindus are not aware of the details of their religion such as scriptural knowledge and the symbolism behind the rituals and prayers that are performed. Learners were able to compare this with how religious education is compulsory for Muslim and Christian children but Hindu children do not have such an equivalent.

4.3.4.2. Analysis of the Meaning Units – Transcript 2

Twenty-five codes were reduced into four meaning units which were used to draw out three themes which will be discussed later. There is some degree of overlap between meaning units but it an attempt is made to discuss them as separately as possible.

a) Rituals of Hinduism

Once again there was mention made of the dependence these learners have on rituals in order for them to be regarded as practising Hindus, although just as in Focus Group 1 there are no meanings attached to them and they seem to do them because generations have done so before them. One learner claims not to practise any rituals because her family cannot explain why they have to be done. This group also realised that they lack a great deal of knowledge about Hinduism and this hampers their ability to answer certain questions.

They feel that as Hindus they are not committed enough to learning about their religion or reading their scriptures. There is almost a feeling of frustration at their own habits in that they do not prioritise the reading of their scriptures and there is a sense that they should do so – “I think that we make a lot of excuses and that we deliberately put our religion behind” (Page 312, line 1). They also claim that there is no proper leadership at the temple whom they can approach if they need guidance or knowledge about their religion. As a result, there is no direction from the temple about how to regard the topic of evolution and the learners are left to make up their own opinion. This shows that the conflict does not arise from the religious institutions in the community but probably from within the learners.

b) Ignorance and poor knowledge of Hinduism

The misconception about humans coming from monkeys is evident in this group as well since the concept of a common ancestor is not well understood by these learners either. Learner U seems to experience some of this conflict because he states that he believes that humans were created by God rather than from monkeys and that “all the scientific stuff contradicts all the religious stuff” (Page 311, Line 8). However, later on in the discussion it becomes clear that even though he experiences this tension within, “it doesn’t really affect” him (Page 313, line 32) and later still he agrees that it is a good idea to learn about evolution in schools because it is interesting to “learn about what was there before us” (Page 314, line 15). This shows that even though he experiences the conflict regarding the aspect of creation between his religion and science, he is still open-minded to regard learning about it as increasing his knowledge base. The value of tolerance is therefore once again evident since he is willing to consider a topic even though it is in conflict with his worldview.

Some of the learners’ parents also are not fully aware of why certain rituals have to be performed, so their ignorance is perpetuated in their children (Page 310, lines 17-19). This idea is also echoed by learner Ys (page 311, lines 28-30) who explains that when they ask someone who is older for clarity, “they don’t know about it either” and that is the reason for the children not knowing the explanations either. There is also a strong sense of ignorance regarding the availability of Hindu scriptures in the English language (page 312, line 10). It is apparent that learner U has not been able to find these translations readily even though they are available if there is more effort placed in trying to find them. This learner further reveals the consequence of not having read any of the Hindu scriptures by stating that he was told by his mother that Lord Rama was the first man on Earth. From section **2.8.2** and **2.8.3** in Chapter 2, the role of Lord Rama according to Hindu scripture was described and it was not that he was the first man. Thus the story told to U is based on a misconception about the Hindu scriptures and it has unfortunately been passed on from the previous generation.

Learner D has no idea of the age of the Earth while learner Yt accurately quoted the present Hindu calendar year as being 5112 but not as the age of the Earth – this is an answer that none of the learners in this group were even prepared to estimate. There was also ignorance from learner U who admits that he is “not very clued up on the

Hindu religion part” (page 313, line 30). He also felt that it is a good idea to include the topic of evolution in the school syllabus because his own religion never taught it to him (page 315, line 12). Learner S (page 314, line 7) states that “we don’t really have a theory in Hinduism about evolution” further attesting to this trend of ignorance about their religion.

c) Belief systems of Hinduism linked to evolution

All the learners in this group regarded learning the topic of evolution as being beneficial in that it teaches them an alternate point of view about creation and not to be too accepting of only the religious aspect. These learners also seem to deal with the conflict they feel between their religion and evolutionary theory by keeping the two aspects separate in their minds. They state that they experience no conflict because they do not know of a creation story in Hinduism and therefore have nothing against which to compare the theory of evolution with.

Learner Yt makes a very interesting comment when he deduces that since God made the Earth and everything in it then He must have also made evolution and that “Hinduism will give you the space to accept it” (Page 318, lines 5-7). The first part of this comment alludes to elements of Intelligent Design while the second part of the comment reiterates the aspect of tolerance that Hinduism is noted for. Learner U explains that he feels there is very little difference between Hinduism and evolution because of reincarnation.

Learner Yt also remarked earlier in the interview that the concept of reincarnation and the development of the soul has links with the evolutionary process where life forms started off simple and then gradually became more complex. According to literature reviewed in Chapter 2 section 2.8.8, this part of the comment is aligned to the notion that reincarnation leads to the development of the soul towards enlightenment.

d) Life Sciences curriculum regarding the topic of evolution

The learners have mixed views about the nature of science (NOS) being taught at school. Learner Yt and U feel that they would be less accepting of the theory of evolution if he did not learn about the NOS beforehand while Learner Ys feels that she would be more accepting. The reasons for being less accepting are because there would be no justification for the story of evolution being devised since it will be

assumed that it came about without any evidence or scientific methods being used. The reasons for being more accepting of evolution if there was no exposure to the NOS is that then people would not have to doubt whether it is a theory or not, they would be forced to accept it. This reason does not have much substance to it but it is nevertheless an opinion offered by learner Ys.

The idea of the age of the Earth has been discussed as a point of ignorance in paragraph b) above. None of the learners could arrive at an answer for this question. According to these learners there is “no place for fossils” (page 313, line 12) from a Hindu perspective because Hindus ought to be cremated when they die so the bones will be burnt to ash and will not fossilise. This is a narrow-minded view because then there is no allowance made for prehistoric organisms either. They also discount the idea that their religion did not teach them about the mass extinctions that science teaches. However, learners D and U remark that Hinduism values all life forms including the prehistoric ones but they also state that Hinduism has not mentioned anything about them having really existed (page 313, lines 3-15).

It is apparent from this interview that these learners are ignorant about their religion and experience some conflict between it and the theory of evolution. However, they are also able to say decisively that they are not averse to learning about the topic of evolution since it expands their knowledge base and that their religion gives them the freedom to do so without fear of being ostracised. The learners were also able to deal with this conflict by keeping the facts of evolution separate from their religious views.

4.4. FOCUS GROUP THREE

4.4.1 Getting to know the learners

These learners were from a private school that called itself a “Hindu School.” It started at grade 1 and continued up to grade 12. However, learners of all faiths were welcome and being a Hindu was not a prerequisite for gaining admission into the school. It was located in the same locale as the school in Focus Group 2 so the proximity to Hindu temples was very close. Learners grew up in this area and they had not relocated there so there was a high prevalence of extended families with three generations of a family living together. This group of learners was made up of one

male and three females. One of the females had one Hindu and one Christian parent and was therefore not a “complete” Hindu. Two learners who were supposed to participate and had signed the consent letters were absent on the day of the interview. According to their Life Sciences teacher, the topic of evolution had been completed the week before so they were in a favourable position to take part in the interview.

4.4.2 Initial impressions of the interview

After the first two interviews I realised that unfortunately the knowledge of the Hindu religion was minimal among grade 12 learners. It was therefore with much anticipation that I faced this third interview, thinking that since it was a Hindu school, the learners would be a lot more acquainted with Hinduism. Instead of all the interviews conducted for this study, this proved to be the most disappointing one. At the very outset, the learners did not call themselves practising Hindus and consequently had very little to say about the religion. Their knowledge of Hinduism and Hindu scriptures was extremely poor – the worst actually from all the groups interviewed. They were not even in a position to volunteer their opinions about most of the questions asked, clearly as a result of their lack of knowledge.

Much of the interview was filled with silence from the learners because they knew so little about Hinduism. Their knowledge of the NOS was also negligible and they could make no significant contribution to any discussion on the topic. The respondents were also uncooperative and unwilling to divulge much information – again, probably because of their lack of knowledge. Eventually, I could no longer use the pre-planned guiding questions since there was no response to most of the questions. Instead, I decided to have a general unstructured discussion with the learners – this was also poor and they volunteered very little information. It was apparent that the learners realised their own lack of knowledge and seemed to be embarrassed about it.

They did not have a problem with accepting evolution and neither did they admit to finding a conflict between it and the Hindu religion. However, this could be since they knew so little about their religion in the first place and were therefore in no position to provide meaningful answers to these questions in any case. One of the more significant points in this interview was raised by learner K who states “I think they are all tolerant and accepting even the Muslims” (page 321, line 50). Studies by Yalvac

(2011) of Muslim learners in purely Islamic schools revealed that they certainly do not display any sign of tolerance when it comes to accepting the theory of evolution. However, in this Hindu school where Muslim learners are a minority, it could be that they feel intimidated by the majority of Hindus and therefore do not voice their dissent regarding this topic.

4.4.3. Transcript analysis of Focus Group 3 – Transcript 3 – APPENDIX N

TABLE 4.4: Table of Analysis for Focus Group 3

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Dress code	Dr	2		1. Ignorance of Hindu religion therefore unable to provide reasons for conflict if any, between their religion and evolution so they resort to saying there is no conflict. 2. Emphasis on rituals and traditional Indian dress rather than the meaning of Hinduism and spirituality. 3. Alternative points of view – creationism but not even aware that this is what it is called.
Temple	T	2		
Lack of Commitment	Com	1	Hindu rituals	
Scriptures	Scr	1		
Tolerance	To	2		
Reincarnation	Re	1		
Law of Karma	Ka	1	Hindu tenets	
More accepting	A ⁺	2		
No conflict	C ^{no}	4		
Ignorance	Ig	8		
Belief system	B	1		
Creationism	Cr	3	Belief systems	
Knowledge of evolution or Hinduism				
Syllabus	K	1		
Value of				

learning about evolution	Syl	1		
Nature of Science				
Fossils	V	1		
	NOS	2	Evolution in the curriculum	
	F	1		

4.4.4 Analysis of Results

4.4.4.1. Explanation of Descriptors used in Transcript 3

Four meaning units and then three themes were extracted from a total of sixteen descriptors from this focus group interview. As mentioned above, the initial impression of this session was extremely disappointing for the researcher as the knowledge level of the learners here was shockingly poor. Most of the descriptors in this transcript also occurred in the previous interviews with one exception: “dress code.” These learners seemed to place much emphasis on how practising Hindus ought to dress rather than on any other aspect of their lives such as scriptural knowledge.

4.4.4.2. Analysis of the Meaning Units – Transcript 3

As mentioned in the preceding paragraph sixteen descriptors yielded four meaning units that were also obtained in the previous two focus group interviews. Even though the quality of their answers was very poor, they had essentially the same ideas that were able to make up the same meaning units as in the other groups. Each of these meaning units will now be discussed in more detail:

a) Hindu rituals

As in the other two groups, this group also mentioned the ritual of performing and reciting prayers as the primary reason for calling themselves practising Hindus. However, learners Sa and K (page 319) also regarded dressing in traditional Hindu gear as an important means of distinguishing a practising Hindu from one who was

not. They seemed to feel that Hindus who wear western attire should not be called practising Hindus. Later on in the interview, learner Sha mentions dress code again but this time with regards to the evolution of Hindu dress from the past to the present – this was her interpretation of how evolution in Hinduism could be compared to Darwinian evolution. Essentially all of the learners seem to be fixated on the superficial notion that Hindu attire is an important attribute of Hindu people.

Attached to this idea of dress code is the lack of commitment. Learners K and Sha feel that Hindus who do not wear traditional dress are influenced to do so (page 322, line 31). If they were committed to their religion and culture then these influences would not be seen. The other ritual that they mention is visiting the temple for prayer. They have the idea that the temple should also offer “guidance and to give us more insight about our religion and why we follow it” (Page 325, line 42). However, it is clear from their overwhelming ignorance that these learners do not use this function of the temple.

b) Hindu tenets

There were four Hindu tenets that these learners managed to refer to: tolerance, scriptures, the law of Karma and reincarnation. The idea of tolerance is mentioned by learner K who basically states that everyone is entitled to their own opinion regarding creation and evolution and that these differences should not “interfere with anyone” (page 321, line 39). Interestingly, according to learner K this acceptance and tolerance is shared by other members of the class including Christians and Muslims. This is interesting because from the literature reviewed it is evident that many people of these two religions are often not as accepting or tolerant of different viewpoints (Naudé, 2012; Yalvac, 2011). Perhaps because they are the minority in this school they are not able to use their religion in order to disagree and are therefore more accepting. This point was however not explored any further because it did not form an aim of this study.

The tenet of reincarnation is mentioned by learner Sha (page 322) whilst referring to the outcome of the soul after death. Although unable to provide accurate details of the concept of reincarnation, learners San and K seemed to have an idea that the soul is re-born into a different body depending on the previous deeds and that “it learns from its mistakes” (page 323, line 1). They were therefore able to merge the idea of the law

of Karma into their response as well. They could not recognize that the concept of reincarnation was to allow the soul to develop and progress from a rudimentary stage to a more advanced state whose ultimate goal is to reach liberation.

The scriptural knowledge of this group of learners is almost non-existent. Learners K and Sam admitted knowing nothing about the Hindu scriptures. They have heard of stories from the scriptures such as that of Lord Rama but they have no idea which scripture it is a part of and neither are they aware of the message behind these stories. Learners Sha and K seem to think that there is a message but they are not sure what it is and they made no attempts to find out on their own what this could be.

c) Belief systems

Learners K and San claim to be more accepting of the theory of evolution and do not seem to experience much conflict between it and their religion. Learner Sha however is non-committal. However their lack of knowledge about Hinduism could also mean that they would be more accepting of any theory regarding the diversity of life on Earth because they would have nothing against which to compare the theory. The point that these learners make about being more accepting is therefore not very significant.

Belief systems for these learners come directly from the older members of their families and this is verified by Learners K and San who credit their parents and grandparents with passing on information about their religion. Although learner San states that “We learn from our parents and they learnt from their parents” (page 323, line 41) she also counters this statement by saying that her family members are unable to act in any way if they object to her learning about evolution because the topic is examinable and is part of the syllabus. This therefore compels her to learn about the topic regardless of what her religion tells her to believe.

Ignorance is an overwhelming aspect of the belief system meaning unit in this interview session. This short transcript is replete with instances where the learners display their lack of knowledge about even the simplest tenets of Hinduism and the facts of evolutionary theory and this therefore compromises many of their responses about other aspects in this interview. The first instance is when two of the respondents admitted quite readily that they knew nothing about their scriptures. This piece of

information was then promptly confirmed by their lack of knowledge regarding the details and the message behind the life of Lord Rama – this was already mentioned in paragraph (b) above.

They also knew nothing at all about what the Hindu version of how life on Earth began and could not volunteer any information about that question. Only learner K admitted to not knowing anything, the other learners were silent and said nothing. Learner K then proceeded to add to this picture of ignorance by remarking that he was taught by the older members of his family that Lord Shiva is the Creator and must have then created everything on Earth. This notion of Lord Shiva being the Creator has cropped up even in the last two interviews and is a gross misconception that these Hindu people have. As mentioned already (Paragraph **4.2.4.2.d**), Lord Shiva is the destroyer God in the Hindu trinity and it seems that the Hindus interviewed do not know this aspect of the scriptures which implies that this level of ignorance probably exists in broader sections of the Hindu community as well.

There is also ignorance concerning the concept of reincarnation because the learners have a vague idea that the soul “learns from its mistakes and [will] carry on reincarnating” (page 323, line 5). However, the learner does not know that although this process can take a long time, the soul has a chance to end this cycle of continuous re-births in order to merge with the Divine. Probably as a result of this lack of knowledge, these learners were unable to also identify a link between evolutionary processes and similar events in Hinduism.

These learners also do not have a good knowledge base for the NOS either which compounds their ignorance about how scientific theories come to be. This is evident by learner Sam who states that a “theory has evidence to support it and hypothesis is just an intelligent guess which leads to a theory” (page 324, line 37-8). The NOS will be discussed in more detail in the next paragraph (d). A possible solution exists for these learners who seem to be unaware of so many aspects of their religion. They have realised that they need to inform themselves about Hinduism and that they need to make the effort to read more widely. It is hoped that this will be followed through with these learners.

d) Evolution in the Life Sciences curriculum

The use of leading questioning and probing during an interview is not an appropriate method of obtaining answers from participants. However, in this case this was a necessary tool in order to extract some response from these learners. Their responses are therefore not very reliable or valid because of the style that was used during this interview.

All the learners in the group uttered a resounding “Yes” when asked whether they thought it was a good idea to include the topic of evolution into the school curriculum. Learner San explained that this was because it was interesting and it taught her about past events since what is learnt at school is more than what is learnt from friends. There was no substance to her answer in terms of evolutionary content as it seemed to be a generic answer that could have been applied to any other subject – such as History, Geography or even English. None of the other learners volunteered an explanation for why they thought it a valuable inclusion in the curriculum. Hence the next question was asked concerning the NOS. The learners needed some prodding to come up with a response that showed a lack of clear understanding of the concept. But even this proved to be a futile effort from the researcher.

They were unable to distinguish between a theory and a hypothesis and only learner Sam explained his idea of the difference which included the presence of evidence to support a theory while a hypothesis is merely an intelligent guess that leads to a theory (page 324). There was no mention from any learner about the scientific method that was part of the grade 12 Life Sciences syllabus or about the hypothesis testing type of question that was also included extensively in their syllabus since grade 10. These learners therefore did not have a clear understanding of the scientific method or of what constituted a theory and their lack of knowledge in this area meant that they could also not explain whether evolution could be a credible theory or not.

Most of the questions based on the NOS were met with silence and an almost refusal from the learners to provide any comments making it a highly frustrating exercise. Learner Sam did volunteer that fossils were the evidence available to scientists to verify the theory of evolution. Learner San sums up the tone of this interview when she states that when confronted with conflicting issues such as between religion and science, she simply ignores it unless she is placed in a situation where she has to think

of it (page 325, line 32). This could account for the silence that often met many of the questions in this interview – perhaps the other learners in this group also felt the same way as learner San and they used silence to indicate they were ignoring the issues being discussed.

However, it is more apparent that these learners are severely ignorant regarding both the Hindu religion as well as the topic of evolution. At the end of the interview, they did acknowledge their lack of knowledge about their religion and seemed embarrassed about this so they promised to make an effort to read and inform themselves about the Hindu religion for a follow-up interview in about three months. Unfortunately, this interview did not take place so it is unsure whether they did adhere to their promise.

4.5. FOCUS GROUP FOUR

4.5.1 Getting to know the Learners

Originally, the arrangement for this interview was that five learners would take part. However on the day of the interview only three were available – one was absent and the other was writing an Olympiad. Two females and one male made up the participants in this group. Like the public school described in focus group one, during apartheid this was a previously Model C school for white children only. The learners had always resided in the area and were not new to the area unlike in the first school described. According to the Life Sciences teacher, the topic of evolution had been completed about a week ago. The interview was conducted in a science laboratory after school.

However one of the limiting factors was that there was a great deal of noise outside since it was after school and there were several sports activities taking place. This made it difficult to hear the respondents and the recordings were therefore not very audible either. The interview was nevertheless transcribed as accurately as possible as were each of the others.

4.5.2 Initial impressions of interview

Despite these extenuating factors this interview turned out to be the best focus group session compared to the other three. It was the best in terms of the quality of responses received by the learners – all three were extremely competent about their religion and were able to converse at length about Hinduism. This impressed the researcher tremendously.

The learners' responses about Hinduism were excellent. The male learner appeared to be deeply spiritual, was well-read with various Hindu texts and offered enlightening responses regarding his views on evolution and the links to Hinduism. One of the female learners was also knowledgeable about Hinduism and indicated that she was even attending classes to learn the Bhagavad-Gita. All three of these learners reported no conflict between their religion and the topic of evolution.

4.5.3. Transcript analysis of focus group 4 – Transcript 4 – APPENDIX O

TABLE 4.5: Table of analysis for focus group 4

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Rituals	R	2	Rituals of Hindu religion	1. Acceptance of evolution and no conflict with Hindu religion. 2. Belief systems are open to questioning – implies absence of indoctrination from Hinduism.
Lighting the lamp	L	2		
Prioritising practising of religion	P	1		
Punishment from God	Pu	1		
Reincarnation	Re	3	Tenets and teachings of Hindu religion	3. Importance of rituals but with a scientific explanation – implies acceptance of science and religion.
Karma	Ka	2		
Scriptures	Scr	2		
Self study about religion	SS	5		
No conflict	C ^{no}	3		4. A place for prehistoric life forms
Knowledge of evolution				

or Hinduism	K	1		<p>– need for evidence to verify science and theories.</p> <p>5. Importance of self study – own initiative to learn about Hinduism – not dependent on Hindu spiritual leaders.</p>
More accepting	A ⁺	2		
Ignorance/ lack of knowledge				
Creation	Ig	2		
Belief system	Cr	1	Belief systems	
Questioning religion	B	6		
	Q	2		
Age of the Earth	A	1		<p>Evolution in the curriculum</p>
Science and Hinduism	Sci	4		
Prehistoric life forms	Pre	1		
Nature of Science	NOS	4		
Theory of evolution	Th	3		
Value of learning about evolution	V	2		
Evidence for theory	Ev	3		
Understanding evolution	U	1		

4.5.4. Analysis of results

4.5.4.1. Explanation of Descriptors used in Transcript 4

New descriptors that occurred in this interview are for “Self-study” and “Punishment from God.” All the other descriptors used in this interview have occurred in the previous focus group sessions so they will not be discussed in detail here again. The descriptor for “Self-study” refers to several references made throughout the interview by two of the three learners. These two learners engaged actively in learning about their religion without coercion from either their parents or spiritual leaders. Their motivation to study their religion and scriptures in such detail was purely intrinsic. This therefore enhanced their ability to converse fluently and with much insight during the interview.

The descriptor for “Punishment from God” arose when learner A explained the reason that prayers should be conducted in a certain manner. He referred to this descriptor as a misconception that most Hindus have for doing prayers incorrectly out of fear. He felt that prayers should be done in a particular way in order to derive maximum benefit from them and not to please God and incur His wrath if done the wrong way. This learner was the only one out of all the groups interviewed to mention that he thought the correct manner in which prayers were conducted had scientific reasons that enhanced a person’s health or spiritual energy and that prayers should not be done just for God but also “to transform yourself” (page 336, lines 11-20). He provided a deeply insightful answer based on his own readings and the inferences he arrived at from them.

Both descriptors highlight the value of Hindus being able to take the initiative for their own desire to learn about their religion rather than depending on outside agents imposing it upon them. There would then be no reason to claim ignorance about Hinduism or to use rituals as a crutch to hold up the religion.

4.5.4.2. Analysis of the Meaning Units – Transcript 4

Twenty three descriptors were reduced to four meaning units and these into five themes. Each of these meaning units will now be discussed in more detail:

a) Rituals of the Hindu religion

As with the other groups these learners also mention the performance of different rituals as a means of regarding them as practising Hindus. The rituals named are similar to those of all the other groups i.e. prayer, lighting the lamp and fasting. Learner A also mentions meditation, an activity that should be performed by Hindus as part of their spiritual discipline but is often not – evident since none of the other groups talked about engaging in meditation.

The view that prayer can have tangible benefits for people has already been discussed above in paragraph 4.5.4.1. The meaning behind prayer is experienced by these learners and they make it clear that prayers are performed with a great deal of significance rather than just as mechanical rituals without any special meaning. Unlike focus group 2 which claims that people do not prioritise time for the study of

their religion, the learners in focus group 4 have made the study of Hindu scripture an integral part of their lives.

This shows that the opportunities do exist for such self-study to occur people just need to seek them out and then ensure that they continue with these programs. As a result of this level of self-study and interpretation of scriptures, these learners are able to view prayers differently compared to the other learners interviewed who had poor scriptural knowledge and hence unable to see the meaning behind them.

b) Tenets and teachings of the Hindu religion

As already discussed, two of the three learners in focus group 4 educated themselves about Hinduism. Their scriptural knowledge was most admirable and they were able to use what they had learnt to engage in a meaningful discussion. Learner C attends weekly classes on a Sunday that will continue for the next three years, in order to study the Bhagavad-Gita systematically and under the tutelage of a learned spiritual guide. She admits that reading the Gita is rather challenging and she therefore needs a mentor to help her understand the various messages of this scripture.

Learner A has learnt the Vedic chants which is a phenomenal achievement since it entails being able to recite the Vedas using a particular tune so that positive vibrations are generated by the chanting. These scriptures are regarded as the source of all knowledge and they are described in more detail in Chapter 2 (2.8.2). In addition to being able to recite the Vedic hymns, Learner A states that he is also an avid reader of spiritual literature. He believes in a deeper meaning of the prayer mantras and that they have a firm scientific basis especially with regard to sounds and vibrations and their effects on objects around them. Of all the participants in this study, learner A was the only one to link the scientific notion of the Big Bang theory to the Hindu sound of “Om.” He further explained that “the sound “Om” resonates in everything” and his interpretation of what he has read is “that “Om” created the cosmos and the five elements and everything” (page 329, lines 29-37). An account of the Hindu creation story is described briefly in Chapter 2 (2.8.4) thus lending credibility to his interpretation.

Reincarnation and Karma are two tenets of Hinduism that were also discussed quite extensively by this group of learners. According to learner C, Hindus believe in

reincarnation unlike Christians who do not (page 329, line 11) and she explains that doing good Karma in one life enables a good birth in the next life and vice versa. She seems to have a reasonable grasp on this Hindu tenet. She also seems to think that in the future humans will not just disappear but may just reincarnate into animals (page 332, lines 28-31). Her idea alludes to the scientific belief that humans will continue evolving into some other form in the distant future. Learner N refers to reincarnation as being the same as one's spiritual being that one evolves into. This is not a very clear explanation but she seems to have the correct idea about this tenet.

Learner A as usual, provided an unusual but logical answer on reincarnation. According to him, all humans were demigods at one stage and they were fully aware of their divine powers but they abused this knowledge causing God to hide it deep within us so that we would have to experience a journey of self-discovery before discovering this inner link to the Divine again. This journey is not easy and all souls start off having demonic tendencies, then evolve into human beings and finally merge into the Divine all depending on their Karma or actions. In Chapter 2 (2.8.7), a brief description on the age of the Earth in Hinduism was provided where it was mentioned that during the first age of the Earth (Satya Yuga) all beings were in close contact with the Divine and that this contact gradually deteriorated through the other three ages. Learner A's explanation is therefore grounded in scripture showing that he is able to apply his knowledge of Hinduism competently.

c) Belief systems

The learners in this focus group with their impressive scriptural knowledge and insights all experienced no conflict between their religion and the theory of evolution. The other focus groups felt no conflict either despite them not having any scriptural knowledge. It can therefore be seen that regardless of the level of scriptural knowledge, Hindu learners from all four groups experience no conflict. The question about whether conflict was experienced or not was asked several times during the interview and each time, the learners all responded that there was no conflict. The reason for repeating the question at different points during the interview was to verify the consistency of their opinions.

For these learners, the influence of their family also plays an important role in their religious education and values. Learner C reveals that her father is a devotee of

ISKCON (International Society for Krishna Consciousness which worships Lord Krishna as the Supreme Being) and that he together with her grandmother have taught learner C all the rituals (page 327, lines 12-14). Learner C also “want[s] to learn everything” (page 328, line 11) and this is her intrinsic motivation to attend the weekly classes on the Bhagavad-Gita. She also explains that her father feels that he is leaving behind a legacy for his children by providing them with religious knowledge that they can always use and in turn pass on to their own children.

d) Evolution in the curriculum

The learners in this focus group were more confident in their knowledge of evolution and the NOS as was evident in their responses. They had an idea of the age of the Earth in terms of the Hindu calendar – 5112 years – a number that was also supplied by the learners of focus group 2. Learner A explains his idea that the Earth could be billions of years old but he is not certain of the exact figure. The learners are comfortable mentioning prehistoric life forms and their place in Hinduism as well as in the process of evolution. They also constantly refer to the link between science and their religion indicating that they do not see a distinction between the two. Learner A even goes to the extent of saying that rituals and prayer in Hinduism have their roots in science (page 329, lines 20-26).

These learners understand that the NOS deals with evidence and that the theory of evolution is based to a large extent on evidence. Learner A mentioned Darwin and Lamarck as evolutionists whose theories are not always supported by evidence (page 333, lines 18-23). Learner N did not think that including evolution in the syllabus was a good idea because new evidence discovered in the future may refute all that has been learnt now. So she acknowledges the role of evidence but at the same time is sceptical of the role that new evidence can have in changing scientific knowledge. This also alludes to the tentative yet durable nature of scientific knowledge – one of the tenets of the NOS mentioned in Chapter 2 (2.6.1). The other two learners value the role of evolution in the curriculum because it informs their desire to know where we come from as humans in order to understand our ancestors.

However, learner A also states that he doesn't think it was a good idea to include the topic because of the conflict with other religions (Islam and Christianity) but from a Hindu perspective it is a good idea. His view therefore shows that as a Hindu he

experiences no conflict learning about evolution and actually welcomes it but he seemed concerned about how learners from the other religions will experience conflict with the topic (page 334, line 18).

TABLE 4.6: COMMON THEMES EMERGING FROM FOCUS GROUPS SESSIONS

COMMON THEMES	FOCUS GROUP NUMBER	1	2	3	4
	1. Acceptance of evolution and no conflict with Hindu religion.	X	X		X
	2. Ignorance about religion.	X	X	X	
	3. Emphasis on rituals rather than spirituality of Hinduism	X	X	X	
	4. Alternative views of origin of life on Earth.	X	X	X	
	5. Science and religion separation to allow acceptance of evolution.				X
	6. Rituals not meaningless actions but based on science				X
	7. Importance of self-study to learn about religion.				X

EXPLANATION OF TABLE

The table (4.6) summarises the themes that emerged from all four focus group interviews and shows the recurrence of several themes in each interview. This is to show that the results obtained are reliable because they appear in more than one group interview and therefore increase the validity of the study. The shaded blocks with the “X” indicate the groups in which the themes emerged and a clearer pattern can be seen amongst them.

All the groups except FG 3 admitted to experiencing no conflict between their religion and evolutionary theory. Group 3 was extremely ignorant about their religion and probably could not understand whether there was a conflict or not since they lacked the knowledge. Group 4 displayed remarkable knowledge about Hinduism and

this also linked to their efforts for self-study. This group realised that rituals and prayers had a deeper meaning both on a spiritual and scientific level whereas the other three groups who knew very little about Hinduism regarded rituals merely as actions to be performed meaninglessly. These three groups also seemed to confuse the Christian notion of Creationism with a Hindu tenet and also brought in elements of Intelligent Design – perhaps as a result of not having a firm knowledge base of their own religion.

These themes will be analysed once again when the individual interviews are discussed to see if there is any recurrence.

4.6. INDIVIDUAL INTERVIEW – TEACHER 1:

4.6.1 Introduction to Teacher 1 and overall impression of interview

Teacher 1 is an experienced teacher of Life Sciences for many years. She has taught in various schools in the Tshwane area. Currently she teaches Life Sciences in a public ex-Model C high school. The demographics of the school are mixed but with a majority of Black Christian learners. There are no Hindu learners in her classes as at the time of the interview. As a Hindu teacher having mainly Christian learners in her classes, it was anticipated that she would provide invaluable feedback on how her learners experience learning the topic of evolution. She is also a devout Hindu and visits India annually in order to spend time in ashrams (spiritual retreats that focus on worship, constant regular prayer, meditation, religious discourse – basically focussing on allowing people to develop their spirituality). She experiences no conflict between evolution and Hinduism.

During her teacher training, evolution was not regarded with much importance because the topic was not part of the syllabus. However, she displayed resourcefulness in informing herself about evolution when the topic was introduced into schools. Even though Teacher 1 is less than five years from retirement, she is currently studying towards an ACE qualification indicating that she is a firm believer in lifelong learning and ongoing professional development.

4.6.2 Transcript analysis for Teacher 1 – Transcript 5 – APPENDIX P

TABLE 4.7: Table of analysis for teacher 1

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Lighting the lamp	L	1	Rituals of	1. Strong PCK – willing to learn about evolution – has an open mind – no conflict or resistance towards evolution from a Hindu point of view. 2. Tolerance is impressed upon learners – no indoctrination. 3. Scriptural knowledge is stronger. Less dependence on rituals but more on the teachings of Hinduism. 4. No separation between Hinduism and science – strong link is evident.
Prayer	Pr	1	Hinduism	
Meditation	Med	1		
Righteous living	Ri	1		
Scriptures	Scr	2	Tenets of	
Karma	K	3	Hinduism	
Lack of interest	Int	1		
Knowledge of Hinduism	K	1		
Prioritising practising of religion				
Lack of commitment	P	2	Lack of knowledge and commitment to Hinduism	
	Com	1		
More accepting	A ⁺	3		
Conflict	C	1		
Belief system	B	1		
Tolerance	To	1		
Ignorance	Ig	1		
Antagonism	An	1	Belief systems	
Fields of knowledge	FK	1		

Age of the earth	A	2	The topic of evolution in the curriculum
Science and religion	Sci	1	
Prehistoric life forms	Pre	1	
Nature of science	NOS	1	
Understanding evolution	U	1	
Pedagogical content knowledge	PCK	2	Teaching evolution
Pedagogy	Ped	1	
Mixed views of learners	Mx	1	
Professional development	PD	1	
Self-study to improve content knowledge	SS	1	

4.6.3 Analysis of Results in Transcript 5

A total of twenty seven codes were extracted from this interview. They were then consolidated into six meaning units and then into four themes. Several codes emerged that were unique compared to the focus group interviews with learners since this was a teacher interview so many of the responses dealt with teaching and pedagogy. In addition this was an adult who had a far greater knowledge of both Hinduism and evolution than the teenagers from the focus group interviews analysed.

4.6.3.1. Explanation of Descriptors used in Transcript 5

New descriptors that emerged from this interview are mainly those of a pedagogical nature. They concern issues of PCK and pedagogy. The former deals with how

teacher 1 uses her teaching experience to deal with the topic of evolution from the perspective of Hinduism and other belief systems when conflicts arise in the classroom. The latter looks at how she is able to teach the content of the topic in an objective manner focussing on the facts alone and not bringing in any aspects of beliefs or religion. In terms of pedagogy she is also open to taking her learners on field trips (Cradle of Humankind) to show them the available evidence to verify evolution. The learners however do not seem to appreciate these efforts and continue to adhere to their belief systems of non-acceptance of evolution. They also have mixed views and misconceptions about human descent from apes where they don't understand the concept of common ancestry.

Teacher 1 is also fully prepared to embark on self-study and enhance her level of professional development by engaging in further study and prior preparation to gain an understanding of the topic of evolution. These descriptors are then grouped into the meaning unit of teaching evolution which will be discussed in the ensuing section.

4.6.3.2. Analysis of the Meaning Units

a) Teaching Evolution

In terms of her pedagogical content knowledge (PCK), teacher 1 has a wide repertoire based on her expansive teaching career spanning almost thirty years. Although she was not exposed to the topic of evolution when she initially trained as a teacher, she readily used her own initiative to educate herself when the topic was introduced into the South African curriculum. This indicates that she was interested in being better informed so that her teaching could be more effective and that she did not depend on the short learning courses offered by the DoE to understand the topic of evolution. She was also at the time of the interview pursuing a further qualification (Advanced Certificate in Education) where the topic of evolution is dealt with thus indicating that she is furthering her professional development in order to be a better teacher.

b) Belief systems

According to teacher 1, her learners who are mainly African Christian children, do not take the topic of evolution seriously both because of their beliefs and their inability to accept the role that evidence plays in the construction of scientific knowledge. However, teacher 1 herself who is a devout Hindu with adequate scriptural knowledge

experiences no conflict with the topic and she uses the available evidence to verify that scientifically evolution is possible (page 341, line 7). She names four Hindu scriptures (Shastras) that she reads regularly and seems to get the impression from these readings of an “evolutionary trend” (page 341, line 43) and links this to some of the Hindu gods who are depicted as hybrids of animals and humans. She names Ganesha – who is shown as having an elephant head on a human body (see Plate 4.1) and Hanuman – who is shown as having the face and tail of a monkey on a human body (see **Appendix K** for a picture reference) (page 342, line 1).

These depictions almost seem to prepare Hindus to be more accepting of evolution because some Gods are not shown as having a completely human form. Her wider knowledge of both Hinduism and evolutionary science therefore allows teacher 1 to be more accepting of evolution without finding any room for conflict between the two.

c) Rituals of Hinduism

Teacher 1 also regards herself as a practising Hindu because she performs the rituals of prayer and lighting the lamp. She also meditates and tries to live righteously, on e of the tenets of Hinduism. In addition, teacher 1 makes an annual pilgrimage to an ashram in India where she spends about a month in meditation, prayer and listening to religious discourses by various Hindu gurus (teachers). She does not ascribe much importance to the performance of rituals only but looks into the deeper significance of these activities instead. As a result she is able to converse about the spirituality of her religion and specifically concerning its views on the topic of evolution.

d) Tenets of Hinduism

Teacher 1 also has strong beliefs in the Hindu tenets of the law of Karma and reincarnation as is evident by her discussion on page 342. Although she does not point out the link between reincarnation and biological evolution she uses this to contribute to her accepting evolution as a Hindu without experiencing any conflict. Her acceptance of evolution is strengthened by her training as a Life Sciences teacher which has given her the knowledge about the concept of natural selection and adaptation. She is therefore in a position to see that organisms can adapt to certain

climatic conditions, which in turn allows them to evolve and this is not problematic even in Hinduism (page 343).

e) Lack of knowledge and commitment to Hinduism

Teacher 1 makes several comments about how religion and knowledge of Hinduism have been relegated to a lower position in present times by many people who are more involved in pursuing material interests such as wealth accumulation. Learners also are influenced by their adult role models and have no time for religion which is not a priority for them. As a result, their lack of interest in their religion leads to them having a poor or non-existent knowledge of their religious teachings.

Like the learners of focus group 3 who also have a poor knowledge of Hinduism, teacher1's learners also do not accept evolution probably as a result of their lack of knowledge and they therefore lack a point of reference with which to compare the two. Furthermore, her learners are predominantly African Christian with a worldview based on the creationist doctrine of the Bible as well as that of their traditional African cultures. It is therefore probably difficult for them to accept the science of evolutionary theory as another alternative.

f) Evolution in the curriculum

Teacher 1 has a wider knowledge of evolution because she has been trained in teaching Life Sciences and the topic. She was also able to link her knowledge of the Hindu scriptures with the topic of evolution which shows that she has the ability to view the two aspects holistically. She does regard the Earth to be millions of years old (page 345, line 12) both in terms of Hinduism and the science of evolution and therefore also feels that there can be a place for prehistoric life forms in her religion.

She has the opinion that learners need to understand the topic of evolution before they can accept it and that the former is a prerequisite for the latter. Teacher 1 also regards the nature of science (NOS) as an important aspect in the teaching of evolution. Her views on this aspect have also been corroborated in her written responses on the teacher questionnaires (*Appendix F*). However she is unable to explain the NOS adequately and did not mention any of the tenets of the NOS as described in chapter 2 (2.6.1).

4.7 INDIVIDUAL INTERVIEW – TEACHER 2

4.7.1 Introduction of Teacher 2 and overall impression of interview

Teacher 2 has been teaching Life Sciences for about ten years. She, like Teacher 1 is currently teaching at an ex-Model C public high school in Gauteng. The school is racially diverse but has a majority of black Christian learners. There is a small group of learners in Teacher 2's grade 12 Life Sciences class that are Hindu. Teacher 2 is deeply religious and observes all Hindu prayers regularly. She is also currently studying towards her Masters degree in science education. This teacher admitted that she does experience some conflict between her religion and the topic of evolution but that it is not an obstacle to her wanting to learn more and informing herself about the topic. She is also not prepared to indoctrinate her learners into believing evolution or anything that her religion proposes. Instead she believes in teaching learners the facts without getting into any debate about religion.

4.7.2 Transcript analysis for Teacher 2 – Transcript 6 – APPENDIX Q

TABLE 4.8: Table of analysis for teacher 2

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Scriptures	Scr	1	Hindu tenets	1. Some conflict between Hinduism and evolution but not enough to prevent self-study and professional development. 2. As a teacher, it is important to develop and inform self about an unfamiliar topic – religion is not a barrier to this. 3. Important not to
Mixed views of learners	Mx	2		
Creation	Cr	2		
Fields of knowledge	FK	1		
Conflict	C	1		
Freedom to choose – not forced to believe in religion				
Ignorance	Fr	1		
Antagonism	Ig	1		
Beliefs	An	1		

Tolerance	B	3	Belief systems	upset learners' personal beliefs – Hindu tenet of tolerance and freedom of choice – absence of indoctrination.
	To	1		
Science and religion	Sci	2	Evidence for evolution	
Evidence for theory	Ev	3		
Fossils	F	1		
Age of the Earth	A	1		
Understanding evolution	U	2		
Pedagogical content knowledge	PCK	2	Teaching evolution	
Self study	SS	1		
Pedagogy	Ped	3		
Syllabus	Syl	1		
Professional development	PD	1		
Nature of Science	NOS	2		

4.7.3 Analysis of results

Twenty three descriptors were extracted from transcript six. These were then condensed into four meaning units and three themes. As the second teacher interviewed, she seemed to share many of the views that teacher 1 held so there was some consistency in the data obtained. The differences came about from teacher 2's learners who argued and presented their beliefs as well instead of merely accepting all the facts that were taught to them. Descriptors that have not yet occurred will now be discussed.

4.7.3.1. Explanation of Descriptors used in Transcript 6

Teacher 2 has been in the teaching profession for nearly eleven years. She also did not encounter the topic of evolution during her teacher training and was first exposed to it in 2007, the year before its implementation into South African schools, during the short learning courses initiated by the DoE. However, she was also open to self-study

(SS) where she explored aspects of the topic on her own in order to prepare herself for teaching it. She is of the firm belief that the topic needs to be dealt with strictly according to the syllabus to avoid discussions where learners argue against it based on conflicts with their belief systems. In addition to attending these in-service training courses, teacher 2 is also keen to continue with her professional development (PD) and this is evident by the fact that she is currently studying towards a Master's degree in science education.

Teacher 2 also places some importance on the NOS as a means of explaining the topic of evolution so that learners can grasp it more readily. However, she did not know at first what this question was about and the researcher had to clarify the question for her. This could imply that teacher 2 did not have a clear understanding herself of the NOS and therefore these doubts were also transferred to the learners which exacerbated their lack of understanding of the topic of evolution. Despite the lack of understanding about the NOS, teacher 2 was clear that one aspect of it was the presentation and analysis of evidence. Her learners were also taken on a field trip to see fossils and palaeontologists at work at a local university but apparently this trip did not strengthen the case for her learners being more accepting of the theory of evolution.

4.7.3.2. Analysis of the Meaning Units

a) Teaching Evolution

Her pedagogy for the topic of evolution is to try and avoid confrontations and conflict with learners' belief systems, hence the adherence to the syllabus she mentioned (page 351). Despite these precautions, her learners seem determined to argue every point and start discussions on many aspects in the topic of evolution. Teacher 2 finds this situation a bit tiresome in her class (page 351) because she feels that much time is wasted when content needs to be completed according to the syllabus within a specified time-frame.

As mentioned in the paragraph above, teacher 2 would rather use the syllabus as a rigid guide to what should be taught rather than allowing her learners to control classroom discussions concerning their beliefs and the topic of evolution. This possibly has a link with her PCK which will show more development as her teaching

experience increases. The learners could also be more accepting of evolutionary theory if they had a better understanding of the tenets of the NOS. Her written responses in the teacher questionnaire (*Appendix F*) however indicate that she probably took the definition of the NOS from a textbook since it is a lucid answer compared to the verbal response she presented at the interview.

It is hoped that the interview stimulated an interest in her to get more information about the NOS which she can then apply to her teaching. She also wants to give her learners the freedom to decide whether they want to believe in creationism or evolutionism by providing them with the facts and expecting them to base their decision on these (page 351, line 14).

b) Belief Systems

Teacher 2 is a devout practising Hindu who from previous discussions with her is known to engage often in dedicated fasting and prayer for extended periods of time. She also mentioned in this interview that she does read the scriptures but not regularly so she does not have a strong base of knowledge on Hinduism.

According to teacher 2 she does experience some conflict between her religion and evolutionary theory mainly because she cannot reconcile the form of Hanuman (the Hindu god depicted with a monkey face) with the science of evolution. It is not very clear what she means by this but she is clear that she has some conflict. She also cannot identify any links between evolution and Hinduism from her reading of the scriptures and this can be ascribed to her comments that she does not have a very comprehensive knowledge of the scriptures (page 354, line 19) and has only read parts of the Ramayana.

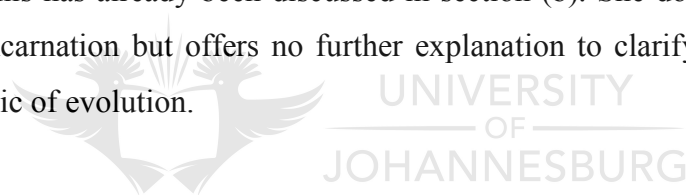
She does display tolerance while teaching this section in spite of her feeling some conflict between her own belief system and the topic of evolution. She does not allow her own conflicting beliefs to interfere with how she teaches the topic and does remain objective. She is also open to having different religious views included in the syllabus and not just focussing on the Christian notion of creationism in order “to show them where the differences lie” (page 352, line 39).

c) Evidence for evolution

Teacher 2 holds the view that “Hinduism is a science as well and is open to understanding and to reason that’s why it hasn’t opened itself to ignoring the theory of evolution” (page 354, line 7). She therefore regards her religion as a science and does not keep them separate. However, she cannot provide a definite response concerning the age of the Earth and only states that “Hinduism is the oldest religion” (page 354, line 30). Her learners demand that the evidence provided for evolution be verified so that they have no room for doubts. Although fossils were shown to the learners they still struggled to accept that as irrefutable evidence for evolution. She is of the opinion that it is more important for learners to understand evolution rather than believing or accepting it.

d) Hindu tenets

The only tenet mentioned by teacher 2 in this transcript is that of reading the scriptures and this has already been discussed in section (b). She does make fleeting mention of reincarnation but offers no further explanation to clarify how she could link it to the topic of evolution.



4.8 INDIVIDUAL INTERVIEW – TEACHER 3

4.8.1 Introduction of Teacher 3 and overall impression of interview

Teacher 3 has been in the teaching profession for thirty five years. She taught Life Sciences for most of that time and also lectured to science teachers at a teacher training college for many years. Towards the latter part of her career she was a facilitator for Life Sciences in one of the district offices in Gauteng. As at the time of the interview teacher 3 has been retired for about five months. She is also a devout Hindu and observes many of the religious festivals and prayers. Teacher 3 does not find any conflict between her religious views and the theory of evolution. She also engaged in self-study to inform herself about the topic of evolution when it was introduced into the syllabus.

4.8.2 Transcript analysis for Teacher 3 – Transcript 7 – APPENDIX R

TABLE 4.9: Table of analysis for teacher 3

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Meditation	Med	2	Rituals of Hinduism	<ol style="list-style-type: none"> 1. No conflict in Hinduism with the theory of evolution. 2. Strong drive for self-study to learn more about theory of evolution to enhance own understanding. 3. Some link between evolution and Hinduism – no separation between the two – merging of natural selection into aspects of Hinduism.
Prayer	Pr	1		
Rituals	R	1		
Scriptures	Scr	2	Tenets of Hinduism	
Supreme energy	Su	2		
Righteous living	Ri	1		
Reincarnation	Re	1		
Karma	Ka	1		
Conflict	C	3	Belief systems	
Tolerance	To	3		
Ignorance	Ig	3		
Creation	Cr	1		
Indoctrination	In	1		
Knowledge of science and Hinduism	K	4	Link between science and religion	
Science and religion				Sci
Self-study	SS	2		
Pedagogical content				

knowledge				
Syllabus	PCK	4		
Pedagogy	Syl	1		
Natural selection	Ped	1	Teaching the topic of evolution	
	NS	2		
Evidence for theory	Ev	3		
Theory of evolution	Th	1		
Age of the earth	A	1	Evidence for evolution occurring	
Understanding evolution	U	1		

4.8.3 Analysis of results

In this interview, twenty four descriptors were reduced to six meaning units and then into three themes. The descriptors that have not occurred in the previous interviews will now be discussed.

4.8.3.1. Explanation of Descriptors used in Transcript 7

Teacher 3 has a wide range of knowledge of both Hinduism and evolution which she draws on in the course of the interview. Most of the descriptors from transcript 7 have also emerged from previous interviews with a few new ones. One of these is the aspect of supreme energy (Su) which is referred to by teacher 3 (page 360). She does allude to this supreme energy as being the source of our souls and that the soul can never die – ideas that are also part of the central tenets in the Vedas (main Hindu scripture) and that gives rise in turn to the concept of reincarnation that was discussed at length in chapter 2 (section 2.8.7). Teacher 3 has the idea that the soul has the

ability to evolve and therefore she has no problem as a Hindu accepting the theory of evolution (page 362).

The descriptor concerning the role that natural selection (NS) plays in the evolution of organisms is also a new descriptor mentioned by teacher 3 (page 360). She mentions how structures that were no longer needed in the “changing universe” were “left aside and those structures that were needed evolved into other structures.” This is a description that alludes to the process of natural selection as described by Darwin.

4.8.3.2. Analysis of the Meaning Units

a) Teaching Evolution

As a facilitator for Life Sciences towards the latter part of her career, teacher 3 used self-study as a means to being informed about the topic of evolution. It helped a great deal that evolution was part of her BSc degree before she trained to be a teacher so she was exposed to the topic and did not have a problem accepting it in the school environment (page 356). She regards it as an interesting topic but feels that it could be taught using more practical examples (page 357). Since she is unable to do this she feels that it is a shortcoming in her PCK.

She also does not think that the historical aspects of evolutionary theory are a necessary part of the school syllabus as it may be boring to them (page 361, lines 1-6). Her view is of particular importance to how she regards the nature of science (NOS). Whilst she claimed that she could describe the NOS and used it in her teaching (before she retired) both her written and spoken responses show otherwise. The historical aspects of the topic of evolution will allow learners to realise the seven tenets of the NOS since the scientists experienced these in their quest for answers. In the questionnaire, teacher 3 emphasises the process of scientific inquiry as what the NOS is about and does not mention the seven tenets at all.

As a Life Sciences facilitator, she assisted her teachers by summarising research from different books in order to prepare her teachers for the topic when it was introduced. At first it was not clear of the depth that the syllabus required but this problem was solved with the introduction of the text book *Understanding Life Sciences – Grade 12* (Isaacs, 2007) because it dealt with the topic in exactly the right amount of depth and detail that was required by the syllabus. She also felt that evolution should be taught

as pure fact and not as speculation (page 358, line 5) since the facts can be verified by the evidence available such as fossils and embryology.

b) Rituals of Hinduism

Being a practising Hindu, teacher 3 engages in the rituals mentioned by the other Hindus interviewed in this study. She prays, meditates, observes major Hindu festivals and also practises righteous living by observing the principles of “honesty, unconditional love, gratitude.” However she is also able to go beyond these rituals by looking into their underlying meaning and using them as vehicles to advance to the next spiritual level. An interesting admission is that she does not force her almost adult children to pray and observe any of the rituals that she does. She lets them decide if they want to take part in the prayers.

This is a difference to the way in which other cultures compel their children into adhering to rituals of their religion – for example in Islam, children have to attend their religious school (Madressa) after secular school hours where they have to learn the Qu’ran and the correct way in which Muslims must pray. There is no choice for Muslim children but teacher 3 clarifies that “Hinduism is a very individual religion, it doesn’t prescribe things” (page 359, line 24) so there is the freedom to decide whether a certain ritual is to be practised or not.

c) Tenets of Hinduism

One of the tenets of Hinduism followed by teacher 3 is that of righteous living which was discussed in the paragraph (b) above. She also has some scriptural knowledge where she mentions the Ramayana, Gita and the Vedanta (page 360) that are so complex as to require a more learned Guru (teacher of religious practice) to explain the intended meanings. According to teacher 3 there is nothing in these scriptures that contradicts the process of evolution.

d) Belief systems

Teacher 3 has a very open mind towards evolution as she experiences no conflict between her religion and the topic at all. She seems to relate every aspect in evolution to Hinduism and finds no tension at all with concepts such as natural selection and the development of organisms to higher and more evolved states. She has some

knowledge of the scriptures which allow her to reinforce her stance on the link between evolution and Hinduism (page 364). The concepts of reincarnation and Karmic law are also a part of her belief system and she relates reincarnation particularly to the process of evolution where the development of the soul in response to actions performed is equated to the development of an organism in response to environmental pressures.

She is also tolerant of other cultures beliefs in evolution – she mentions the African culture on page 361 that also believe in evolution. However she does not feel that Hindu perspectives should be introduced into multicultural classrooms because it is too complex for them to understand and that will cause tension. This level of tolerance is also evident in her attitude that people can only be presented with different facts but it is up to them to decide if they want to accept them or not – she does not believe in indoctrination or forcing people to accept evolution (page 364, line 33).

e) Science and evolution

Teacher 3 is able to link the science of evolution with the teachings and beliefs of Hinduism without any conflict. According to her, if religion is left out of the science of evolution it will bring more conflict to learners than if different cultures were mentioned (page 361). She also mentions the development of the different Phyla on Earth as being a form of evolution and uses that as a reason to accept that a process of evolution exists in all organisms from birth to death. She confirms that in the Hindu scriptures there is nothing that states evolution does not occur (pages 357, line 31). There is a place for biological evolution in her interpretation of the Hindu scriptures and she is able to draw a parallel between that and the spiritual evolution of the soul.

f) Evidence for evolution

Several examples are provided from teacher 3 as evidence for evolution. She cites the existence of fossils and embryological studies indicating that evolution occurred. The progression from single-celled organisms into multi-cellular ones is also mentioned (page 362) as a sign that evolution has occurred. Teacher 3 also talked about the development of a baby into an adult as being a form of evolution and the adaptation of

living organisms to the changing cycles of climate (page 357) as further evidence for evolution.

4.9 INDIVIDUAL INTERVIEW – TEACHER 4

4.9.1 Introduction of Teacher 4 and overall impression of interview

Teacher 4 has been teaching for almost fifteen years. He is currently teaching in a private Islamic school and is also a devout Hindu. His comments are of particular importance because of where he teaches and the way in which he, as a Hindu, deals with Muslim learners when the topic of evolution is taught. Teacher 4 has a greater scriptural knowledge and believes more in righteous living than in conducting rituals only.

According to him, he practises tolerance and the absence of indoctrination in the classroom. This is important given the school in which he teaches and he is careful not to talk to his learners about Hinduism sensing that it might lead to arguments in the classroom. He does believe in evolution from a Hindu perspective and therefore sees no conflict between the two. Teacher 4 is also a proponent of self-study and researched the topic of evolution in depth in preparation for when it was introduced into schools.

4.9.2 Table of analysis for Teacher 4 – Transcript 8 – APPENDIX S

TABLE 4.10: Table of analysis for teacher 4

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Lighting the lamp	L	1	Rituals in Hinduism	1. Good knowledge of Hinduism, scriptures and teachings of Hinduism – more important to be a good Hindu (to live righteously) than to follow rituals only. 2. Belief in evolution
Rituals	R	1		
Avatars	Av	1	Hindu tenets	
Scriptures	Scr	4		
Righteous living	Ri	3		
Reincarnation	Re	1		

Tolerance	To	3		from a Hindu perspective:
Indoctrination	In	6		evolution of the soul
Antagonism	An	1		to a higher plane.
Conflict	C	3		3. Freedom to choose
Mixed views of learners	Mx	3		and greater tolerance
Fields of knowledge	FK	1		towards keeping an
Beliefs	B	2		open mind – shows
Ignorance	Ig	2		absence of
Lack of commitment	Com	1		indoctrination in
Openness to accepting aspects of evolution in religion	Op	1	Belief systems	Hinduism.
Freedom to choose – not forced to believe in religion	Fr	1		4. Willingness to
Pedagogy	Ped	3		pursue self-study as a
Self-study	SS	5		teacher to empower
Professional development	PD	1		self to teach a new
Syllabus	Syl	1	Teaching evolution	topic (evolution) –
Nature of science	NOS	1		not hampered by
Intelligent design	ID	3		religious beliefs to
Age of the earth	A	3		learn more.
Creation	Cr	4	Evolution theory	
Fossils	F	1		
Evidence for theory	Ev	3		
Science and Islam	Sci ¹	4		
Knowledge of				

evolution and Hinduism	K	5	Evidence for evolution	
Knowledge of evolution and Islam	K ¹	1		
Understanding	U	1		

4.9.3 Analysis of results

A total of thirty-two descriptors were extracted from this transcript which were in turn condensed into six meaning units and then into three themes. Some of the descriptors were unique and a few pertained to the Islamic perspective of evolution since teacher 4 taught at an Islamic school. These unique descriptors will be discussed in the paragraph below:

4.9.3.1. Explanation of Descriptors used in Transcript 8

A new descriptor that emerged from this interview was the idea of an avatar (Av). Teacher 4 describes the churning of the primordial ocean (page 369) but does not quite continue with the complete account of the appearance of the Kurma (tortoise) avatar described in Chapter 2 (2.8.3). The idea of science and Islam (Sci¹) and knowledge in Islam (K¹) are new descriptors that look at how Islam interprets human existence on Earth. The six meaning units will now be discussed.

4.9.3.2. Analysis of the Meaning Units

a) Teaching Evolution

Teacher 4 trained at a teacher-training college where according to him, the topic of evolution was “brushed over by the lecturers” (page 367, line 10) to such an extent that it was not even assessed in the examinations. Teacher 4 feels that this could have been because the lecturers did not know much about it themselves (page 367, line 16). He also attributes their lack of knowledge to the presence of Christian National Education (CNE) which did not allow the topic of evolution to be part of the education system in South Africa. Due to his poor training in the topic, teacher 4 therefore undertook to educate himself when evolution was introduced into the curriculum, like the previous three teachers in this study did as well. His motivation

for embarking on self-study was that he did not want to give learners the “wrong perspective” and needed to have a more accurate view of the topic for himself.

His concern about adhering to the syllabus is also evident when he informed the principal and board of directors at the Islamic school where he taught that this topic needed to be taught for the learners to have a fair chance for success when they wrote the NSC examination (page 373). Teacher 4’s view of the nature of science (NOS) is not very clear though. He claims that his learners use the evidence provided to support evolution to try and discount the theory and instead put forward alternative evidence to prove otherwise, from the Qu’ran. These learners are therefore more accepting of the Qu’ranic verses than of concrete scientific evidence (pages 383-4).

Teacher 4 admits in the questionnaire that he cannot describe the nature of science (NOS) although he uses it to teach Life Sciences but not evolution. This seems to be a contradiction. His explanation for why the NOS is beneficial when teaching the topic of evolution is that it increases learners’ knowledge of the topic by questioning and finding answers to questions. This answer shows that he is emphasising the hypothesis testing type of questioning that is in the Life Sciences syllabus but is not aware of the seven tenets of the NOS discussed in chapter 2 (2.6.1).

b) Hindu Rituals

Teacher 4 does consider himself a practising Hindu because he prays and lights the lamp daily as most of the Hindus interviewed in this study do. However, in addition he also believes in showing kindness and compassion to his fellow man. He believes that it is pointless to pray and read the scriptures if one does not practise being good to people. His stance is therefore the importance of following the rituals but also practising being a humanitarian.

c) Hindu Tenets

Following on from the previous paragraph on Rituals, the tenets that teacher 4 talks about are those of reincarnation, scriptures and just a brief mention of an avatar. The main focus for him seems to be righteous living and doing good for his fellow man especially those who are in need. He has some knowledge about the scriptures from his childhood but he does not feel confident about this. He also feels that Hindus nowadays are not committed and they lack the discipline to study their scriptures

which is why the knowledge of evolution in Hinduism is so poor. He compares this to the Muslim children he teaches who have almost complete knowledge of the Qu'ran and attend their religious classes regularly.

Teacher 4 also talks about the non-dogmatic, open nature of Hinduism (page 369, line 23) alluding to tolerance which gives its followers the freedom to accept a scientific view of life on Earth that is evolution without enforcing the idea of a divine creator.

d) Belief systems

The interview with teacher 4 revealed two different belief systems: one where the beliefs of his Muslim learners were seen and the other where his personal beliefs as a Hindu teacher were divulged. The Hindu beliefs will be discussed first: Midway through the interview, teacher 4 admits that he does not “particularly agree with the theory of evolution” (page 386, line 8). Earlier on he talks about Hinduism being a non-prescriptive religion that allows people to follow a scientific path for the existence of life on Earth if they so wish. He also mentions that he believes in the diversity of life being a planned event, not something that happened by chance – thus alluding to the notion of intelligent design.

He admits not knowing what the official Hindu stance on evolution is because of his poor scriptural knowledge. Later on teacher 4 talked about mental or emotional evolution (page 392, line 1) and the process of reincarnation being a form of evolution that humans have to undergo in order to eventually merge with the “Godhead” (page 392, line 7). According to teacher 4, the process of re-birth teaches one something – he does not mention the presence of a soul as such.

The perspective of his Muslim learners is very different. They believe strictly in Allah being the supreme creator and take the stories in the Qu'ran literally. They do not have room in their belief systems to accept that there could be an alternative to how life began and diversified on Earth. Their belief systems therefore seem to border on indoctrination because they do not have the freedom of choice unlike in Hinduism.

e) Evolution theory

Teacher 4's idea of planned creation or ID has been discussed in paragraph (d) above although he also seems to have an idea of evolution of the soul which seems to

contradict each other. This could be explained by the poor scriptural knowledge that he has. His notion of the age of the Earth according to Hinduism is about 50-60 thousand years but his knowledge of evolutionary evidence confirms for him that this number extends into four billion years. His religion gives him the freedom to accept the scientific evidence without fear of damnation. He mentions that according to his Muslim learners, the Earth is a million years old and they arrive at this figure from verses in the Qu'ran.

The presence of fossils on Earth as evidence for evolution is also a contentious issue for his learners who try to discredit them by expecting more fossils to be found of missing links than what is currently known. They also feel that the fossils of hominids are not true depictions of how man started off on Earth because they make direct correlations with what the Qu'ran says. According to them, early man, including Adam and Eve were giants so the fossils of short hominids cannot be of early man.

As a Hindu who believes in tolerance, teacher 4 is hesitant to get into a religious debate with his learners and is also reluctant to push the scientific evidence available because it conflicts with their religion. He therefore merely asks them to study the facts presented according to the syllabus for the examination alone and that they do not have to believe in what they have to learn.

f) Evidence for evolution

There is a great deal of evidence for evolution from teacher 4 that comes from an Islamic perspective as a result of what his learners divulge. Their notion of fossil evidence is discussed in paragraph (e) above. As mentioned, they equate Qu'ranic verses with scientific knowledge and therefore seem to confuse the two. For Muslim learners, their religion takes priority over any other kind of knowledge so there is no room to consider the scientific aspects of evolution. However, on page 397, teacher 4 reveals that he sometimes gets the feeling that some of his learners experience a flicker of a shadow of a doubt where they could accept the science behind evolution but this is quickly replaced with their religious views again.

Teacher 4 is of the opinion that learners need to be able to understand the theory of evolution and although a few of his learners do understand, they will not accept it. He

feels that this is because their religion plays an overarching role in their lives and leaves no room for any other belief.

TABLE 4.11: TABLE OF COMMON THEMES EMERGING FROM INDIVIDUAL TEACHER INTERVIEWS

THEMES	TEACHER NUMBER	1	2	3	4
	1. Strong PCK – self-study and willing to keep an open mind.	X	X	X	X
	2. Tolerance to learners’/ teachers’ views – no indoctrination.	X	X	X	X
	3. Scriptural knowledge present and less dependence on rituals.	X	X	X	X
	4. Link between Hinduism and science.	X		X	
	5. Some conflict present but willing to learn about evolution.		X		
	6. No conflict between evolution and Hinduism.	X		X	

EXPLANATION OF THEMES FROM INDIVIDUAL TEACHER INTERVIEWS

There were six common themes that emerged from the interviews with Hindu Life Sciences teachers. All of them had a strong motivation to embark on self-study in order to enhance their PCK and convey the right content to their learners. They all have some scriptural knowledge although this is stronger in teachers 1 and 3 and although they perform the rituals associated with Hinduism, they are aware that there are deeper meanings attached to them and they do not perform the rituals just for the sake of doing so.

Teachers 1 and 3 are also the ones who see a strong link between Hinduism and the science of evolution. As Hindus, all four teachers do not indoctrinate their learners with any particular belief but are prepared to present them with facts and allow them

to make up their own minds about evolutionary theory. Only teacher 2 experienced some conflict with evolution but this was not a deterrent to motivating her to learn about evolution when the topic was introduced.

On the whole the common themes show that all the teachers interviewed were not influenced by their religion and were prepared to engage in self-study to be well-prepared for teaching the topic. They were not willing to treat the topic lightly and wanted to be fully prepared to disseminate the correct information to their learners. The Hindu tenet of tolerance was strongly displayed by all four teachers who did not indoctrinate their learners at all.

Unlike most of the learners in the focus group interviews who had a poor or non-existent awareness of their scriptures, these adults were more aware of them and used their knowledge to look for deeper meanings behind the rituals.

Despite the presence or absence of scriptural knowledge, this round of interviews produced similar themes of no conflict between Hinduism and evolution as compared to the focus group interviews with learners. The topic of this study is to investigate the lived experiences of Hindu learners and teachers – thus far the interviews reveal that both these groups experience no conflict between the two aspects. The next analysis is done on an individual learner interviewed in order to verify if learners are influenced by group dynamics in a focus group session or if their views are consistent even when they are alone.

4.10 INDIVIDUAL INTERVIEW – LEARNER 1

4.10.1 Background of learner 1 and initial impressions of interview

Learner 1 is the daughter of Parent 3. At the time of the interview she is in grade 12 and has been learning Life Sciences since grade 10. She can be considered a top achiever since she consistently scores above 80% in the subject. Since relocating to Gauteng, she claims to have lost some contact with her Hindu roots and culture. This is exacerbated because she attends an ex-Model C school where there are no other Hindu learners in her class with whom she can interact on a similar level. However she was quite adamant about experiencing no conflict with her religion and the topic

of evolution. There were a few minor misconceptions regarding her understanding of the topic of evolution.

4.10.2 Transcript analysis of results for Learner 1 – Transcript 9– APPENDIX T

TABLE 4.12: Table of analysis for Learner 1

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Rituals	R	1	Rituals of Hinduism	1. No conflict about learning evolution and accepting of theories.
Righteous living	Ri	1	Tenets of Hinduism	
Scriptures	Scr	1		
No conflict	C ^{no}	5	UNIVERSITY OF JOHANNESBURG	2. Some misconceptions of theory of evolution. 3. Hindu teachings learnt and practised – some scriptural knowledge but insufficient to know about evolution from a Hindu perspective.
Intelligent design	ID	1		
Ignorance	Ig	1		
Openness to accepting aspects of evolution in religion	Op	1		
Creation	Cr	2		
Beliefs	B	1		
Misconceptions of evolution	Mis	1		
Understanding evolution	U	1		
Age of the earth	A	1	Theory of evolution	
Prehistoric life	Pre	1		
Fossils	F	1		
Nature of Science	NOS	1		
Theory of evolution	Th	1		

4.10.3 Analysis of results

This interview yielded sixteen descriptors that were condensed into four meaning units and in turn into three themes. The learner's comments were mostly of little substance but the gist of her beliefs was clear: that she experienced no conflict between her religion and evolution. There were no new descriptors from this interview hence the next aspect to be discussed will be the meaning units.

4.10.3.1. Analysis of the Meaning Units

a) Hindu rituals

This learner mentioned only one descriptor that could be grouped into this meaning unit – that she believes in the customs of her religion. However she did not specify what these customs were. She did seem to be more concerned that she was not as devoted to performing these customs as other Hindus were but regarded herself as a practising Hindu nevertheless.

b) Hindu tenets

As a practising Hindu learner 1 did not have a wide repertoire of tenets that she followed. She mentions only two – that of righteous living and some scriptural knowledge. According to her, she abides by the principles of non-violence, being helpful to people around her and being polite (page 399). Her scriptural knowledge is based on hearsay so she has no direct experience with the scriptures herself. Her mother told her about the origin of people on Earth (page 400) and that story is what she holds on to. This shows that her belief system is strongly influenced by her family and she is willing to maintain her beliefs just because it was told to her by her mother.

c) Belief systems

Learner 1 consistently states that she experiences no conflict between her religion and evolutionary theory. She is not offended learning about evolution either (page 401). She also displays some ignorance about her religion where she cannot draw parallels between Hinduism and the development of life forms from simple to complex. However, this issue was also seen by the other Hindus interviewed so it is not a unique problem confined to learner 1. She is open to learning about evolution not just for examinations but in order to “have basic knowledge” (page 401) which she feels

that everyone should have. She seems to therefore want the knowledge of evolution to be known by people of all religions.

Her one belief is aligned to intelligent design (ID) where her notion of evolution is that simple cell organisms were first created by God and they then evolved into the diversity of life present on Earth today (page 399). However she also has a degree of creationist belief when she cites her mother's view that "God created people in his image" (page 400). Although she holds these two beliefs it does not seem to occur to her that they cannot coexist because if she believes that God created people in his image then how could the simple celled organisms have also evolved into humans? Her conflicting beliefs could probably be resolved if she becomes more informed about the views held by Hinduism and if she reads the scriptures for herself. She is however aware that controversies arise from religion (page 402) but once again does not herself have any conflicts with her own religion.

Learner 1 has a few misconceptions about the theory of evolution and of what she thinks constitutes a theory (page 403). Many of these misconceptions probably stem from her lack of knowledge about the topic and this could be because at her school the topic was taught to the learners in grade 11 so she perhaps did not remember much at the time of the interview, more than five months later. This is compounded by her poor knowledge of Hinduism as well.

d) Theories of evolution

With regards to the age of the Earth, learner 1 cannot give a Hindu version but uses the age according to her Life Sciences knowledge (page 400) of 6 billion years. She does not have a problem accepting this age from a Hindu perspective. Learner 1 also experiences no difficulty accepting that there is a place in Hinduism for prehistoric life forms but does not explain further.

Her account of fossils is limited to her reference to them during practical work in class. She does not seem to know the significance of fossils as evidence to verify the processes of evolution, once again alluding to her lack of knowledge about the theory of evolution. As mentioned above she feels that if something offends people then it should be called a theory. Learner 1 seems to have an idea of what the NOS entails

but she does not interpret its value in understanding how the theory of evolution came about.

4.11 INDIVIDUAL INTERVIEW – PARENT 1

4.11.1 Background of parent 1 and initial impressions of interview

Parent 1 is a high school English teacher who is currently studying towards her Masters degree in education. Her daughter is in grade 12 and has studied Life Sciences since grade 10. Although Parent 1 was born into a Christian family she has followed the Hindu way of life since getting married to a Hindu. When she was approached to take part in this study, she undertook to find out more about evolution and conducted some basic research on the topic.

From the interview I gathered that she experienced no conflict between Hinduism and evolution and that she had no problems as a parent with her child learning about this topic in school. However, she seemed to have some difficulty reconciling her Christian upbringing before marriage with the theory of evolution but this was short-lived. In the discussion with her she admitted to practising more tolerance and being more accepting of the topic as a Hindu than if she were still a Christian. This stance was however not pursued to a great extent in this study since the focus is on the Hindu perspective of evolution.

4.11.2 Transcript analysis of results for Parent 1 – Transcript 10 – APPENDIX U

TABLE 4.13: Table of analysis for Parent 1

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Rituals	R	1	Rituals of	1. Willingness to have an open mind – use of education to do this. Available evidence a strong reason for open mind. Does not
Temple	T	1	Hinduism	
Avatars	Av	4		
Reincarnation	Re	4	Tenets of	

Scriptures	Scr	1	Hinduism	allow dogma of religion to impede desire to learn more.
Righteous living	Ri	2		
Freedom to choose – not forced to believe in religion	Fr	3		<p>2. Rituals are done but with understanding, not blindly. Uses Hinduism to instill discipline into child.</p> <p>3. No conflict / not against child learning about evolution – wants her to keep an open mind based on evidence presented at school.</p> <p>4. Misconception - apes evolving into man and no common ancestor.</p>
More accepting	A ⁺	1		
Conflict	C	1		
No conflict	C ^{no}	5		
Openness to accepting aspects of evolution in religion	Op	1		
Questioning religion	Q	3		
Mixed views of parent	Mx ^P	2		
Beliefs	B	3		
Creationism	Cr	2	Belief systems	
Indoctrination	In	1		
Knowledge of Hinduism or evolution	K	4		
Science and Hinduism	Sci	9		
Age of the earth	A	1		
Evidence for theory of evolution	Ev	5	Evidence for evolution	
Fossils	F	2		
No common ancestry	NCA	2		
Misconception of evolution	Mis	4	Theory of evolution	
Natural selection	NS	1		

4.11.3 Analysis of results

The transcript contained twenty four descriptors converted into five meaning units and then into four themes. There were only a few descriptors that did not occur in the previous nine interviews and these will be discussed next.

4.11.3.1. Explanation of Descriptors used in Transcript 10

One of these descriptors is that of openness (Op) where certain aspects of evolution are accepted in Hinduism and it goes together with the descriptor for freedom (Fr) where Hinduism allows its followers to have alternative beliefs. Parent 1 displays this because she says repeatedly that she gives her child the prerogative to decide on her own what to make of evolutionary theory together with Hinduism. She states that she does not prescribe to her child what she needs to believe. This also alludes to the absence of indoctrination (In) from a parental perspective. In addition as a Hindu parent 1 does not accept the performance of various rituals and prayers blindly but prefers to question (Q) their significance first.

In order to prepare for the interview, parent 1 took the initiative to do some reading on the topic of evolution and she also asked some of her learners who study Life Sciences about the topic. However, it was apparent during the interview that she has many misconceptions (Mis) concerning evolution especially with regard to the concept of common ancestry (NCA) and natural selection (NS). Her misconceptions are also shared by many Life Sciences learners so they are not unique to her. At two points in the interview (pages 410, 416), she also states that she has mixed feelings (Mx^P) and her confusion is evident in the way she answers some of the questions regarding the different viewpoints held in Hinduism and her feeling that some of her comments are contradictory.

4.11.3.2. Analysis of the Meaning Units

The five meaning units that emerged from this interview will now be discussed in detail:

a) Hindu Rituals

As mentioned earlier parent 1 was Christian by birth and she became a Hindu after marrying a Hindu. However upon entering a new religion she was not willing to

merely accept every ritual and prayer that Hindus performed. Instead she questioned the reasons behind them so that they were meaningful to her and she knew why they had to be done. As a result she also did not indicate a wide repertoire of rituals that she observed – compared to previous interviewees who mentioned more of the different rituals they performed.

Parent 1 mentions observing certain prayers and not even going to the temple often. For her, it is more important to understand why the prayers have to be done rather than the number of prayers observed and this is the message she conveys to her children at home. She sums up her stance effectively by describing herself as being “not only a practising Hindu but a practical Hindu as well” and that she is “a realist” (page 1).

b) Hindu Tenets

Some of the tenets she mentions is that she has a vague idea of the different forms that God manifests in (e.g. she mentions the form of a fish – page 407; that there are “forms and shapes of different Gods” – page 406; the form of a fish and other animals that Lord Vishnu takes on – page 411). However she does not mention the term “Avatar” indicating that she is not aware of this concept. She does not have any proper scriptural knowledge and does not answer the direct question posed regarding this. Instead she bases her response on Darwin. She also does not mention any of the Hindu scriptures although she names Lord Vishnu (the preserver aspect of the Hindu trinity described in greater detail in chapter 2, **2.8.4**) but not in any detail and offers no further explanation.

Parent 1 has some knowledge of reincarnation which she talks about repeatedly. Most of the time she equates reincarnation with evolution (page 407) and describes that evolution is the development of life forms when they take on the lower life-forms and progress from there (page 415). Although she mentions this tenet so often, she does not have a clear perception of it and does not refer to the influence of the law of Karma on reincarnation. This could possibly be because she tried to link science and religion each time and her responses were biased in this way.

Another tenet that parent 1 mentions is that of righteous living and mentions that Hinduism has “a code of conduct and rules” that are followed “for self improvement”

(page 405). However she does not say what these rules are or what self improvement entails. Later on she says that parental discipline and the Hindu beliefs should be used together to bring up children. Again, she provides no further explanation about which beliefs are used to foster discipline.

Parent 1 therefore has some ideas of Hinduism but these are not substantial because she does not provide much detail. The fact that she is only a Hindu since her marriage (about seventeen years) could be a reason for this. However it is also worth stating that compared to some people who are Hindu from birth, parent 1 seems to have a better idea of how Hinduism should be practised probably because she asks questions (page 413).

c) Belief systems

Many beliefs were expressed or shared by parent 1. Basically she experiences no conflict with her child learning about evolution and she gives her child the freedom to make up her own mind about what to believe. She does not force her daughter to follow any Hindu tenet or ritual and accepts that she is learning different views at school. Only once during the interview did parent 1 express that she felt conflict between Hinduism and science but she explained this by stating that there are different viewpoints held in the religion (page 410).

She also seems to value the role of evidence in evolution that makes it more valid while in religion there is no evidence, only different viewpoints. Thereafter she repeatedly stated that she felt no conflict existed between her religion and evolution (pages 408, 417, 419). Her confusion is also evident in her deliberate comment that she has “lots of mixed feelings” in this interview (page 416) – a point that could be attributed to her having both a Christian and Hindu background.

Parent 1 admits to questioning her religion and does not accept that rituals and prayers have to be performed meaninglessly. It is interesting that she feels free to do this in Hinduism without fear of being chastised and this is probably because of the tolerance and absence of indoctrination that exists in this religion. When she was a Christian she used to believe in the creation of Adam and Eve by God because that is what the Bible said and what was preached in church. However since becoming a Hindu her

perspective has changed and now she believes more in the scientific notion of “cells changing” (page 415) implying evolution.

In addition, parent 1 believes that people who study have a more open mind and can therefore be more accepting of different “philosophies and theories” (page 418) unlike having one viewpoint if there is no further education. As stated in paragraph 4.11.1 above Parent 1 was at the time of the interview studying towards her Masters degree in education thus giving her the open mind she displayed in answering the questions. Although she lacks specific knowledge in both Hinduism and evolution she tries to find links between the two topics with the limited knowledge that she does have, which in turn allows her to accept that her child is studying the topic of evolution at school.

d) Evidence for evolution

As already mentioned in paragraph (c) parent 1 holds the belief that Hinduism and science are linked but that she regards evidence as her confirmation that evolution occurred. She cites the presence of fossils especially with the recent discovery of a hominid fossil (she is referring to *Australopithecus sediba*) as proof for evolution. Parent 1 considers herself a realist hence her need for concrete evidence such as fossils (page 408). Her thoughts on the age of the Earth from a Hindu perspective are “thousands of years old” while she believes that science regards it to be “only hundreds of years old” (page 408). She therefore has a mistaken idea of the scientific age of the Earth which could be attributed to her hurried preparation for the interview without consulting proper sources.

Parent 1 draws strong links between science and Hinduism indicating that she regards the religion as having more scientific roots. This link has emerged in previous interviews (Transcripts 1, 4, 5, 6 and 7) as well although there was more substantiation. It seems that even though parent 1 lacks the reasons for this link, she seems to be getting the same impressions about Hinduism.

A question by the researcher about parent 1’s scriptural knowledge received the response about Darwin’s place in Hinduism (“I don’t know how the Darwin’s theory fits into Hinduism” on page 407) which had no connection whatsoever to the question. Parent 1 then explained that she believes that “in some way science and

Hinduism are linked” (page 407) because Darwin “came up with evolution theory ... only when his daughter died ... and he became an atheist” (page 407). Once again, her explanation is misplaced but can be attributed to her quickly gathering information about the topic of evolution in order to prepare for the interview. It is interesting to note that she decided to prepare herself on evolutionism only and not on Hinduism as well.

She states that Hinduism is older than science so theories of evolution were originally in the former and then “science takes off from there” (page 408). Her belief of equating reincarnation in Hinduism with evolution has been done before by other interviewees (Transcript 4, 8) but parent 1 seems to think that science takes over at a certain point from reincarnation (page 409) and that the two processes are not concurrent.

e) Evolutionary theory

Under this meaning unit, the concepts of common ancestry and a few misconceptions are discussed according to what parent 1 said during the interview. Some of these misconceptions have already been discussed in paragraph (d) above. She sees a link between reincarnation and the development of apes into humans thus showing a lack of knowledge in the notion of a common ancestor existing in the distant past that gave rise to both humans and apes. However, as stated in paragraph (d), the concept of a common ancestor is problematic for learners and lay-people to grasp mainly because of the infamous picture that exists showing that apes changed into humans. Parent 1 states “I am starting off with the picture of an ape and then developing and progressing to becoming a man” (page 409) where she is referring to this picture exactly.

Parent 1 has also touched on the idea of natural selection but as with the age of the Earth she also gets this idea wrong. She concludes that “we don’t really change unless there are climatic changes” (page 416). The notion of the climate driving the process of natural selection is not incorrect. Instead the misconception is that that individuals change immediately in response to the changing environment rather than populations of organisms changing over time – a mistake shared by some Life Sciences learners as well.

4.12. INDIVIDUAL INTERVIEW – PARENT 2

4.12.1 Background of parent 2 and initial impressions of interview

Parent 2 is a primary school teacher who is also studying further to advance her teaching qualifications. Her son took Life Sciences from grade 10 to 12 and they come from a deeply religious Hindu family where prayer and rituals play a fundamental role. However, Parent 2 was adamant that she is no longer a follower of meaningless rituals. Instead she has progressed to becoming more spiritual and looking for a deeper meaning to her life. She experiences no conflict between Hinduism and her son learning evolution at school.

4.12.2 Transcript analysis of results for Parent 2 – Transcript 11 – APPENDIX V

TABLE 4.14: Table of analysis for Parent 2

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Rituals	R	4	Rituals of Hinduism	1. No conflict about child studying evolution at school. Religion does not indoctrinate or condemn learning about evolution.
Prayer	Pr	1		
Fasting	Fs	1		
Righteous living	Ri	2	Tenets of Hinduism	2. Rituals are performed but leans more towards spirituality.
Spirituality	Sp	2		
Karma	Ka	1		
Scriptures	Scr	2		
Ignorance	Ig	2		3. Misconceptions about the evolution of man from apes – no common ancestry.
More accepting	A ⁺	1		
Tolerance	To	1		
No conflict	C ^{no}	1		
Freedom to choose – not forced to believe in religion	Fr	1		

Lack of commitment	Com	1	Belief systems
Lack of discipline	LD	1	
No common ancestor	NCA	1	Theory of evolution
Misconception about evolution	Mis	1	
Age of the earth	A	1	
Science and Hinduism	Sci	1	

4.12.3 Analysis of results

4.12.3.1. Explanation of Descriptors used in Transcript 11

Sixteen descriptors emerged from this interview and were reduced into four meaning units and then into three themes. All sixteen of the descriptors extracted from this interview have occurred in the previous interviews so none will be discussed here.

4.12.3.2. Analysis of the Meaning Units

a) Rituals of Hinduism

Parent 2 describes herself as belonging to a highly religious family where rituals were performed dutifully and without question. She subsequently married into a similar family where Hindu prayers, fasting and rituals were of great importance and governed their lives and homes on a daily basis. However, even after years of doing this, parent 2 felt that there was no fulfilment in her life and decided to de-emphasise the performance of rituals and concentrate more on spiritual awakening.

In the interview parent 2 mentioned the rituals stated in the previous paragraph and said that she tries to find the significance of them instead of performing them just because she was told to do so. When her children ask why rituals have to be done, she remarked that neither she nor her own parents are able to offer explanations for why certain rituals must be done and that this is the source of her confusion and disillusionment with wanting to continue with those rituals. She is therefore “moving

more towards the spiritual line rather than being religious” (page 420) where she feels a closer bond to God than if she just performed the rituals.

On page 421 of transcript 11, parent 2 describes two major prayers that are observed by many South African Hindus of south Indian descent (Tamil and Telegu –speaking people). She claims that these prayers are performed with extreme devotion and great care is taken to ensure that offerings are meticulously arranged in front of the oil-lamp (described in more detail in section 4.2.4.2 (a) of this chapter) and pictures or statues of certain Hindu gods relevant to that prayer. However, her disenchantment comes from the differing views she hears about how and why these prayers are observed in India from where they originated.

b) Hindu tenets

Parent 2 admits to not having much knowledge of Hindu scriptures although she believes that proper scriptural knowledge would rectify the meaningless performance of rituals as discussed in the previous paragraph and would ensure that people get to understand why certain prayers must be observed in specific ways. Surprisingly, her knowledge of Christian-based stories concerning Adam and Eve is much better (page 422) and she is able to use that as her picture of the origin of man on Earth. She has no knowledge of the Hindu notion of man’s origin on Earth which she attributes to the lack of available literature in a simpler language (page 424).

Other Hindu tenets that parent 2 talks about are those of righteous living where she expects her children to observe the qualities of peace, love, kindness, charity and non-violence to all and not to reciprocate unkindness that other people show to them. Her move towards spirituality and realising that as a more effective way to reach God rather than performing rituals is another tenet in Hinduism where the focus is on spirituality rather than on materialism.

She also talks about the law of Karma, which she equates quite correctly with the biblical quote “what you sow you shall reap” and the scientific law of “cause and effect” (page 421). She believes strongly that all our previous actions determine the kind of experiences that we have in our present and future lives and therefore we need to always be good – a lesson that she tries to instil in her children.

c) Belief systems

The primary reason for this interview was to ascertain how parent 2, a practising Hindu felt about her child studying the topic of evolution at school. To this, she responds that she does not really have any conflict with this (page 423). She adds that she “kind of accepted” what her son was learning because it made her curious to learn more since the learners she teaches give the Christian view of creation which they seem to understand better.

Thus she implies that in the absence of not knowing the Hindu perspective she was encouraged to find out more about evolution even if it was from a purely scientific position. This shows that she did not feel restricted by her religion to pursue alternative explanations and had the freedom to accept them if they made sense to her.

Her dependence on the scientific stance is also evident when she comments that the “big bang started everything” (page 422) but she lacks the knowledge to explain the Hindu version of the big bang that is revealed in the Vedas as being the generation of the “Om” sound by the Supreme Energy, Brahman (see Chapter 2, section 2.8.4). She also states that the Hindu concept of how life began is not a topic that is widely discussed amongst Hindus probably because it is not well known. This could be another reason for many Hindus being more accepting of evolutionary theory – they do not have an alternative worldview which contradicts it.

However at the same time, the scientific big bang theory and the primordial “Om” sound that started off the universe according to the Hindu scriptures are closely related which therefore makes the scientific perspective easier to accept. Most Hindus interviewed lacked the knowledge to describe this occurrence except for learner A in transcript 4 who was widely read in some of the Hindu scriptures.

Parent 2 also indicates the lack of availability of simplified versions of the Hindu scriptures (page 424). She states also that “if it’s simple and we have reasons for reading it, it will make it much easier and simpler.” These two statements indicate her lack of commitment and lack of discipline as a Hindu in pursuing regular study of her religion. It was evident that she did not know about the abundance of simpler English versions of the Hindu scriptures available from many religious organisations and Hindu groups. Reasons for reading them could be to gain a wider knowledge base of

one's religion without claiming ignorance about it and this is an intrinsic reason that in Hinduism is not enforced upon its followers.

d) Evolution theory

According to parent 2, the age of the Earth in Hinduism is about 300 000 years. Again her lack of scriptural knowledge is evident since this is merely an estimation. Like parent 1, parent 2 also displays the common misconception that “man originated from the ape” (page 423) and clearly has no concept of common ancestry.

4.13. INDIVIDUAL INTERVIEW – PARENT 3

4.13.1 Background of parent 3 and initial impressions of interview

Parent 3 is a single mother whose grade 12 daughter studies Life Sciences at a public ex-model C high school. This parent is currently studying towards her PhD in Social Work and is a registered Social Worker by profession. She is also a devout Hindu and was involved at one stage in teaching children Hindu religious studies on Sundays (similar to Sunday School attended by Christian children). This was when she lived in KZN before relocating to Gauteng. Parent 3 also experiences no conflict between evolution and Hinduism and has no objections to her child learning about the topic in school.

4.13.2 Transcript analysis of results for Parent 3 –Transcript 12– APPENDIX W

TABLE 4.15: Table of analysis for Parent 3

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes
Prayer	Pr	1	Rituals of Hinduism	1. Scriptural knowledge studied but not much knowledge about evolution from a Hindu perspective.
Lighting the lamp	L	1		
Spirituality	Sp	2		
Scriptures	Scr	2		

Reincarnation	Re	3	Tenets of Hinduism	2. Strong move towards using rituals to achieve spirituality – more important than doing rituals.
Supreme energy	Su	1		
More accepting	A ⁺	1	Belief systems	3. No conflict about child learning evolution – freedom for her to choose how or what to believe – no indoctrination.
No conflict	C ^{no}	2		
Freedom to choose – not forced to believe in religion	Fr	1		
Age of the earth	A	2	Theory of evolution	4. Misconception about common ancestor; evolution of man; co-existence of Pangaea and man.
Misconceptions	Mis	2		
Evidence for theory				
Creation	Ev	1		
No common ancestor	Cr	1		
	NCA	1		

4.13.3 Analysis of results

The interview with parent 3 resulted in fourteen descriptor codes which were then condensed into four meaning units and these were then formed into four themes. Many of the descriptors have been discussed when they occurred in previous interviews so they will not be repeated here. The meaning units will however be discussed in the ensuing section.

4.13.3.1. Analysis of the Meaning Units – Transcript 12

a) Rituals of Hinduism

Parent 3 regards herself as a practising Hindu because she performs the rituals of prayer and lighting her lamp daily (page 425). She uses the ritual of prayer especially to give her strength when she experiences hardships in her life. Therefore it is apparent that she does not perform the rituals meaninglessly but uses them as a support system in her life. She does not mention the role that rituals play in her

children's lives so this is unclear. It is of particular significance because her daughter is learner 1 and she admitted to not performing as many rituals as other Hindus do.

b) Tenets of Hinduism

One of the tenets mentioned by parent 3 is that of spirituality. She seems to be aware of this facet of Hinduism and uses her religion to enhance her spiritual development. Another tenet linking on to this is that of scriptural knowledge which parent 3 admits to having. This is also evident because her view of reincarnation is that of constant birth and re-birth until liberation is reached – an idea that is also conveyed in the Vedas and the Bhagavad-Gita. She also talks about “moving towards Godhood” (page 425) which is the Hindu tenet of the existence of a Supreme Energy or Being that all souls are sub-consciously striving to merge with (see Chapter 2, 2.8.7). Although parent 3 has this scriptural knowledge she admits to not having the knowledge of what the Hindu perspective of evolution is about.

c) Belief systems

Essentially Parent 3 experiences no conflict between Hinduism and the topic of evolution that her child studies at school. This is seen in the descriptors that she is more accepting, feels no conflict and allows her daughter the freedom to decide what she wants to believe even if this means she would rather accept the Adam and Eve story in the Christian bible instead of the Hindu version (page 427). The reverse of this situation would be a rare occurrence: very few Christian or Muslim parents would allow their children to accept the creation story from another religion (Naudé, 2012; Yalvac, 2011). This once again emphasises tolerance, a Hindu tenet that has appeared several times in many of the previous interviews.

However, parent 3 says that she experiences no conflict because she is “not sure what Hinduism exactly says” (page 427). Once again, this shows that she is able to keep an open mind without clinging irrationally to her religious beliefs. She is also honest about her knowledge of Hinduism and does not claim to know more than she actually does. This allows her to then be more accepting of evolution, a scientific perspective.

d) Evolution theory

As a parent with minimal knowledge in the Life Sciences, parent 3 provides a few aspects concerning evolutionary theory. She accepts the scientific view that the Earth is “billions of years old” (page 426) and admits to not having an idea of what this age is according to Hinduism. Her reasons are that science has already spent much time, effort and resources in arriving at certain facts and she is not going to question that. Her implicit acceptance of scientific facts once again shows her willingness to believe alternative views and that her religion gives her the freedom to do so without fear of being blasphemous or disrespectful in any way.

She mentions also the joining of all the continents at one time into “huge masses of land” which is an accurate scientific view of the existence of Pangaea. However she gets the timeline drastically wrong by saying that this happened only 5 000 years ago when according to scientific evidence, it was more than 225 million years ago (Isaacs, 2007). In terms of man’s origin on Earth, she is willing to accept the Christian view of Adam and Eve in the absence of her knowledge of the Hindu view. From a scientific stance, she also has a misconception that humans existed on Pangaea – a notion that has no scientific basis but is her “personal belief” (page 427).

According to parent 3, the evolution of man began with “the baboon face, and the man that was walking on fours and then eventually an upright two-legged citizen” where she mentions Neanderthals (page 427). She is rather accurate in her summation of this development and even includes the notions of quadrupedalism and bipedalism. She does not say anything about man descending from apes like parents 1 and 2 so she seems to have some idea about the concept of common ancestry.

TABLE 4.16: TABLE OF COMMON THEMES EMERGING FROM INDIVIDUAL PARENT INTERVIEWS

THEMES	PARENT NUMBER	1	2	3
	1. Increased move towards spirituality rather than religion. Less dependence on rituals.	X	X	X
	2. Misconception about common ancestry or other evolutionary concepts.	X	X	X
	3. Scriptural knowledge present.			X
	4. No conflict between evolution and Hinduism. Tolerance to their children learning about evolution. Willing and open-minded to accept alternative views apart from Hindu ones.	X	X	X

EXPLANATION OF TABLE OF COMMON THEMES FROM INDIVIDUAL PARENT INTERVIEWS

All three parents interviewed shared three of the four themes. Firstly, they were less inclined to perform rituals without knowing the reasons for them first. Compared to most of the learners in the focus group interviews who seemed satisfied with meaningless performance of rituals the adults are more in search of enhancing their spiritual growth instead. Perhaps this desire to seek out spirituality is an aspiration that comes with age since only the learners of focus group 4 were keen to delve into this aspect of Hinduism.

Secondly, all three parents also experienced no conflict between their religion and evolution and had no objections to their children studying evolution at school. Although only one of the three parents had some scriptural knowledge, all of them interviewed displayed elements of tolerance in accepting that evolution is a reality. One of the parents also cited the presence of fossils to verify that evolution has occurred. In addition, the parents believed that they were willing to allow their children the freedom to decide for themselves what they wanted to believe. This was clearly indicative of the absence of indoctrination from parents towards their children – they were not forced to believe what their parents did.

Thirdly, a recurring theme in two of the three parents is the misconception of common ancestry where they believe that man descended from apes. However, as mentioned previously, this misconception is not unique to the parents since many of the learners interviewed also held that view. It is apparent that the concept of common ancestry is not understood both in the classroom and by the general public and there are misconceptions that abound concerning this. This lack of understanding could possibly be one of the reasons why evolution is not widely accepted. Parent 3 also has a misconception that man was around on Pangaea which indicates further ignorance about evolutionary concepts.

The fourth theme is around scriptural knowledge and it is once again evident that it is lacking in the Hindu community. Only parent 3 has some idea of the Hindu scriptures however this is not extensive. This lack of scriptural knowledge was also seen amongst the teachers and most of the learners who were interviewed.

4.14 INDIVIDUAL INTERVIEW – PRIEST

4.14.1 Background of Priest and initial impressions of interview

The priest was originally from KZN and was trained to conduct prayers in the South Indian dialect of Tamil since this was also his birthright. Hindu priests are respectfully addressed as Guru-ji or Guru – a respectful form of addressing a Hindu priest. Currently the Guru is the resident priest at a Hindu temple in close proximity to the school described in Focus Group 1. Many of the Hindu learners from this school are in fact devotees at this temple – it can therefore be regarded as a religious institution in their community.

His comments can then serve as a means of triangulating the learners' responses as he represents the role of spiritual leader in the CHAT model. The Guru has an extensive and worthy knowledge of Hinduism and Hindu scriptures as is to be expected from a religious leader in the community. Although many of his comments on Hinduism allude to the theory of evolution, it seems that he is not often aware of their links to evolution as a science. As a result he appears to be facing a dilemma regarding the Hindu version of the creation of life with the theory of evolution. Instances of these mixed views will be provided in sections **4.14.3.1** and **4.14.3.2**.

4.14.2 Transcript analysis of results for interview with Hindu Priest-Transcript

13

TABLE 4.17: Table of analysis for Hindu priest – APPENDIX X

Descriptor	Code used	Frequency of Occurrence	Meaning Units or Categories	Themes	
Scripture	Scr	8	Tenets of Hinduism	1. Rich scriptural knowledge – conflict between Hinduism and evolution. 2. Belief in humans being created but also in existence of prehistoric life and fossils. 3. Cyclical pattern of time 4. Knowledge of avatars - no link to evolution. 5. Rituals – a means to an end – no dependence on them. 6. Merging of souls into a Super soul – chief tenet of Hinduism.	
Supreme energy	Su	5			
Karma	Ka	2			
Cyclical aspect of time	Cy	2			
Spirituality	Sp	9			
Trinity	Tr	1			
Avatars	Av	3			
Reincarnation	Re	1			
Trinity	Tr	1			
Tolerance	To	1			
Righteous living	Ri	1			
Rituals	R	2			Hindu Rituals
Temple	T	3			
Punishment from God	Pu	2			
Self study	SS	1	Self-study		
Less accepting	A ⁻	1			
Conflict	C	1			
Creation	Cr	1			
Misconception about Hinduism	Mis ^H	1			
Mixed views of		3			

priest	Mx ^{Pr}	3		
Ignorance	Ig	1		
Values role of education in schools	VE		Belief systems	
Science and Hinduism	Sci	3		
Age of the Earth	A	3		
Fossils	F	2		
Prehistoric life forms	Pre	1	Evidence for evolution	

4.14.3 Analysis of results

This interview yielded twenty seven descriptor codes that were condensed into five meaning units and then into three themes. Many of these codes did occur in previous interviews but a few of them were unique to this one. These will now be discussed.

4.14.3.1. Explanation of Descriptors used in Transcript 13

The Guru was aware of the cyclic idea of time in Hinduism (Cy). He was able to name the ages (yugas) according to the Vedas. However he swapped the order of the Dwapara and Satya yugas around thus indicating some ignorance of scripture (Ig). This could also be interpreted as a misconception of Hinduism (Mis^H) that he has.

Guru-ji also displayed mixed views of evolution and Hinduism (Mx^{Pr}) where he does not see a reconciliation of the two. He admits to experiencing some conflict (C) between evolution and Hinduism. He acknowledges that the school curriculum is Christian-based (page 433, line 22) and seems to share the view that man was created. However whilst the Christian view is that God created man in his current physical state, the Guru believes that “man came from the super conscious state” (page 433, line 24) which could mean that there was no physical creation from God, just a spiritual aspect. He qualifies this by explaining that “God created human which was the highest consciousness” (page 433, line 38).

The Guru also does not agree with the topic of evolution taught in school but feels that he does not have the “power to stop it.” Although he alludes to a form of

indoctrination from the Hindu temples by “hoping” that prayer and discourse can change the perception of how man and life on Earth began according to Hinduism. However he has not actively embarked on any concerted vocal campaigns during the course of his religious discourse to stop the teaching of evolution or to denounce its credibility in the Hindu community.

Although he feels some conflict between the topic of evolution as taught in schools and Hinduism he places great value in education (VE) conveying the correct understanding of how creation occurred from this religious perspective.

4.14.3.2. Analysis of the Meaning Units

Five meaning units resulted from the twenty seven descriptors in this interview. All of the meaning units have occurred in previous interviews and they will each be described now from the point of view of the Hindu priest.

a) Hindu rituals

The Guru does not place much emphasis on performing rituals just for the sake of it. As a spiritual leader he feels that rituals that were performed in a certain way long ago can be modified to suit the present times – once again displaying the tolerance and flexibility of the Hindu religion. The Guru believes that rituals are just “one tier” of Hinduism and that they should be used as tools to achieve spirituality (page 434, line 30).

Guru-ji also mentions the temple where worship takes place. He talks about two shrines in KwaZulu-Natal that were established about 150 years ago when the indentured Indian labourers arrived from India and that are still active places for worship by many Hindus. He also states that many artefacts were found in these temples that attest to the immense importance placed on the performance of rituals by these people for many generations. Guru-ji describes the different aspects of cleanliness that are associated with spiritualism including physical and mental cleanliness which also confirms the point mentioned in paragraph **4.2.4.2a)** about the importance of cleanliness in the temple grounds.

Another aspect that the Guru makes concerning rituals is that many Hindus execute rituals like prayer, fasting and visiting the temple for the wrong reasons – that is they

fear being punished by God if they do not perform them (page 435, line 33). This idea of punishment was also raised by the learner A in focus group 4 who mentioned it for the same reason that Guru-ji did. Thus it seems to be a recurring point of concern that Hindu people are probably placing too much emphasis on the mere performance of rituals rather than on their deeper spiritual meaning.

b) Hindu tenets

The Guru has a rich and expansive repertoire of scriptural knowledge even though he sometimes seems to misinterpret or misrepresent this knowledge. His knowledge of scripture recurs throughout the interview and he is able to substantiate most of his answers with reference to multiple scriptures including a few that stem from South India (e.g he mentions the Thevaram on page 434, line 27) which is a text written in the Tamil language and that expounds the behaviour for righteous living.

His scriptural knowledge also includes the Vedas, Mahabharata and the Ramayana to which he refers frequently especially when he talks about the cycles of time on Earth and about the deities Lord Vishnu, Rama, Brahma, Shiva, etc. However, he also admits that his scriptural knowledge is not complete and he rates himself a 4 out of 5 implying that he is humble enough not to claim that he knows everything. This also shows that he is open to learning more and he does read more to enlighten himself and increase his understanding of Hinduism (page 429, lines 15-19). He is therefore also engaging in self-study like all the other adults interviewed.

He also talks extensively about his enthusiasm for the worship of the female aspect of the Divine – which he calls Mother Worship. Hinduism is one of the few religions that engages in this type of worship. The Guru mentions the Hindu trinity as discussed in Chapter 2 (2.8.4) – Lord Brahma, Vishnu and Shiva – also has a female consort who complements their role in the universe. These are the Goddesses Saraswati, Lakshmi and Parvati who are worshipped with immense veneration for their bestowing of knowledge, wealth and nurturing respectively. Just as the male aspects are all a part of the Supreme Energy (Paramatman), so too are these female aspects and altogether the male and female aspects constitute this Super Soul. Guru-ji however, focuses his energy and devotion towards the worship of the female aspect of the Divine.

The Guru also refers to the Supreme Energy as the super-consciousness. He also mentions that humans are the Atman (soul) which has to eventually merge with the Paramatman (Super soul). This concept has been described in detail in Chapter 2, section **2.8.8** and is also referred to as Moksha which is when the soul will be freed from the cycle of births and deaths on this earthly plane and will thereafter exist in the spiritual dominion. Guru-ji makes reference also to the Hindu tenets of Karma and reincarnation where he believes that the soul has to endure 108 cycles of birth before it can merge with the Divine. The quality of life that one is born into is determined by one's Karma or actions (page 430).

Guru-ji also explains in detail the concepts of the soul, spirit and life (page 430) and this also has reference to the description presented in Chapter 2, section **2.8.5.1**. Rosen (2002) and Parthasarathy (1986) clarify that all living things have both a soul and a physical body while man has a spirit and matter as well where the latter consists of the mind and intellect. The notion of spirituality is therefore an extension of these concepts where religion ought to lift humans out of the material world into the spiritual realm and Guru-ji alludes to this purpose in his constant reference throughout the interview to the super consciousness and to understanding the meaning behind the rituals performed.

The Hindu tenet of the manifestation of this Divine in different forms in the form of Avatāras was also explained in great detail in Chapter 2, section **2.8.3**. Guru-ji is able to provide some information on this topic but cannot provide an accurate account of the Avatāras as described in the Vedas. He succeeds in naming some of the Avatāras – the fish, tortoise, Lord Rama and Lord Krishna – but is unable to give the correct explanation for the manifestation of the fish (Matsya) avatar. His mention of a hare is not according to the scriptures as there is no Avatāra in this form. However he does correctly talk about the link between the form of the Avatāra being appropriate to the type of calamity that was prevalent on Earth at the time. He states that “each form that Vishnu took was for specific purposes” (page 438, lines 31-40).

Guru-ji was also able to correctly explain that the souls were reaching “a higher level of consciousness” (page 439, line 3) each time although he is quite adamant that this is not called evolution in Hinduism. He therefore gets the concept right but not the terminology. He does eventually concede that reincarnation can be considered a type

of evolution but does not want to commit to being in complete agreement to accepting that evolution is responsible for the origin and biodiversity of life on Earth.

c) Belief systems

The Guru seems to be in a dilemma about his feelings towards evolution. On the one hand he is able to present his reasonably sound scriptural knowledge about the three aspects that probably contribute to Hindus being more accepting of evolution (i.e. reincarnation; Avatāras and cyclical view of time). On the other hand he is unable to reconcile these aspects to the scientific theory of evolution and is reluctant to accept that there is a parallel between them. He therefore admits to being less accepting of the theory of evolution and does feel that there is some conflict between it and the Hindu religion.

Although he is not an active opponent of the topic being taught at schools he would favour the Hindu version of creation from the super consciousness being part of his religious discourses at the temple. He believes that this would give people an alternative to the scientific view.

He states “It would be wrong for me as a spiritual leader to say evolution is the Hindu way because we believe in reincarnation” (page 439, lines 9-11). His statement clearly indicates the dilemma that he is experiencing because in response to the next question on whether he thinks that reincarnation is a type of evolution, he says “Probably is.” From these two responses it seems that he feels compelled as a spiritual leader to put forward Hindu rather than scientific ideology even though he does concede that reincarnation, one of the Hindu tenets, can be deemed as a type of evolution.

Great emphasis is placed on spirituality and the ultimate purpose of each soul to achieve liberation and merge with the Divine. That tenet seems to be the driving force behind the Guru’s purpose as a religious leader in the community. He believes very strongly in this tenet and that there is “a better purpose” (page 439, line 31) for man’s existence than mere material pursuits.

d) Self-study

This aspect was covered in paragraph (b) above and will not be repeated.

e) Evidence for evolution

Guru-ji describes that Hindus believe that there was an explosion of a huge ball of fire into particles that reassembled into the planets and all the components of the universe (page 429, lines 25-26). He is actually describing the scientific concept of the Big Bang but does not identify it as such. This description is also similar to learner A's description in focus group 4 of the Hindu "Om" sound that resonates throughout the universe and that created it.

According to the Guru, there is a place for fossils in Hinduism and he states clearly that this "is an actual event that occurred" (page 438, line 15). However, he qualifies that fossils such as footprints confirm the age of Hinduism to being thousands of years old. He does not use the fossils therefore as scientific evidence for evolution but rather as proof for the age of events in the Hindu religion. This once again reveals his reluctance to accept the theory of evolution even though he is willing to accept elements of evolutionary evidence. Instead he uses this evidence to support the Hindu religion. He feels duty-bound as a spiritual leader to do so.

With regards to the age of the Earth, the priest accepts that the Earth could be millions of years old. He proceeds by citing the different yugas (ages) that make up the cyclical aspect of time according to Hindu scriptures. Although he does not accurately name the ages in their correct order he is aware of the vast periods of time that they each comprise. He does not relate this to the possibility that evolution could therefore have occurred.

4.15. SUMMARY OF COMMON THEMES EMERGING FROM ALL 13 INTERVIEWS

TABLE 4.18: Summary table of common themes found in all 13 interviews

INTERVIEW TYPE AND FREQUENCY OF THEMES OCCURRING IN EACH					
COMMON THEMES	FOCUS GROUPS	INDIVIDUAL LEARNER	TEACHERS	PARENTS	PRIEST
1. Importance of rituals in worship	75%	-	0%	0%	X
2. Emphasis on spirituality rather than on rituals	25%	-	100%	100%	X
3. Ignorance of Hinduism	75%	X	25%	33%	
4. Misconceptions about evolution	-	X	0%	100%	X
5. No conflict between Hinduism and evolution	100%	X	50%	100%	
5.1. Acceptance of alternative views and willing to be self-informed	75%	-	100%	100%	X
5.2. Link between science and religion	75%	-	50%	67%	
5.3. Keeping science and religion separate	25%	-	0%	-	X

EXPLANATION OF THE TABLE OF THE SUMMARY OF COMMON THEMES

The overwhelming response from all participants in this study revealed no conflict between Hinduism and the theory of evolution. The few people interviewed who

experienced some conflict were nevertheless prepared to accept alternative versions of the diversity of life on Earth and they were able to embark on self-study to become informed about the topic of evolution. The latter two points indicate that Hindus are generally tolerant and more open to accepting alternatives without fear of being blasphemous. The Hindu religion therefore allows its followers the freedom to explore other concepts without fear of reprisal. In addition some respondents were able to accept evolution by keeping science and Hinduism separate and in so doing could accept both without conflict. Other respondents however recognised a link between science and Hinduism which allowed them to experience no conflict either.

With regards to the Nature of Science (NOS), all the teacher and learner participants did not seem to have a strong idea of what this entailed and they were unable to provide an adequate explanation without probing questions during the interview. The four teachers interviewed were all experienced having taught for more than ten years at least. They displayed strong Pedagogical Content Knowledge (PCK) however there was room for improvement especially concerning their own understanding of the NOS. The teachers interviewed are well-known to the researcher having served together in the same cluster groups (communities of practice) for many years. Knowledge of their PCK being strong is therefore evident apart from the interviews alone.

Most of the adults interviewed were on the path towards spirituality rather than being dependent on rituals alone. It was apparent that the learners interviewed had not yet reached that level of maturity in seeking out the meanings behind the rituals and were quite content to merely perform them. However the learners in focus group 4 who were ardent students of Hindu scripture already seemed to have this more advanced level of development compared to their more ignorant peers.

It is possible therefore that an indirect relationship exists where the greater the knowledge of scripture, the less is the dependence on rituals alone. The priest, as a spiritual leader in the community is a proponent of both rituals and the search for spirituality because he needs to be able to perform the rituals for his devotees while at the same time guiding them onto the path of enlightenment. He does believe that rituals should be used as a means of attaining spiritual mastery and should not be performed meaninglessly.

One of the most overpowering themes is that most of the Hindus interviewed displayed their ignorance of Hinduism. The lack of scriptural knowledge is probably responsible for this since many of the participants admitted to not being highly committed to reading their scriptures regularly if at all. The exception to this was of course the learners in focus group 4 who undertook to studying Hindu scripture as one of their priorities.

There were also a few recurring misconceptions about evolution that was common in many of the interviews. All the parents interviewed seemed to believe that evolution entailed the descent of man from apes. However this was not reason for detracting from their desire to learn more about the topic. It seemed that this idea of evolution was not offensive or insulting to their religion as many Christian or Muslim people felt (Yalvac, 2011; Naudé, 2012).

This concludes the data presentation and analysis chapter. The findings, contribution to knowledge, future research, limitations and recommendations from my study follows in the next and final chapter.



CHAPTER FIVE

FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

5.1. INTRODUCTION

The focus of my study was to investigate the lived experiences of Hindu Life Sciences teachers and learners towards the topic of evolution. After a comprehensive literature review and detailed discussion with reference to the varied facets of my study, it was apparent that there was a gap in the field of knowledge concerning the Hindu perspective of evolution that needed to be filled. Many studies were done on teaching and learning evolution from a Christian and Muslim perspective but no information was found about how Hindu people regard this topic. My study therefore contributed towards filling this gap. In addition, research in South Africa concerning the teaching and learning of evolution has so far mainly focussed on tertiary level students. My study looks at secondary school learners and their experiences of this topic.

This study used the Cultural Historical Activity Theory (CHAT) as the lens through which the interplay between various role-players was examined. CHAT is a system of tensions that exists and is used to analyse the way in which these different role-players influenced the effective understanding of evolution. Social constructivism is the theoretical framework for my study. It forms the basis for CHAT and is therefore also discussed at length. In addition, the nature of my topic required the use of other intermediate theories such as that of controversial conceptual change (CCC) – to describe how people accommodate or assimilate topics that might be in conflict with their worldviews and belief systems; the nature of science (NOS) – to see the value of teachers grasping this in order to teach this to learners so that they can in turn be more prepared to understand the theory of evolution; pedagogical content knowledge (PCK) – to ascertain how the teaching and content knowledge of teachers influences the effectiveness of their portrayal and perception of the topic of evolution.

My literature review also included a detailed discussion of teaching and learning evolution internationally and in South Africa. Most of these studies were conducted using university students so my study addressed a further gap in the literature by using high school learners instead and their perceptions of the topic of evolution. I also included a brief discussion of the topic of evolution with some emphasis on aspects

included in the school curriculum such as the principles of natural selection according to Darwin and human evolution. Since my study deals directly with Hinduism, I provide brief aspects of this religion with particular reference to how they link to the topic of evolution. A navigational tool (**Figure 2.1**) provides a bird's eye view of the comprehensive literature review and ought to keep the reader accurately positioned to the relevance of that aspect under discussion.

In order to delve into the perceptions of Hindu teachers and learners I conducted both focus group and individual interviews with them. Triangulation for my study was obtained in part by also conducting interviews with Hindu parents and a Hindu priest in order to verify that the responses of the learners interviewed were aligned to what they were exposed to at home and in their place of worship. The interviews were then transcribed and analysed using the coding system outlined by Saldana (2009). This analysis revealed interesting results which will be described in the ensuing section.

5.2. SUMMARY OF FINDINGS

The findings of my study will be outlined based on the common themes that emerged from the analysis of the interview transcripts in Chapter 4. **Table 4.18** which is a summary of these themes is the main source of the findings to be discussed. Five main findings emerged from my study and discussions of them are summarised below:

5.2.1. Absence of conflict for Hindu teachers and learners with the topic of evolution

It emerged from the interviews that it was not difficult for Hindu teachers and learners to build evolution into their worldview. They were able to accept the topic without experiencing major conflict with their religion. This acceptance was also evident by the self-study that most of the adults interviewed were prepared to undertake in order to learn more about the topic of evolution.

This is in direct contrast to the studies conducted by Yalvac (2011) and by Naudé (2012) with South African Muslim and Christian teachers and learners respectively who found that evolution contravened the tenets of their particular religions and they were therefore not prepared to accept it at all let alone engage in any self-study about

the topic. Their results were similar to many international studies such as by Moore *et al* (2011) who found that “individuals having the strongest religious beliefs are most likely to reject evolution” (p. 225).

The absence of conflict among the Hindus interviewed was probably because of the process of assimilation that allowed them to adapt the new information so that it fitted within their existing worldview. This view of assimilation is according to literature reviewed in chapter 2, section 2.2.1 (Siegler, 1995; Ausubel, 1985). It is in contrast to the process of accommodation where people change their way of thinking to hold the new knowledge as is the case in religions that experience conflict to evolution.

A few of the respondents who did experience some conflict were also the ones who did not have much knowledge of either their religion, of evolutionary theory or of both. This is in line with the study of Trani (2004).

5.2.2. Ignorance of the Hindu religion

It was evident from the interviews that most of the Hindu people were deeply ignorant of their religion and scriptures. Despite this ignorance they were still accepting of the topic of evolution with the exception of focus group 3 who displayed the greatest degree of ignorance and also expressed that they felt some conflict. A converse view has been seen in studies conducted by Trani (2004); Chinsamy and Plagányi (2007) and Abrie (2010) – more religious students and teachers were more likely to reject the theory of evolution because it was incompatible with their worldviews.

One of the primary reasons for this lack of knowledge cited by some of the respondents is that many Hindu youth especially have no commitment or discipline to want to learn more about their religion and they are satisfied to merely observe rituals and prayers without exploring their underlying significance. The dependence on ritual performance rather than the quest for spirituality is one of the key findings among the interviews with the learners. However, most of the adults interviewed seemed to be in pursuit of spirituality instead. It seems therefore that the goal for spirituality comes with age and most of the learners have not yet realised that this should be their purpose. Scripture reading is also non-existent for most of the interviewees, including some of the adults, whose knowledge of the stories and messages of the scriptures are

negligible and based mainly on myth and misconception – e.g. the story of Lord Ganesha as explained in section 4.2.4.2a).

A broader knowledge of Hinduism also limits conflict because people will be more informed and will be able to compare their knowledge with that of evolution. The Cultural Historical Activity Theory (CHAT) is useful in placing this conflict into context because it shows the interplay between the tools (scripture), the subject (learner), the object (lived experiences of Hindu learners towards evolution) and the outcome (more tolerant learners). CHAT therefore implies that conflict could be diminished if learners have greater scriptural knowledge.

5.2.3. Misconceptions about evolution

Most of the respondents, except for the teachers, seemed to think that man descended from apes. They did not have knowledge of the concept of common ancestry and for the learners particularly it was apparent that this was not properly understood in the classroom. However this misconception did not lead to a non-acceptance of evolutionary theory and the parents in particular were enthusiastic in its support nonetheless.

Once again, a comparison can be drawn with the studies conducted with Muslim and Christian learners and teachers (Yalvac, 2011 and Naudé, 2012). In these two groups of people, the misconception that man descended from apes is one of the reasons cited for renouncing the theory of evolution. In the case of the Hindus interviewed, although some of them held this misconception, it did not deter them from accepting evolutionary theory.

5.2.4. Adequate PCK of teachers

All the teachers interviewed displayed an adequate PCK especially since they had many years of teaching experience. They actively pursued self-study in order to continue enhancing their knowledge of evolution so that their teaching could improve – this was also the case amongst two of them who had over thirty years of teaching experience each.

Each of the teachers in this study displayed an intrinsic concern to be better teachers and therefore embarked on intensive self-study that included researching and reading

about evolution and attending workshops for the teaching of this topic. They were therefore improving their subject matter content knowledge (Schulman, 1986:9) by enhancing their knowledge about the topic of evolution. They were not content to skim over the topic as is often the case with teachers when the topic of evolution has to be taught. This apathy from some teachers towards the topic of evolution has been the topic of numerous international studies (Moore *et al*, 2011:224; Trani, 2004:423).

However, it must be noted that the PCK of Life Science teachers is open to constant improvement especially because the topic of evolution has only been introduced since 2008. Furthermore, teachers face a constant challenge trying to keep abreast of advancements in the fields of molecular biology and palaeontology. As I will highlight in the next paragraph, teachers also need education regarding the NOS, which is not receiving the attention it deserves in the classroom. There is therefore a great deal of PCK that can still be developed. Teacher 3 did comment that when the topic was introduced the scope and depth was unclear thereby referring to the curriculum-related knowledge that Schulman (1986:9) indicates a good teacher ought to have.

5.2.5. The role of and teachers' understanding of the nature of science (NOS)

Even though the teachers in the study displayed admirable levels of PCK, the interviews showed that both learners and teachers had a poor understanding of the NOS. Most of them did however acknowledge the value of having evidence to verify theories. The seven tenets of the NOS described in detail in section 2.6.1 were not well known by the respondents. Clearly therefore these aspects would not have been conveyed to learners during lessons.

These tenets are a crucial factor in determining how learners deal with the generation of knowledge. Studies show that learners who have a sound understanding of the NOS are also more accepting of the theory of evolution (Cavallo and McCall, 2008). Furthermore, in our country where there is a dire shortage of research in science and technology, the NOS should be emphasised in the classroom.

5.2.6. Lack of major tensions linked to CHAT

This was an overwhelming finding in my study. All the respondents were adamant that they experienced no conflict between their religion and the theory of evolution.

Although the priest admitted that he felt some conflict he was unable to pinpoint exactly where this originated from because at the same time he accepted that Hinduism had a place for prehistoric animals and certain aspects of avataric evolutionism but he was unable to link this to evolutionary theory. This was probably because he lacked that aspect of scientific knowledge and therefore could not relate the two.

This lack of tensions in my study is in direct contrast to the studies undertaken by Yalvac (2011) and Naudé (2012) who found great conflict between Islam and Christianity respectively, with the topic of evolution. Although my study revealed no such tension among Hindu people, CHAT is still an appropriate lens because without it there would have been no other means of realising those tensions did not exist.

Being aware of the various places in which tension can occur in an activity system makes it possible to determine where to look for these in my study. This could not have been possible if CHAT was not the main instrument in the first place.

5.3. RECOMMENDATIONS



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The findings of my study led to a few recommendations mainly concerning the teaching of evolution in secondary schools in a multi-cultural society such as South Africa. These recommendations will be listed and explained below:

5.3.1. The Hindu perspective

My study contributes information that brings a new dimension to teaching evolution apart from the Christian or Islamic views that prevail internationally and even in South Africa. This perspective shows that the teachers implementing the curriculum, regardless of their creed must be trained to be more tolerant of different views.

The Hindu perspective is a case study showing that science and religion do not have to be in conflict and it introduces the value of tolerance that can exist between the two fields of knowledge. There is a parallel that exists between the spiritual change in Hinduism and biological evolution that leads to tolerance and this should be an important aspect of both INSET and PRESET teacher training courses.

5.3.2. PCK development in teaching evolution

The teachers interviewed displayed adequate PCK because they were highly experienced and were able to explore different ways of adding to their knowledge and skills as Life Science teachers. This is however influenced by the lack of conflict that they experience as Hindus when dealing with the topic of evolution.

Even if PCK is adequate, there is still room for improvement, especially in suitable hands-on laboratories when dealing with evolution in the classroom, and in developing a better understanding of the NOS. This is especially so when comparing the studies of Yalvac (2011) and Naudé (2012). The key to effective PCK is to be a critical reflective teacher so that one's teaching can always serve as a means of improving and informing future lessons. However this ability for critical reflection is lost in those who reject or oppose the topic of evolution because of their fundamental religious beliefs. Hindu teachers on the other hand, according to my study, are more open to the theory of evolution and can engage in deeper reflections thereby increasing their PCK.

My study therefore showed that there are always opportunities for teachers to improve their PCK and possibly that they should not allow their religious beliefs to hinder their pursuit for effective teaching. A further recommendation linked to the PCK of teachers is that there should be greater focus on the historical aspects of scientific concepts including evolutionary theory. Van Dijk (2008:265) proposes that the historical nature of biology should be integrated into teacher education courses because this would allow an appreciation of the process of evolution by learners.

It is also recommended that evolution be taught like a story to enhance its understanding. Bybee (2002) advocates the use of historical case studies and narratives to teach the topic of evolution so that it would allow learners to follow the development of different aspects of the theory like a story. Van der Mark (2012) also showed that narratives (and concept cartoons) can be a very successful pedagogy to use in the classroom when dealing with evolution. This in turn would enhance both their interest and understanding of how knowledge is constructed in science as well as of how scientists work. The integration of narratives and concept cartoons into the teaching of evolutionary theory could in turn lead to enhanced professional

development of teachers and greater understanding of the NOS particularly with regard to evolution.

Evolutionary processes play an important role in daily life and perhaps if learners are exposed to what this relevance is, they will be more receptive to understanding how the theory works (Scharmann, 2005; Chinsamy and Plagányi, 2007). This is therefore another recommendation – that the relevance of evolution to daily life be presented to learners during lessons (as outlined in Section 2.7.2). An additional recommendation is that lessons should be made more interactive where learners share their views and opinions rather than having the content delivered to them lecture-style.

5.3.3. Greater focus on the NOS by teachers

This recommendation is linked to the finding that the teachers interviewed did not have a good grasp of the tenets of the NOS. Thus it is necessary that the NOS and the inquiry method of science teaching receive greater attention especially in teacher education. Presently, many sectors of education and industry in South Africa are experiencing a severe shortage of science specialists and this could be addressed in part by emphasising the NOS and the value of the scientific process in generating new knowledge in the classroom and the methodical way in which this knowledge is constructed.

The value of the NOS in conducting more effective research can then contribute to increasing studies at a post-graduate level for all sectors of society, not science alone. However, this level of research can only be achieved if learners are sensitised to the tenets of the NOS from the classroom. This in turn can only arise if teachers receive adequate training during their teacher training to teach the NOS explicitly as highlighted by Lederman (2004:403) in section 2.6.3 of this report.

Another reason that the NOS is not receiving the attention it warrants is because learning in most South African schools is too examination-driven. Very often vast quantities of content have to be taught in short periods of time just for the sake of completing a formal assessment task or examination. As a result, an important topic like the NOS is neglected because it is actually a skill that has to be incorporated and

reinforced gradually and it is often cast aside in favour of speedy coverage of pure content.

The recommendation is therefore that the NOS be emphasised during teacher training courses and that teachers integrate aspects of the NOS in their lessons regardless of what content is being taught. In this way learners will come to understand the value of conducting research and they will appreciate how the knowledge they learn was generated in the first place.

Linking on to the benefit of learning about the NOS is the recommendation that the NOS be taught before the topic of evolution. This was also one of the findings by Dagher and Boujaoude (2005) in their study with Lebanese students that the NOS should be taught before evolutionary theory can be understood.

5.3.4. Improved explanation of the concept of common ancestry

One of the findings of my study was that many respondents believed in the descent of man from apes. This is a misconception that has been perpetuated in the media and by the opponents of evolution and has unfortunately also filtered down into schools. It is a difficult idea to shake off because it has received much adverse publicity.

Schools have a responsibility to ensure that the correct idea is conveyed to learners and ultimately to the general public. It is recommended that the notion of common ancestry receive more attention in the classroom so that learners understand how the misconception began and what is wrong with it. Common ancestry would allow learners to see that there was a common ancestor that gave rise to both the hominid family and to the rest of the primates and that this is why apes and humans co-exist today without the one having evolved into the other.

Although this concept is presently taught to learners they fail to relate it to the context of human evolution. A possible reason for them being unable to do so is that their teachers also probably do not have full cognizance of this concept and hence cannot instruct them properly. It is therefore recommended that together with the NOS the concept of common ancestry be emphasised during teacher training.

In addition, another recommendation is that academics in tertiary institutions should play a more active role in educating the general public about the value of evolution to biology. Falsities and misconceptions portrayed in the media such as the one described above regarding man's descent from apes should be denounced as such more vociferously by these academics in a bid to straighten the record on evolutionary processes. This view that academics have done little to promote the topic of evolution is held by Blackwell *et al* (2003:60) who maintains that university professors have a significant role to play in promoting the value of evolution to biology.

5.4. CONTRIBUTIONS OF MY STUDY

A research study such as this had to result in a few contributions to the body of knowledge around some of the aspects highlighted in chapter 2. These contributions are:

5.4.1. Addressed gaps in the literature

My study which looked at the lived experiences of Hindu Life Sciences teachers and learners to the topic of evolution addressed three aspects usually absent in the literature. Part of this void concerns how Hindu people regard the topic of evolution. As mentioned previously there are many studies on how Muslim and Christian people view the topic but none from the perspective of Hindu people.

Another part of this void addresses the teaching and learning of evolution in South Africa. Since the topic of evolution has only been introduced into school curricula from 2008 it is a relatively new topic and very little research has been conducted about how it is dealt with by South African teachers and learners. In addition, the few studies conducted in South Africa used tertiary level students and not secondary school learners. My study therefore looks at how secondary school learners feel about the topic of evolution – thus filling another part of the void in the literature.

5.4.2. Use of CHAT as a lens

This study had elements of phenomenology and looked closely at how people felt about the topic of evolution. These feelings stemmed from their existing worldviews and religious background and many tensions between various aspects were

anticipated. Although my study revealed that there were no significant points of tension, it was necessary to use CHAT as a lens and as the overarching theory with which to identify and analyse sites where these tensions could possibly arise.

My study therefore contributed to the growing body of literature using CHAT as a lens with which to conduct and analyse research.

5.4.3. Leadership in teaching the topic of evolution

My study does an in depth literature review of various aspects that can enhance the teaching of evolution. These include the NOS, PCK of teachers and evolutionary theory. This information in turn can inform teaching so that teachers have greater confidence in how they deliver an enhanced understanding of the topic in the classroom.

It is also hoped that the research conducted in my study will provide some leadership and direction to teachers in how the topic is viewed by a different religious group – Hindus. The study therefore provides an alternative view that religion is not always in conflict with the topic of evolution unlike in the Abrahamic religions of Islam and Christianity. In turn this can allow teachers to show learners that religious views can exist in harmony with science.

In addition, my study has been presented at a conference for Life Sciences teachers convened by NAPTOSA in 2012 – a large teacher union in South Africa whose primary focus is teacher development. This presentation provided a forum to start discussion about the Hindu perspective – a view that was previously unheard of.

5.4.4. Interest in Hinduism

As mentioned in the last paragraph, presenting my study at a conference attended by teachers of different religious groups hopefully served to stimulate an interest in the Hindu religion. In a multi-cultural society such as South Africa, tolerance for other faiths can only serve to foster greater peace and harmony among its citizens. Under the apartheid regime, Indian people and the religion of Hinduism were minority groups that were sidelined to such an extent that the majority racial groups were severely ignorant of this culture. It is sincerely hoped that my study can contribute to

this very importance process of nation building especially since Indians and Hindu people have been an integral part of the fabric of South African society since 1860.

Furthermore, many of the Hindu people who took part in my study also displayed varying levels of ignorance in their own religion. However, some of them mentioned that their participation actually sparked off an interest to find out more about the Hindu religion (transcripts 3 and 8). Many of the questions asked during the interview were met with uncertainty but this stimulated a desire to start reading and researching more about their religion.

The contribution of this study is therefore that it has created some interest and awareness in the Hindu religion. These interested people can in turn contribute to increasing the knowledge of this religion by talking about it and broadening their own base of information.

5.4.5. The value of indigenous knowledge systems (IKS)

My study also contributes to the value of including IKS into the syllabus. When teaching, teachers must then make IKS a part of their PCK to enable more inclusivity. Hindus have a rich history of their own indigenous knowledge and their view of evolution has been largely ignored by the west. IK systems have a significant contribution to make towards knowledge, especially the science field that should be included in syllabi to bring attention to minority groups and the role they play in knowledge construction.

5.4.6. Awareness of the NOS and worldviews

A topic like evolution is controversial mainly because it is often regarded to be in conflict with people's worldviews. Hence it is necessary to make learners aware of the methods involved in arriving at such a theory and the tenets of the NOS play a crucial role in this process. An understanding of the NOS can also inspire and promote scientific literacy, creativity and critical thinking among learners – a beneficial skill especially in South Africa where there is a dire need for development in the fields of science and technology.

My study therefore, with its extensive discussion on both the NOS and worldviews, highlights what these two entail and how they should be given more attention in the

classroom. In fact Schilders *et al* (2009:115) are of the opinion that learners' worldviews can even increase their understanding of the NOS. This will also contribute to learners being able to harmonise their worldviews with the theory of evolution as is supported by researchers such as Schilders *et al* (2009:115); Cobern (1996) and Andrews (2005).

Although my study was conducted on a minority religious group in South Africa, it contributed a few valuable insights into how the Hindu community regards the topic of evolution by providing an alternative worldview. Of greater significance is that this worldview does not experience much conflict with evolutionary theory thus providing a healthy model to accepting science and religion simultaneously. My study nevertheless, allows teachers to be aware that all learners have worldviews that can interfere with their understanding of evolution and teachers therefore need to accommodate for these barriers in their pedagogy.

The assimilation of evolutionary theory into learners' worldviews is important because it contributes to improved teaching and learning of evolution and in turn an increased understanding of the topic.



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5.5. LIMITATIONS OF MY STUDY

In retrospect it emerged that my study was limited in certain ways that could serve as points to be wary of when conducting future research along similar lines.

5.5.1. Limited scope of interviews

A total of thirteen focus group and individual interviews were conducted in my study. This could be construed as a limited number of interviews so the comments received cannot be used with much authority to make generalisations about all Hindu people. However, of the twenty six respondents it became clear from the interviews that they shared similar views regarding their knowledge of Hinduism and that they experienced a substantial absence of tension between their religion and the topic of evolution. Thus, there was saturation of data from the coding and this was used to establish certain patterns and common themes. These patterns and themes were then

summarised into various tables of data in chapter 4. Saldana (2009) refers to data saturation as “no new information” that “seems to emerge during coding.”

One of the reasons for the limited number of interviews conducted is that there are not many Hindu Life Sciences teachers around the geographical area of the study and that some of the teachers that did meet the criteria were either unwilling to participate or had other commitments that did not allow them the time to be interviewed. In addition it must be mentioned that as a Deputy Principal at a large high school, this study had to be conducted part-time so it was difficult to juggle work with the short time in which my data collection had to be completed. Therefore it was not possible to prolong this period by giving the teachers more extended opportunities to participate.

It was also not feasible to travel long distances to procure interviews with teachers who did meet the criteria because of limited funding that was insufficient to cover such travel costs. When this study began, one of the intentions was to obtain more interviews with Hindu people in Durban, Kwazulu-Natal because this is regarded as one of the biggest hubs of Hindu culture outside India. However this did not materialise because of the prohibitive travel costs and the lack of time to accomplish this.

However despite this shortcoming, data saturation was obtained from the interviews that were conducted, implying that perhaps the limited number of interviews was not such a hindrance after all.

5.5.2. Ignorance of some of the respondents

Most of the interviewees had a limited knowledge of Hinduism and therefore depth of discussions was not always possible with some of them. Their ignorance may be seen as a limitation in my study. Perhaps in future this situation could be avoided by having a pre-interview in order to ascertain the level of knowledge of the participants. In my study however, I did not want to portray an image of brow-beating the candidates since they had readily agreed to sacrifice their time to take part in the study and I appreciated that it would not have been easy to find replacements at short notice and for the reasons mentioned in **5.5.1** already.

To counter this shortfall however, interviews conducted with both people ignorant and knowledgeable of the details of Hinduism revealed similar results: an acceptance of

evolutionary theory without conflicting with their religion. Focus group 3 displayed the greatest amount of ignorance and they seemed to be unsure of whether there was any conflict between their religion and the theory of evolution. However, this conflict was not so debilitating that they were against learning about the theory of evolution at school.

5.5.3. Improved selection of participants

Following on from the previous point about screening the participants, another limitation could be that the learners in each focus group were well-known to each other. This may have influenced their responses since they could have been trying to impress each other. Vaughn *et al* (1996:64) suggest that using strangers in focus group interviews will yield more truthful responses since they know they may never see each other again and therefore have nothing to hide and have fewer inhibitions.

5.5.4. Methodological limitations

Since my study looked at the lived experiences of Hindu people, it had elements of phenomenology. The data gathering process therefore relied strictly on interviews of purposively chosen respondents. I feel that perhaps it was too limiting and narrowly focussed to use only one source of data collection.

If there was more time and resources available then other methods could have been used such as observation of a few lessons on evolution by Hindu teachers interviewed. Written tests could have been administered to the learners to determine the level of their knowledge on evolution and their test scores could then be used as a comparison against their responses in the interviews. Triangulation of results would have then been more reliable and valid if multiple sources were used rather than just interviews. The questionnaires filled out by the teachers allow some triangulation but these are not ideal since there was such a small sample size.

Ideally, I would have preferred having had the interviews transcribed and then going back to the respondents to verify their comments or to give them an opportunity to make additions to what they had initially said. However, as already mentioned, time was limited and this could not be done.

5.6. FUTURE RESEARCH

Now that evolutionary theory is a part of the Life Sciences curriculum in South African schools, it can open the way for many different types of research using aspects touched on in my study. There could perhaps be a more in depth study conducted on how the topic is dealt with by Hindus in other parts of the country. A broader range of participants could also be used in Gauteng province to verify the reliability of the results in my study.

More studies can also be conducted on the teaching of evolutionary theory in high schools around the country since it is evident that many teachers lack this necessary pedagogy. Coupled with this should be the aspects of the NOS that all teachers should be thoroughly aware of. Research should be done on how teachers can incorporate the tenets of the NOS into their lessons thereby making science more relevant and real to learners. Studies can also be conducted on improving and enhancing teaching methodology for the topic of evolution such as the use of narratives, interactive lessons, cartoons, etc. Greater involvement from university academics in ensuring the public is aware of the role of evolution in science can also be explored in future research.

The learning of evolutionary theory also provides opportunities for future research. Many learners have grave misconceptions often relating to their worldview or poor understanding of evolutionary concepts, such as that of common ancestry. These issues should be investigated further in South Africa in order to improve the understanding of this important topic. Investigating the link between science and religion can also be grounds for further study – this may allow learners to be able to keep their worldview while at the same time having a better understanding of scientific concepts.

These are just some of the avenues that could be explored in future studies.

5.7. CONCLUSION TO STUDY

This study on the lived experiences of Hindu Life Sciences learners and teachers to the topic of evolution started off with an observation that research in this particular

field has been lacking, i.e. how Hindu people view the topic of evolution in relation to their religion and worldview. This prompted the formulation of the following research questions around this area of investigation which served to direct this study:

- 1) What are the lived experiences of South African Hindu teachers on the teaching of evolution in Life Science?
- 2) What are the lived experiences of South African Hindu learners on the learning of evolution in Life Science?
- 3) How do Hindu people view the process of evolution?

The primary gap that my study addressed was that there was no formal study on the Hindu perspective of evolutionary theory. A thorough literature review on the various aspects surrounding this topic revealed that there was also very little information on the teaching and learning of evolution in South African secondary schools especially since this topic was only recently introduced (since 2008) in this country. In addressing this gap, my study therefore also contributed information towards secondary school teaching and learning of the topic of evolution.

My findings indicate that essentially Hindu people do not experience conflict between their religion and the topic of evolution and the different role-players in the CHAT model are in harmony with one another. Hindus are open to assimilating the concepts of evolutionary theory into their existing worldviews as a result of three main tenets of Hinduism that allow them to do so – i.e. the cyclical nature of time as described in Hindu scriptures; the notion of avataric evolutionism and the law of Karma incorporating the idea of reincarnation. Unfortunately, another of my findings show that many of the Hindus interviewed are ignorant of the details of these tenets but were nevertheless able to accept the theory of evolution more readily than people of the Abrahamic faiths as shown in previous studies.

In terms of teaching the topic of evolution, my study indicated that the Hindu teachers interviewed had sufficient PCK to enable them to teach with reasonable confidence however, their knowledge of the NOS and the inquiry method of science teaching needed substantial attention. This then implies that their scientific literacy is also questionable.

5.8. MY REFLECTIONS ON DOING THIS STUDY

Embarking on this study has had a positive impact on my personal growth as a teacher, researcher and as a Hindu. Firstly, it revealed the results of my research questions which dealt primarily with the lived experiences of Hindu Life Sciences teachers and learners to the topic of evolution. These findings are listed in section 5.2. On a second level, this study has expanded my knowledge about the topic of evolution as well as on each of the other aspects covered in my literature review.

Although I had previously delved into the theory of constructivism and its proponents Piaget and Vygotsky, its off-shoot of the activity theory together with the proponents Leontev and Engeström were new to me. Since my study was dependent on the use of CHAT as a lens through which the research had to be conducted and analysed, I had to research this activity theory extensively. At first I could not grasp this theory at all. It was only through my persistent reading that I eventually managed to understand what it was about. I owe this flash of inspiration to the readings by Hardman (2005 a and b, 2007 and 2008) which explained the workings of CHAT in a very clear, easy to understand manner. Thereafter I was in a more informed position to read and make sense of CHAT in papers by Engeström, Stetsenko, Beatty and Roth. Once understanding of this theory dawned on me, it was fairly easy to then view my study in light of CHAT as the overarching framework.

The extensive readings I conducted on aspects such as PCK of teachers, NOS and CCC or worldviews have served to increase my knowledge and more significantly to enhance my Life Sciences teaching skills. Since I am in a senior school management position these fields of knowledge will also enable me to guide and assist other teachers to improve their own teaching styles in order to accommodate different worldviews of learners. More attention can then be given to the concept of warm as opposed to cold conceptual change (De Beer and Henning, 2010). The seven tenets of the NOS are certainly going to inform my teaching and I intend to share this information with other science teachers as well.

My initial encounter with the theory of evolution was as a first-year BSc student almost twenty three years ago when parts of it was taught to us in separate pockets with no indication that it was the central part of biological science. The theory of evolution has nevertheless always been of great interest to me and when I first taught

it in 2008, it was a thoroughly enjoyable journey into new territory that I shared with my grade 12 learners. Completing this study has shown me new insights into evolutionary theory and how it can be taught in ways that would increase learners' understanding and kindle their interest in the topic.

As a Hindu I was able to add to my existing knowledge of my religion by reading more extensively on the fundamentals of Hinduism. Pursuing this study has allowed me to delve into great detail concerning various aspects of Hinduism in order to inform people who knew nothing about this religion. The aspects from Hinduism relevant to evolutionary theory described in this report have been familiar to me since childhood although perhaps not to this level of detail. I was also not able to relate them to the theory of evolution until this study forced me to do so. This study showed me that there are in fact substantive reasons why Hindu people are more accepting of the theory of evolution than people of the Abrahamic faiths.

I was given the opportunity to present part of my study at the NAPTOSA conference in March 2012 to a small group of Life Sciences teachers. This enabled me to inform a broader community of teachers about the alternative worldview that exists in South African schools – i.e. the Hindu perspective to evolution. See *Appendix K* for a copy of this presentation.

The methodology of this study has developed more confidence in me as a teacher and as a school manager by having to approach school principals, parents and fellow teachers to obtain their permission for the interviews. The interview process was new to me and showed me a different side to how I am able to interact with people and has enhanced my interpersonal skills. By carrying out the various steps in the interview, transcription and analysis process, it has reinforced the scientific method and the NOS for me as a teacher because I had to practise many of the tenets during this process.

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GAUTENG DEPARTMENT OF EDUCATION



RESEARCH REQUEST FORM

REQUEST TO CONDUCT RESEARCH IN INSTITUTIONS AND/OR OFFICES OF THE GAUTENG DEPARTMENT OF EDUCATION

1. PARTICULARS OF THE RESEARCHER

1.1	Details of the Researcher	
<i>Surname and Initials:</i>	Reddy, C	
<i>First Name/s:</i>	Camantha	
<i>Title (Prof / Dr / Mr / Mrs / Ms):</i>	Mrs	
<i>Student Number (if relevant):</i>	200840568	
<i>ID Number:</i>	710625 0170 089	
<i>Gender (Male/Female):</i>	Female	

1.2	Private Contact Details	
<i>Home Address</i>	<i>Postal Address (if different)</i>	
9 East Street	PO Box 6493	
Halfway Gardens	Halfway House	

Midrand	Midrand
Postal Code: 1685	Postal Code: 1685
Tel: (011) 805 5051	
Cell: 082 767 1939	
Fax: (011) 805 2476 (W)	
E-mail: camantha.reddy@gmail.com	

2. URPOSE & DETAILS OF THE PROPOSED RESEARCH

2.1	Purpose of the Research (Place cross where appropriate)	
	<i>Undergraduate Study - Self</i>	
	<i>Postgraduate Study - Self</i>	X
	<i>Post-Doctoral Study</i>	
	<i>Private Company/Agency – Commissioned by Provincial and/or National Government Department/s</i>	
	<i>Private Research by Independent Researcher</i>	
	<i>Non-Governmental Organisation</i>	
	<i>National Department of Education Commissioned Study</i>	
	<i>Commissions and Committees</i>	
	<i>Independent Research Agency</i>	
	<i>Statutory Research Agency</i>	
	<i>Independent Study by Higher Education Institution</i>	

2.2	If Post-Graduate Study – Please indicate by placing a “X” in the appropriate column		
	Honours	Masters	Doctorate
		X	

2.3	Full title of Thesis / Dissertation / Research Project
The teaching and learning of Evolution from a Hindu perspective.	
The lived experiences of Hindu Grade 12 Life Science learners and educators in learning and teaching the topic of Evolution.	

2.4	Value of the Research to Education (Attach Research Proposal)
(See attached proposal)	

2.5	Student and Postgraduate Enrolment Particulars (if applicable)	
	Name of institution where enrolled:	University of Johannesburg
	Degree / Qualification:	Masters in Education (Science Education)
	Faculty:	Humanities
	Department:	Mathematics, Science, Technology and Computer Education
	Name of Supervisor / Promoter:	1. Dr. Josef De Beer 2. Dr Umesh Ramnarain

2.6	Employer (where applicable)	
	Name of Organisation/School:	Midrand High School
	Position in Organisation:	Deputy Principal (Academics)
	Head of Organisation:	Mrs A Van Zyl (Principal)

Street Address:	Corner of 1 st and 3 rd Street
	Halfway Gardens, Midrand
Postal Code:	1685
Telephone Number (Code + Ext):	011 – 3150676 ext. 114
Fax Number:	011 – 8052476
E-mail:	camanthar@midhigh.co.za

2.7	PERSONAL Number (where applicable)
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6	0	3	2	0	6	1	3
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3. PROPOSED RESEARCH METHOD/S



(Please indicate by placing a cross in the appropriate block whether the following modes would be adopted)

3.1 Questionnaire/s (If Yes, supply copies of each to be used)

YES		NO	
-----	--	----	--

3.2 Interview/s (If Yes, provide copies of each schedule)

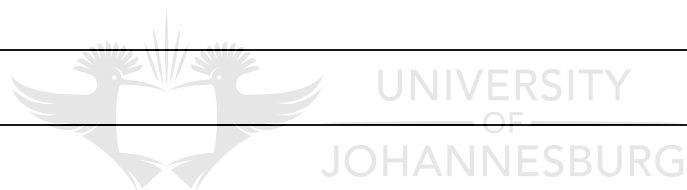
YES	X	NO	
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3.3 Use of official documents

YES	X	NO	
<i>If Yes, please specify the document/s:</i>			
1. National Curriculum Policy documents 2. Subject Assessment Guidelines – Life Science 3. Others			

3.4 Workshop/s / Group Discussions. (If Yes, Supply details)

YES	X	NO	
One of the methods for data collection, interviewing, will involve focus-group interviews as well as individual interviews. Participants in the group interview will be Grade 12 Life Science learners and educators.			



3.5 Standardised Tests (e.g. Psychometric Tests)

YES		NO	X
<i>If Yes, please specify the test/s to be used and provide a copy/ies</i>			

4. RESEARCH PROCESSES

4.1 *Types of Institutions.* (Please indicate by placing a cross alongside all types of institutions to be researched).

INSTITUTIONS	Mark with "X" here
<i>Primary Schools</i>	
<i>Secondary Schools</i>	X
<i>Technical Schools</i>	
<i>ABET Centres</i>	
<i>ECD Sites</i>	
<i>LSEN Schools</i>	
<i>Further Education & Training Institutions</i>	
<i>Other</i>	

4.2 *Number of institution/s involved in the study.* (Kindly place a sum and the total in the spaces provided).

Type of Institution	Total
<i>Primary Schools</i>	
<i>Secondary Schools</i>	4
<i>Technical Schools</i>	
<i>ABET Centres</i>	
<i>ECD Sites</i>	
<i>LSEN Schools</i>	
<i>Further Education & Training Institutions</i>	
<i>Other</i>	
GRAND TOTAL	4

- 4.3 *Name/s of institutions to be researched. (Please complete on a separate sheet and append if space is deemed insufficient).*

Name/s of Institution/s
<i>Have not selected the four schools yet. However, the following may be used:</i>

- 4.4 *District/s where the study is to be conducted. (Please mark with an "X"). (Will be confirmed once the schools are selected)*

District	
<i>Johannesburg East</i>	X
<i>Johannesburg South</i>	
<i>Johannesburg West</i>	
<i>Johannesburg North</i>	
<i>Gauteng North</i>	
<i>Gauteng West</i>	
<i>Tshwane North</i>	
<i>Tshwane South</i>	X

District	
<i>Ekurhuleni East</i>	
<i>Ekurhuleni West</i>	
<i>Sedibeng East</i>	
<i>Sedibeng West</i>	

If Head Office/s (Please indicate Directorate/s)



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NOTE:

If you have not as yet identified your sample/s, a list of the names and addresses of all the institutions and districts under the jurisdiction of the GDE is available from the department at a small fee.

4.5 *Number of learners to be involved per school. (Please indicate the number by gender). Approximate numbers given – subject to change*

Grade	1		2		3		4		5		6	
Gender	B	G	B	G	B	G	B	G	B	G	B	G
Number												

Grade	7		8		9		10		11		12	
Gender	B	G	B	G	B	G	B	G	B	G	B	G
Number											8	8

4.6 *Number of educators/officials involved in the study. (Please indicate the number in the relevant column).*

<i>Type of staff</i>	Educators	HODs	Deputy Principals	Principal	Lecturers	Office Based Officials
<i>Number</i>	4					

4.7 *Are the participants to be involved in groups or individually? Please mark with an “X”.*

Participation	
<i>Groups</i>	X
<i>Individually</i>	X

4.8 *Average period of time each participant will be involved in the test or any other research activity (Please indicate time in minutes)*

Participant/s	Activity	Time
Learners	Focus group interviews	30 minutes
Educators	Individual Interviews	30 minutes

4.9 *Time of day that you propose to conduct your research. Please mark with an “X”.*

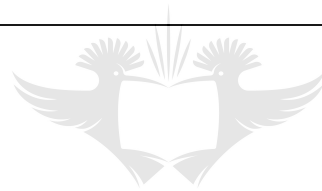
School Hours	During Break	After School Hours
X		X

4.10 *School term/s during which the research would be undertaken. Please mark with an “X”.*

First Term	Second Term	Third Term

X	X	
---	---	--

DECLARATION BY THE RESEARCHER	
<p>1. I declare that all statements made by myself in this application are true and accurate.</p> <p>2. I have read and fully understand all the conditions associated with the granting of approval to conduct research within the GDE, as outlined in the GDE Research Briefing Document, and undertake to abide by them.</p> <p>3. Should I fail to adhere to any of the approval conditions set out by the GDE, I would be in breach of the agreement reached with the organisation, and all privileges associated with the granting of approval to conduct research, would fall away.</p>	
Signature:	Mrs C Reddy
Date:	28 February 2011



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DECLARATION BY SUPERVISOR / PROMOTER / LECTURER

I declare that: -

- 1. The applicant is enrolled at the institution / employed by the organisation to which the undersigned is attached.**
- 2. The overall research processes meet the criteria of:**
 - **Educational Accountability**
 - **Proper Research Design**
 - **Sensitivity towards Participants**
 - **Correct Content and Terminology**
 - **Acceptable Grammar**
 - **Absence of Non-essential / Superfluous items**

Surname:	De Beer
First Name/s:	Josef
Institution / Organisation:	University of Johannesburg
Faculty:	Humanities
Department:	Education
Telephone:	011 – 559 2765
Fax:	011 – 559 2048
Cell:	082 923 2865
E-mail:	josefdb@uj.ac.za
Signature:	
Date:	

N.B. This form (and all other relevant documentation where available) may be completed and forwarded electronically to Ebrahim Farista (ebrahimf@gpg.gov.za) or Nomvula Ubisi (nomvulau@gpg.gov.za). The last 2 pages of this document must however contain the original signatures of both the researcher and his/her supervisor or promoter. These pages may therefore be faxed or hand delivered. Please mark fax - For Attention: Ebrahim Farista at 011 355 0512 (fax) or hand deliver (in closed envelope) to Ebrahim Farista (Room 911) or Nomvula Ubisi (Room 910), 111 Commissioner Street, Johannesburg.



Ethics Clearance Application – Faculty of Education

I, Camantha Reddy, hereby confirm that:

1. The information provided in this ethics clearance application to undertake research with human participants is accurate to the best of my knowledge;
2. I understand the principles of conducting ethical research;
3. I will endeavor to conduct all the research in an ethical manner as prescribed by Faculty and University rules; and
4. I will inform the Faculty Academic Ethics Committee of any substantive changes to the project that might impact on the ethical clearance of the project.

Signature



UNIVERSITY OF JOHANNESBURG

If this is a student project, then:

- This project and associated ethics application has been approved by the Department for submission to the relevant Committees of the Faculty of Education

Signature - Supervisor

If this research project will be undertaken under the auspices of UJICE, then:

- This project and associated ethics application has been approved by the UJICE Management for submission to the relevant Committees of the Faculty of Education

Signature - UJICE Management



Research Design

Please supply the relevant information.

1. Data Collection Types

- Qualitative
- Quantitative
- Mixed Methods

2. Research Methodologies/Approaches

- Biographical
- Phenomenological
- Grounded Theory
- Ethnographical
- Case Study
- Design Experiment
- Action Research
- Survey
- Other (please provide details)

3. Research Instruments/Methods

- Document analyses
- Questionnaires
- Surveys
- Individual interviews
- Group interviews
- Observations
- Other (please provide details)



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4. Sampling

- Random
- Targeted
- Purposeful
- Snow balling
- Other (please provide details)

5. Sample size

- < 11
- 11- 50
- > 50
- Other (please provide details)

6. Age of participants

- < 14
- 14- 17
- > 17

Please provide the name and designation of an adult who will protect the rights of the child who has neither parents nor a guardian, or who is younger than 14 years of age.



Faculty of Education - Research Project Information MASTER OF SCIENCE EDUCATION

Background to the study

Since 2008 when the topic of Evolution has been introduced into the Life Science syllabus, it has been met with discussion and controversy. Much of this controversy has been based on the influence of religious views of creationism from a Christian/ Islamic perspective. Very little work has been done to measure the teaching and learning of evolution from a Hindu standpoint. My study is therefore an attempt to find out how Hindus regard the teaching and learning of evolution.

Intention of the project

Research associated with this project attempts to:

Find out how Hindu learners and teachers regard the topic of evolution i.e. does it also clash with what Hinduism teaches about life forms on earth? Or is there no conflict? These questions presently have no certain answer especially in a South African context. My study will therefore try to address these questions.

Procedures involved in the research

My research deals with how Hindu learners and teachers experience the topic of evolution. I will therefore use the technique of conducting focus group interviews with learners at school. This entails a group discussion with the learners where I will ask a few questions in order to stimulate the discussion process. Accurate recordings of the discussion will be made via audio recording equipment. There will be no videography taking place, thus further protecting the identity of the learners.

Potential Risks

The names of the learners will not be revealed in my research write-up so their identity will be protected. There will be no physical or emotional risks that the learners will be exposed to.

Potential Benefits

The study intends to highlight that the vast religion of Hinduism also has a view with regards to the topic of Evolution. This will lead to improving the teaching and learning of Evolution in Life Science, since at the moment, most of the conflict is discussed from a Christian/ Islamic perspective. We live in a diverse society both in South Africa and globally - it is therefore necessary that the religion of Hinduism with a vast following worldwide, has its viewpoints heard together with the voices of other major religions.

Confidentiality

Every effort will be made to protect (guarantee) your confidentiality and privacy. I will not use your name or any information that would allow you to be identified. However, we are often identifiable through the stories we tell. Furthermore, if information you have provided is requested by legal authorities then I may be required to reveal it. In addition, all data collected will be anonymous and only the researchers will have access to the collected data that will be securely stored for no longer than 2 years after publication of research reports, or papers. Thereafter, all collected data will be destroyed.

Participation and Withdrawal

Your participation in this study is voluntary. You may withdraw your consent to participate in the project at any time during the project. If you decide to withdraw, there will be no consequences to you. Your decision whether or not to be part of the study will not affect your continuing access to any services that might be part of this study.

Futures interest and Feedback

You may contact me (see below) at any time for additional information, or if you have questions related to the findings of the study.



Informed Consent/Assent Form

Project Title:

The lived experiences of Hindu Life Science teachers and learners in the teaching and learning of Evolution

Investigator:

Camantha Reddy

Date:

22 May 2013

I hereby:

- Agree to be involved in the above research project as a participant.
- Agree to be involved in the above research project as an observer to protect the rights of:
 - Children younger than 14 years of age;
 - Children younger than 18 years of age that might be vulnerable*; and/or
 - Children younger than 18 years of age that are part of a child-headed family.
- Agree that my child, _____ may participate in the above research project.
- Agree that my staff may be involved in the above research project as participants.

I have read the research information sheet pertaining to this research project and understand the nature of the research and my role in it. In addition, I have had the opportunity to ask questions about my involvement in this study and to receive additional details I requested. I understand that I may withdraw from the study at any time.

- Please allow me to review the report prior to publication.

Name:

Phone or Cell number:

e-mail address:

Signature:

If applicable:

- I consent/assent to audio recording of my/the participant's contributions.
- I consent/assent to video recording of my/the participant's contributions.

Signature:

* Vulnerable children refer to individuals at risk of/exposed to harm (physical, mental, emotional and/or spiritual).



FACULTY OF EDUCATION

Direct Line: +27 11 559 2765
Telefax: 011 559-2048
E-mail: josefdb@uj.ac.za

Enquiries 011 559 2765 (Dr J de Beer)
Date: 16 May 2011

The Principal – _____
 _____ School

Dear _____,

RE: Request to conduct research at _____ School

I am currently studying towards a Masters degree in Science Education through the University of Johannesburg. My study intends to investigate the ways in which Hindus regard the teaching and learning of the topic of Evolution in Life Science at school. Further details of my study can be found in the attached pages.

In order to proceed with this study it is necessary for me to conduct focus group interviews with the small group of Grade 12 Life Science Hindu learners at your school. I therefore humbly request your permission to carry out these interviews with the selected learners at _____ School.

The interviews are scheduled for after school hours so that there will be no disruption to their academic time. The interviews should last for about 60 minutes. A similar permission letter will also be sent out to parents of these learners to obtain their consent. This letter will also indicate the expected time of completion to enable parents to make transport arrangements.

Further details of my study and the methodology involved are outlined in the attached official document from the university.

I trust that this request will be met with your favourable consideration.

Thank you.

Yours faithfully,

 Mrs Camantha Reddy
 Deputy Principal (Academics), Midrand High School
 Student number: 200840568
 Cell Number: 082 767 1939



FACULTY OF EDUCATION

Direct Line: +27 11 559 2765
Telefax: 011 559-2048
E-mail: josefdb@uj.ac.za

Enquiries 011 559 2765 (Dr J de Beer)

Date: 11 May 2011

Dear Parent,

I am currently studying towards a Masters degree in Science Education through the University of Johannesburg. My study intends to investigate the ways in which Hindus regard the teaching and learning of the topic of Evolution in Life Science at school. Further details of my study can be found in the attached pages.

In order to proceed with this study it is necessary for me to conduct individual interviews with Hindu parents whose child is a Life Science learner. Your time and input is therefore required for this purpose. The interviews should last for approximately one hour and will be audio recorded for accuracy of data transcription.

I assure you that the information discussed at the interview will remain confidential and no real names will be used in the write-up of the research reports. All data collected, including audio recordings will be kept safely and will be destroyed two years after publication of the reports.

The results of this study will be communicated to you once it has been complete.

Kindly complete the permission form that is attached to this letter and return it to me.

Thank you for your cooperation, it is highly appreciated.

Kind regards,

Mrs C Reddy
 Deputy Principal (Academics), Midrand High School
 Telephone: 011 – 3150676 (OH)
 UJ Student number: 200840568
 Cell Number: 082 767 1939



FACULTY OF EDUCATION

Direct Line: +27 11 559 2765
Telefax: 011 559-2048

Enquiries 011 559 2765 (Dr J De Beer)

Date: 16 May 2011

Dear Parent,

I am currently studying towards a Masters degree in Science Education through the University of Johannesburg. My study intends to investigate the ways in which Hindus regard the teaching and learning of the topic of Evolution in Life Science at school. Further details of my study can be found in the attached pages.

In order to proceed with this study it is necessary for me to conduct focus group interviews with small groups of Hindu learners. I therefore require your grade 12 child to participate in these interviews and I humbly request your permission to allow your child to take part. The school principal, _____, has been notified about this interview as well.

The interview is scheduled for Wednesday, 25 May 2011 after school in order to prevent disruption of any academic time. The interview will take place at school and will last for approximately 60 minutes, from 14:10 to 15:10. The interview will be audio recorded for accuracy of data transcription.

I assure you that the information discussed at the interview will remain confidential and no real names of children will be used in the write-up of the research reports. All data collected, including audio recordings will be kept safely and will be destroyed two years after publication of the reports.

The results of this study will be communicated to all participants once it has been complete.

Kindly complete the permission form that is attached to this letter and return it with your child.

Thank you for your cooperation, it is highly appreciated.

Kind regards,

Mrs C Reddy (UJ Student number: 200840568)
Deputy Principal (Academics), Midrand High School
Telephone: 011 – 3150676 (OH)



UNIVERSITY
OF
JOHANNESBURG

FACULTY OF EDUCATION

Direct Line: +27 11 559 2765
Telefax: 011 559-2048
E-mail: josefdb@uj.ac.za

Enquiries 011 559 2765 (Dr J de Beer)
Date: 6 May 2011

Dear Colleague,

I am currently studying towards a Masters degree in Science Education through the University of Johannesburg. My study intends to investigate the ways in which Hindus regard the teaching and learning of the topic of Evolution in Life Science at school. Further details of my study can be found in the attached pages.

In order to proceed with this study it is necessary for me to conduct individual interviews with Hindu Life Science teachers where your time and input is necessary. The interview should last approximately one hour and will be audio recorded for accuracy of data transcription.

I assure you that the information discussed at the interview will remain confidential and no real names will be used in the write-up of the research reports. All data collected, including audio recordings will be kept safely and will be destroyed two years after publication of the reports.

The results of this study will be communicated to you once it has been complete.

Kindly complete the permission form that is attached to this letter and return it to me.

Thank you for your cooperation, it is highly appreciated.

Kind regards,

Mrs C Reddy (UJ Student number: 200840568)
 Deputy Principal (Academics), Midrand High School
 Telephone: 011 – 3150676 (OH)
 Cell: 082 767 1939



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Date: 11 May 2011

Dear Colleague,

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In order to proceed with this study it is necessary for me to conduct individual interviews with groups of Hindu Life Science learners where your time and input is necessary. The interviews should last for approximately one hour and will be audio recorded for accuracy of data transcription.

I assure you that the information discussed at the interview will remain confidential and no real names will be used in the write-up of the research reports. All data collected, including audio recordings will be kept safely and will be destroyed two years after publication of the reports.

The results of this study will be communicated to you once it has been complete.

Kindly complete the permission form that is attached to this letter and return it to me.

Thank you for your cooperation, it is highly appreciated.

Kind regards,

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Deputy Principal (Academics), Midrand High School
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Direct Line: +27 11 559 2765
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E-mail: josefdb@uj.ac.za

Enquiries 011 559 2765 (Dr J de Beer)
Date: 11 May 2011

Dear Guruji,

I am currently studying towards a Masters degree in Science Education through the University of Johannesburg. My study intends to investigate the ways in which Hindus regard the teaching and learning of the topic of Evolution in Life Science at school. Further details of my study can be found in the attached pages.

In order to proceed with this study it is necessary for me to conduct individual interviews with Hindu priests. Your time and input is therefore required for this purpose. The interviews should last for approximately one hour and will be audio recorded for accuracy of data transcription.

I assure you that the information discussed at the interview will remain confidential and no real names will be used in the write-up of the research reports. All data collected, including audio recordings will be kept safely and will be destroyed two years after publication of the reports.

The results of this study will be communicated to you once it has been complete.

Kindly complete the permission form that is attached to this letter and return it to me.

Thank you for your cooperation, it is highly appreciated.

Kind regards,

Mrs C Reddy
 Deputy Principal (Academics), Midrand High School
 Telephone: 011 – 3150676 (OH)
 UJ Student number: 200840568
 Cell Number: 082 767 1939

TEACHER QUESTIONNAIRE:

Dear Colleague,

Thank you for agreeing to be a part of this study on the lived experiences of Hindu teachers teaching evolution. Please take a few minutes to complete this short questionnaire.

1. For how long have you taught Life Sciences?

2. 1. Have you encountered the topic of evolution in your studies to become a teacher?

YES NO

2.

2. If YES, when and how was it taught to you?

2.3. If NO, how did you prepare yourself to teach it to Life science learners?

3. How would you rate your knowledge on the topic of evolution?

- | | |
|---|---|
| A. Excellent, I am very confident. I can answer most questions that learners ask in class. | A |
| B. Very good, I understand most of the concepts and can answer some questions that learners ask. | B |
| C. Good, I am able to understand some concepts but need more understanding as I teach. | C |
| D. Satisfactory, I know the basics of Evolution and Natural Selection but need to research more before I teach each lesson. | D |
| E. Poor, I have no knowledge on Evolution and feel intimidated by this. | E |

4. How would you rate your pedagogical content knowledge (PCK) especially with regards to teaching evolution?

- A. Excellent – I build on my knowledge and use this to enhance my lessons A
- B. Very good – my confidence in teaching the topic is growing each time I teach it. B
- C. Good – I am fairly confident but still unsure about how to address certain issues regarding evolution. C
- D. Satisfactory – I teach strictly according to the text books and cannot answer questions from learners. D
- E. Poor – I do not have the knowledge to teach evolution . E

5. Can you describe the Nature of Science (NOS)?

YES NO

6. Do you use the NOS when teaching any topic in Life Sciences?

YES NO

7. Do you use the NOS when teaching Evolution?

YES NO

8. Write down briefly why you think it is beneficial to teach the NOS for the topic of Evolution.

THANK YOU ONCE AGAIN FOR YOUR TIME AND EFFORT IN COMPLETING THIS QUESTIONNAIRE AND FOR BEING A PART OF THIS STUDY. YOUR INPUT IS HIGHLY APPRECIATED!!!

MODERATOR’S GUIDE TO FOCUS GROUP INTERVIEWS WITH GRADE 12 HINDU LIFE SCIENCE LEARNERS:

*Compiled using the following sources: Courtesy of the Bill and Melinda Gates Foundation
<http://www.smallschoolsproject.org/PDFS/focusgroups.PDF> retrieved 11/04/11 at 21:30;
 Kreuger(2002)*

MODERATOR
 INTRODUCTION,
 THANK YOU AND
 PURPOSE (1 minute)

Hello, my name is Mrs Reddy. I’d like to start off by thanking each of you for taking the time to participate in this focus group interview. We should be here for the next hour or so.

The reason we are here today is to get your opinions, experiences and attitudes about how you as Hindus regard the topic of Evolution. You were each invited, therefore, because you are Hindu, in grade 12 and taking Life sciences this year.

I am going to lead the discussion today. I am not here to convince you of anything or try to sway your opinion. My purpose is just to ask questions and then encourage and moderate the discussion. So, just for this interview, try to forget that I am a teacher at this school!

GROUND RULES (3 minutes)

To allow our conversation to flow more freely, I’d like to go over a few ground rules:

1. Please talk one at a time and avoid side conversations. If you do need to make a comment, kindly raise your hand so that you can be given a chance to speak.
2. This interview session will be audio-recorded because I don’t want to miss any of your comments. People often make very useful comments in these discussions and I cannot write fast enough to get them all down on paper.
3. I will however be making some notes as the discussion continues. Please don’t feel intimidated when you see me writing – I am not assessing you in any way, I am merely trying to get clarity on what you are saying.
4. Everyone does not have to answer every single question, but I’d like to

hear from each of you today as the discussion progresses.

5. This will be an open discussion ... feel free to comment on each other's remarks.

6. There are no "wrong answers," just different opinions. Say what is true for you even if you're the only one who feels that way. Don't let the group influence you. But, if you do change your mind, then please let me know. Remember that I am interested in everything that you have to say about the topic under discussion.

7. Let me know also, if you need a break while the discussion is proceeding.

INTRODUCTION OF PARTICIPANTS (2 minutes)

Before we start talking about your perceptions of Evolution as Hindus, I'd like to formally meet each of you. Please tell me your name. You may be assured of complete confidentiality as your real names will not be used in my write-up.

GENERAL QUESTIONS (20 minutes)

OK. Thank you for that. Let us begin:

1. Do you consider yourself a practising Hindu?
2. If yes, what are some of the activities you engage in to observe your religion?
3. If no, why don't you consider yourself a practising Hindu?
4. As a Life Sciences learner, you have learned about Evolution since grade 10. Do you have any difficulty accepting what you have learnt in the classroom as a result of what Hinduism teaches you?
5. According to your knowledge of Hindu scripture, what is written about the origin of **life** on Earth?
6. According to your knowledge of Hindu scripture, what is written about the origin of **humans** on Earth?
7. According to your religion, what is the approximate age of the Earth?
8. Where do you think pre-historic life forms fit into Hinduism, if it fits at all?
9. How do you view the process of Evolution in the Hindu faith? i.e is there a belief in Hinduism that is similar to the process of Evolution?
10. Do you think learning about Evolution in school is going against your religious

beliefs? Why/ Why not?

SPECIFIC QUESTIONS
(20 minutes)

1. You have learned about evolution since Grade 10. How would you regard this topic compared to any other topic you have studied in Life Sciences? E.g. the heart; ecosystems; etc...
2. Are these differences due to factual knowledge or due to a belief system that you hold? This belief system can be anything you have been brought up to believe – by your family, community, religious leader and even your own beliefs that you have developed.
3. After studying evolution since grade 10, do you think it was a good idea to include this topic in secondary school Life Science? Please elaborate.
4. Do you understand what is meant by the scientific method/ nature of science (NOS)? Can you provide a brief idea of what this method entails?
5. Do you agree that the concept should be referred to as a THEORY of evolution? What do you understand by this term THEORY, in terms of science?
6. If you were not taught the NOS as part of this topic, what do you think your perception of evolution would be? i.e. would you be more/less accepting? Please explain further.
7. Is the topic of evolution, or any aspect of it, disturbing you personally in any way? Please explain what you mean.
8. As a Hindu, do you find learning about evolution to be in conflict with your religion? Explain your answer.
9. Do you think it is more important to ACCEPT evolution or to UNDERSTAND it? Would Hinduism allow you to both accept and understand evolution? Please elaborate.

CLOSING (2 minutes)

We have reached the end of this focus group session. Once again, I thank you for agreeing to give up your time to participate in this study. Your comments have given me many different ways to see this issue. You will each receive feedback of the study once it is complete. Thank you for your time.

QUESTIONS FOR TEACHER INTERVIEWS:

Dear Colleague,

Thank you for agreeing to take part in my study. I am looking at how Hindu Life Science teachers regard teaching the topic of Evolution to Life Science learners. Since you are a Hindu and you teach Life Science, you have been chosen to take part in this study. I am going to ask you a few questions and I would like you to be as honest and open as possible when you answer. I am interested in everything that you have to say so this interview will be audio recorded so that I don't miss anything that you have to say. Let us begin:

1. How long have you taught Life Sciences for?
2. The topic of Evolution has been introduced into the syllabus since 2008. How did you approach teaching this topic for the first time?
3. Have you encountered the topic of evolution in your studies to be a teacher? If yes, when and how was it taught to you? If no, how did you prepare yourself to teach it Life Science learners?
4. How would you rate: a) your pedagogy and b) your knowledge of the topic of evolution? Use a rating scale of 1 → 5 with 5 being excellent.
5. As a Hindu teacher, is there any aspect in the topic of evolution that you find to be in conflict with your religion?
 - 5.1. If yes, how do you deal with this aspect in the classroom? i.e. do you teach it as pure fact or as speculation?
 - 5.2. If no, can you explain why or how your religion is in harmony with the topic of evolution?
6. Do you regard yourself as a practising Hindu? Please explain.
7. Can you please rate your knowledge of Hindu scriptures with 5 being excellent and 1 being poor? Would you please elaborate on your knowledge?
8. Briefly explain what you understand to be the fundamental issues regarding the theory of Evolution.

9. Is there any aspect of Hinduism that would cause you to disregard Evolution as it is required to be taught? If so, what is this aspect?
10. Comment on the following quote: “Nothing makes sense in biology except in the light of Evolution” (Dobzhansky, 1973).i.e. do you agree and why?
11. How do learners respond when the topic of evolution is taught – as compared to other topics in Life Science e.g. Nervous System, Ecosystem, etc...
12. Can you account for this difference in their response? Do you think this is as a result of their religious beliefs?
13. Should religion be brought in with the teaching of the topic of evolution? i.e. do you think that different religious beliefs should be taught alongside evolution? Why?
14. According to Hinduism, what is the age of the Earth? How does this compare with what you are teaching with regard to the age of the Earth?
15. As a Hindu, what stance do you adopt when dealing with learners of other faiths whose religion conflicts with evolution? i.e. how do you handle learners who come to class with a Creationist world-view? e.g. Muslims or Christians. Do you try to convince them using scientific evidence or your faith?
16. Can you describe the Nature of Science (Scientific Method or Hypothesis Testing)? Do you use the NOS when teaching any topic in Life Sciences, particularly when teaching evolution? Do you think it is beneficial to teach the NOS for a topic like evolution – please explain? Please complete this short questionnaire on the NOS.

That brings us to the end of this interview. Once again, thank you for your time and input and for your valuable comments.

QUESTIONS FOR PARENT INTERVIEWS:

Dear Parent,

Thank you for agreeing to take part in my study. I am looking at how Hindu Life Science teachers and learners regard the topic of Evolution in the Life Science curriculum. Since you are a Hindu and your child takes Life Science, you have been chosen to take part in this study. I am going to ask you a few questions and I would like you to be as honest and open as possible when you answer. I am interested in everything that you have to say so this interview will be audio recorded so that I don't miss anything that you have to say. Let us begin:

1. Does your religion (Hinduism) play a role in your life? i.e. are you a practising Hindu?
 - 1.1.If yes, how strong are your Hindu beliefs? E.g. what are some of the tenets that you live by according to Hinduism?
 - 1.2.If no, why do you consider yourself a Hindu? Is there another kind of spirituality that you believe in instead?
2. Do you have any knowledge of the Hindu scriptures? Please explain.
3. According to Hinduism, how did life on Earth come about?
4. According to Hinduism, how old is the Earth?
5. Are you aware that the topic of evolution is being taught to your child at school? How do you feel about this?
6. Do you have any idea of what the topic of evolution entails at school? Can you elaborate?
7. Do you feel that there is any conflict between what your religion says about man's origin on Earth and what Evolution teaches him/her? Please explain.
8. If you don't know, does it concern you that perhaps your child is learning something that goes against their upbringing? Why/Why not?

That brings us to the end of our interview. Once again, thank you very much for your time and input. Your comments have been very insightful and I appreciate your honesty.

QUESTIONS FOR INTERVIEW WITH HINDU PRIEST:

Dear Guruji,

Thank you for agreeing to take part in my study. I am looking at how Hindu Life Science teachers and learners regard the topic of Evolution in the Life Science curriculum. Since you are a Hindu priest it is assumed that you have a sound knowledge of Hinduism and it is this knowledge that I need to explore for this study. I am going to ask you a few questions and I would like you to be as honest and open as possible when you answer. I am interested in everything that you have to say so this interview will be audio recorded so that I don't miss anything that you have to say. Let us begin:

1. Please can you tell me the names of some of the Hindu scriptures that you have studied? How would you rate your knowledge of these scriptures – on a scale from 1 to 5 with 5 being excellent and 1, poor.
2. Do any of these scriptures describe how life began on Earth, why life began and the origin of man on Earth?
3. Can you provide a brief description of these events, according to the scriptures?
4. What do Hindu scriptures say about the age of the Earth?
5. Have you heard of Charles Darwin and his theory of Evolution by Natural Selection*? Can you see any conflict between this theory and what Hindu scriptures teach? Please explain.
6. How do you feel about this scientific theory being taught at schools – specifically with regard to Hindu children?
7. Do you feel there should be a place in science lessons for religious knowledge?

*If NOT, Guruji, will you allow me to explain briefly?

Charles Darwin formulated this theory over a period of about 20 years through careful observation of living organisms. He decided that the organisms on Earth today evolved from much simpler organisms that lived millions of years ago. This evolution came about through “survival of the fittest” where organisms that were best suited for the changing climate and environment survived and were in turn able to have offspring that had the same

qualities so they could also survive. This process took place over long periods of time and is still taking place on Earth today and it is through this process that we have such a wide variety of life on Earth today.

Guruji, that brings us to the end of this interview. Once again, thank you for taking the time to take part in this interview. Your comments and answers have been most helpful and very interesting.



The Hindu perspective on teaching and learning the topic of evolution in Life Science.



Gamy Reddy

Masters Student

University of Johannesburg

Supervisor: Dr Josef de Beer

APPENDIX K

MOTIVATION FOR STUDY



BACKGROUND RESEARCH

Teaching and learning evolution internationally and in South Africa.

NOS - Nature of Science

PCK - Pedagogical Content Knowledge

CHAT - Cultural Historical Activity Theory

Hinduism

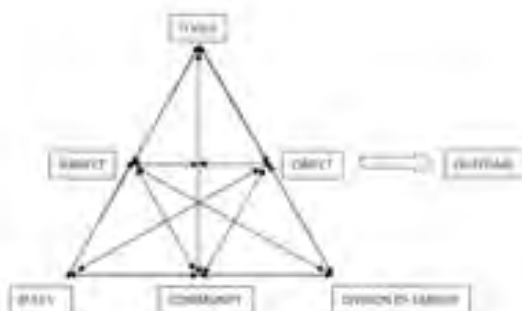
Theory of Evolution

CCC - Controversial Conceptual Change

CHAT

- Roots in constructivism – Piaget and Vygotsky
- Vygotsky – ZPD – social basis for learning and development; in children – mediated learning
- Piaget – cognitive levels in children – depends on physical development (brain) – learning and development starts on an individual level.
- A system of tensions between various role-players:
Subject; object; rules; community; division of labour; tools; and outcome
- Purpose: to analyse the tensions that exist and to see their influence on how the topic of evolution is dealt with.

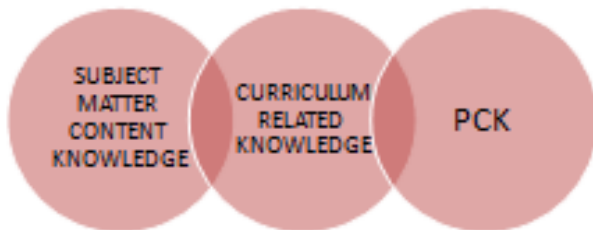
BASIC CHAT MODEL



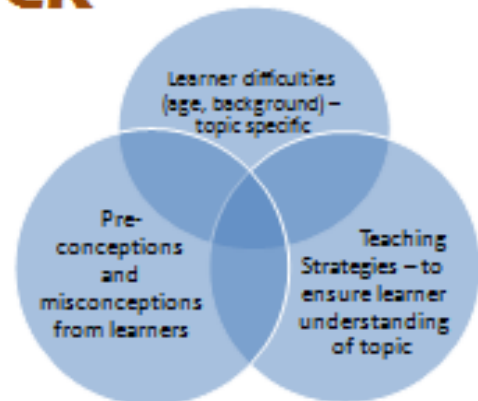
TEACHING EVOLUTION OVERSEAS

- Countries researched – USA, Scotland, Lebanon, Pakistan, South Africa, (India)
- USA – much conflict in southern states; northern states more liberal and willing to explore different teaching strategies.
- Scotland – no major problems with accepting evolution.
- Lebanon – no conflict with religion! Problem with lack of evidence for evolution.
- Pakistan – trying to reconcile evolution with creation by including Quranic texts in school textbooks – religious authority for people to accept it without fear of contradicting their religion.
- India – no studies available
- SA – strong religious convictions hamper effective teaching/ learning; other problem – teacher competence

3 TYPES OF CONTENT KNOWLEDGE IN TEACHING



PCK



CONTROVERSIAL CONCEPTUAL CHANGE (CCC)

- COLD CONCEPTUAL CHANGE – new knowledge is built into existing knowledge frameworks objectively and purely from a cognitive level; easier to measure.
- WARM CONCEPTUAL CHANGE – human input of emotions, experiences, worldviews, etc... – considered in understanding how learning occurs; difficult to measure.

NATURE OF SCIENCE (NOS)

Seven tenets of NOS accessible in a classroom:

Science is empirically based

Science knowledge is tentative yet durable

There is a difference between observation and inference

Science knowledge is theory-laden, yet partly subjective

Imagination and creativity play a role in science

There is no single scientific method

There is a difference between law and theory

FINDINGS OF MY STUDY

- Interviewed Hindu Life Science learners and teachers; Hindu parents and a Hindu priest – phenomenological study.
- No conflict between Hindu religion and theory of evolution.
- Also not much is known about the Hindu religion even by many Hindu's themselves.
- Possible reasons for no conflict:
 - 1) Age of the Earth
 - 2) Avataraic Evolutionism
 - 3) Law of Karma and Reincarnation

HINDUISM

- "Hindu" – a geographical term indicating Sindhu inhabitants of the area around the Indus River.
- Persians mispronounced Sindhu → Hindu - and the name persisted.
- Actual name is *Sanatana Dharma* (Eternal Religion).
- Overarching belief: we are all spiritual beings in material bodies with an immortal spirit soul that strives to be united with the supreme soul (*moksha/ nirvana*).

HINDU SCRIPTURES – SHASTRAS

- Many, as opposed to one main book e.g. Bible or Qu'ran.
- Original language – recorded in Sanskrit – several different translations – English and other languages.
- VEDAS (Knowledge of God) – 4 types.
- Within each Veda – separate portions that contain their essence → Upanishads or Vedanta:

MESSAGE OF THE UPANISHADS



THE RAMAYANA

- Story of Lord Rama – prince and later king of Ayodhya in Northern India.
- Introduces Sri Hanuman to the world – misnomer of his name in popular writings – “Monkey God”.
- Exile to the forests for 14 years; kidnap of his wife Sita by demon king Ravana of Lanka.
- Her subsequent rescue and their return to Ayodhya – bulk of this epic tale.
- Also: one of the reasons for Festival of Lights – Deepavali (Oct/Nov).
- And: illustrates triumph of good over evil.

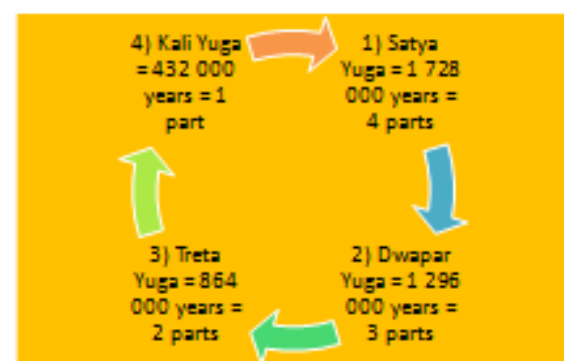
THE MAHABHARATA

- Another epic tale spanning many years.
- Story of Pandavas and Kauravas – rival cousins and their battle for sovereignty in the battle of Kurukshetra that lasted for 18 days [Mohenjo-Daro and Harappa].
- Introduces the world to Lord Krishna → delivered the *Bhagavad Gita* to mankind
- Rules of right conduct (*Dharma*) spelled out.
- Both Lord Rama and Lord Krishna are *Avatars* of Lord Vishnu.

HINDU CONCEPT OF TIME

- Cyclical rather than linear form of time.
- Universe was formed billions of years ago.
- Earth itself existed for aeons (rather than the mere 6000+ years that Creationists believe).
- Linear pattern of time (Creationists) – started with Creation and will end with judgement day.
- Cyclical pattern (Hinduism)– time continues in a series of 4 cycles so there is no end to time (infinite) – called *Kalachakra* – wheel of time.

CYCLES OF TIME



CALCULATIONS!!!

- All 4 yugas = 1 Mahayuga – added up together = 4 320 000 human years.
- One day of Brahma divided into 10 000 parts, each of which equals 432 000 human years.
- Therefore, 432 000 X 10 000 = 4 320 000 000 or 4.32 billion years make up one day of Brahma.
- One day of Brahma therefore has 1000 Mahayugas → Mahakalpa
- Age of the Earth according to evolutionists and geologists = 4.54 billion years.

SYMBOLISM OF YUGAS

- SATYA YUGA = 100% truth and most spiritual awareness
- TRETA YUGA = 75% truth and gradual loss of spiritual awareness
- DWAPARA YUGA = 50% truth and descent into immorality began
- KALI YUGA = 25% truth remains – most degenerate of the 4 ages [5000 years into this age, another 427 000 to go!!!]

HOLY TRINITY IN HINDUISM

CREATION – Lord Brahma

PRESERVATION – Lord Vishnu

DESTRUCTION – Lord Shiva

Brahma – Vishnu – Shiva



AVATARAS

“Whenever there is a decline of Dharma and a rise of Adharma, then I embody myself. For the protection of the good, for the destruction of the wicked, and for the establishment of Dharma, I am born from age to age.”

Bhagavad-Gita [4:7-8]

AVATARAS contd...

1. Matsya – fish
2. Kurma – tortoise
3. Varaha – boar
4. Narasimha – man-lion
5. Vamana – dwarf
6. Parasurama – man with an axe
7. Rama – prince and then king
8. Krishna – worshipped as a deity – Dwapara Yuga
9. Buddha – 300 BC – spiritually enlightened one – Kali Yuga
10. Kalki – head of a horse, body of a man or a rider on a white horse (yet to come – signals the end of the Kali Yuga)

MATSYA (FISH)

story

- Saved humanity and the Vedas from a flood that destroyed the world.
- Paralleled by story of Noah and the Ark



KURMA (Tortoise)

story

- allowed the churning of the ocean by supporting the churning rod (Mt Mandara) on its back.
- Churning resulted in the nectar of immortality (Amrit) which Gods used to defeat the demons and regain control over the world.



VARAHA (Boar)

story

- The world sank to the bottom of the ocean during another global flood.
- Lord Vishnu in the form of a boar dove into the ocean to raise it out of the water using its two tusks.



NARASIMHA (Man-Lion)

story

- killed a tyrant demon king who wanted to reign supreme over the whole world.
- The only avatara in the form of a hybrid.



story

- appeared to destroy demon king Bali.
- During a ceremony, he asked Bali for land that he could cover in three paces.
- Bali agreed since Vamana was a dwarf and of small stature that would not take up too much land with his paces.
- Vamana then grew in size until he could cover the whole Earth, and the heavens with his paces, thus relegating Bali to the netherworld where he could no longer harm mankind.

VAMANA (Dwarf)



PARASURAMA (Rama with an axe)

story

- appeared to destroy the warrior caste (Kshatriya).
- kings became despotic and harmed people and saints in the forests.
- used his axe and his skills as a warrior himself to destroy all the warriors and restore peace to the world.




STORY

- appeared to destroy the demon king Ravana who kidnapped his wife Sita.

* Together with his brother Lakshmana, Hanuman and the rest of the monkey army, they built a bridge to Lanka where Sita was being held and rescued her.

* Rama is also described as an ideal son, brother, husband, friend, King etc and his life is an example for humanity to follow.

LORD RAMA (Prince and later King of Ayodhya)



LORD RAMA & SRI HANUMAN-ji



STORY

- appeared to kill demon king Kansa who was also his maternal uncle.

* also gave mankind the epic poem and revered scripture, the Bhagavad Gita.

* later became the king of Dwarka

KRISHNA (Cowherd, charioteer, king)



LORD KRISHNA – charioteer for Arjuna in the Kurukshetra Battle → Bhagavad Gita



LORD BUDDHA

STORY

- was born as a Hindu prince – Nepal.

* realized that all sorrow comes from attachments and desires.

* we can only be happy if we give up all attachments.

* also known as the enlightened/ awakened one.

* appeared to teach mankind the lesson of following the middle path in life to attain Nirvana.




STORY:

KALKI (Eternity/ Time/ Destroyer of Foulness)

- yet to appear – at the end of the Kali Yuga.

* rider on a white horse OR a man with a horse's head.

* akin to the white horseman of the apocalypse.



FOCUS GROUP INTERVIEW – TRANSCRIPT 1 – 6 May 2011

Transcribed By L. Glaus

1
2
3
4 (Introduction by researcher)

5
6 Researcher Firstly, just to get us into the whole discussion, do you consider yourself to
7 be a practicing Hindu?

8
9 All Yes, yes, yes, of course.

10
11 Researcher You have all answered yes, so what activities do you engage in to observe
12 your religion? K can we start with you?

13
14 K Praying every morning. Prayers like for Lord Ganesha because he is the
15 Lord of obstacles so if we feel we have some sort of obstacle coming our
16 way we pray to him to remove them.

17
18 Y In my house we pray in the morning and in the afternoon and we have
19 service on Tuesdays and we go to Temple at least twice a month and the
20 official prayers like Ram Naumi and Saraswathi Pooja. We do prayers at
21 home.

22
23 H We pray at home in the morning and afternoon and attend temples we also
24 do the important prayers for each God like Luxmi and Ganesha and so on.

25
26 O I light the God lamp every morning. We go to the temple whenever we
27 need to. We always participate in Kavady. My parents believe strongly in
28 trance and and we fast.

29
30 S We fast every Monday, Tuesday and Friday and Thursday. We light the
31 lamp but not every day. We don't believe in slaughtering and my father
32 and I do trance.

33
34 Researcher As a Life Science learner, you have learnt about evolution since Grade 10,
35 do you have any difficulty in accepting evolution as a result of what
36 Hinduism teaches you?

37
38 S No, the evidence is there.

39
40 Researcher The evidence for?

41
42 S Evolution.

1 Y When I spoke to my Grandfather and my Dad, they say that Hinduism
2 doesn't have a specific date or time when it began and that it is one of the
3 oldest religions. I am not really sure how life on earth from a religious
4 aspect started whereas with Life Sciences, it's one of the Sciences that tells
5 us how human life evolves. To me it's kind of contradictory because I
6 don't know from a religious aspect I don't know but from a Life Science
7 side, I know because it's a proven fact, evidence.
8

9 H I would have to agree with Y that Hinduism is the oldest tradition existing
10 today. I believe that what we learn in science. I believe it to a certain
11 extent based on past evidence learnt from school about evolution but our
12 religion tells us that we all came to earth due to God. With all our
13 traditions in religion, nobody exists from that time – nobody can really
14 back up or prove these beliefs to be true so I believe in Science.
15

16 S I believe it to an extent because there might be evidence that we were here
17 but that spark of life, there is no evidence that we evolve from it,
18 somebody gave it to. It must be that a spiritual being gave it to us.
19

20 Researcher We were all talking about the rituals that we observe at home as practicing
21 Hindu's but how au fait are you with the scriptures of Hinduism in terms
22 of religious books. K?
23

24 K I have not read any books.
25

26 Researcher Okay but do you know any of the stories, even if you don't read the books.
27 Was anything every told to you as an oral tradition.
28

29 K I do, one. Yes the story about Ganesha and how he got the elephant head.
30

31 Researcher OK
32 K Ganesha was knocking on his mother's door while she was changing and
33 his father thought that he was being impatient so he chopped off his head.
34 I think the moral of the story is to be patient.
35

36 Y I don't know the story in detail but I know the story about why we
37 celebrate Diwali. Diwali and the story that's in our Bhagavad Gita like the
38 1st chapter but not the details.
39

40 H I don't know any stories.
41

42 Researcher Any scriptures?
43

- 1 O I have not read any scriptures at all but I know the story about why we
2 celebrate Diwali. I participate in some shows about Diwali.
3
- 4 S Maam, I heard the same story as K but in a different way. I heard that
5 Ganesha's mother created him. She couldn't have children so the one day
6 she was taking a bath and he was there playing around. So when the father
7 came, he thought he was an intruder so he chopped his head off and then
8 when the mother told the father that was his child, he sent his guards to
9 find the 1st face that was facing the sun and that was the elephant head.
10
- 11 Researcher Okay that was just to establish your knowledge of scriptures. Moving on
12 to the next question. What have you heard from your family or when you
13 go to temple about origin of life on earth as far as Hinduism is concerned?
14
- 15 K Lord Shiva is the creator of all things.
16
- 17 Y I know there is a creator, a preserver and a destroyer and I know that there
18 was life before our creator. Our creator created, I think it was, 10 other
19 life forms to help him create the world but I'm not sure how human like
20 this creator was.
21
- 22 H My answer would be the same as K's, Lord Shiva created everything
23 otherwise I don't really know. — OF —
24 JOHANNESBURG
- 25 S The creator is Lord Shiva and everything came about by an explosion of
26 the sea.
27
- 28 Researcher According to your religion, what is the approximate age of the earth?
29 Because if you remember about creationism in class, according to the book
30 of Genesis, the earth is about 6000 years old. So what does Hinduism say
31 about the age of the earth?
32
- 33 K I'm not sure.
34
- 35 Y I know the world goes through different phases and I know that we are in
36 the last phase called Kal Yug at the end of the era the world will come to
37 an end.
38
- 39 H I would say that the world is millions of years old but I'm not sure of the
40 exact date or time.
41
- 42 O I know it's the oldest religion that exists today but I'm not sure exactly
43 how old.
44

1 Researcher So do you think it's older or younger than 6000 years?
2
3 S Older, definitely.
4
5 K I think it's younger.
6
7 Y It must be older.
8
9 K Oh no, it's older. Do you remember the Cambrian explosion?
10
11 Researcher In evolution we learn about the pre-historic life forms, now where do you
12 think those pre-historic life forms fit into Hinduism? Do you think there is
13 a place for it?
14
15 Y Looking at the stories they tell us in the Bhagavad Gita and the Vedas and
16 what our parents tell us, I don't think that there was actually something
17 that existed before the actual birth of humans. Maybe animals and stuff
18 but not humans or like what we are now.
19
20 Researcher So do you think that humans were just created as we are?
21
22 Y According to our religion it does say that God created us so I don't think
23 we evolved from a religious aspect.
24
25 Researcher Ok
26
27 K Could it be that we were created like Lord Hanuman through apes and
28 monkeys.
29
30 Researcher Ok so what are you getting out of Lord Hanuman?
31
32 K Maybe we came from all different types of ancestors. You know in
33 evolution, we evolved from our ancestors, apes and monkeys. We evolved
34 from our ancestors, apes and monkeys.
35
36 Researcher So are you saying that we evolved from apes and monkeys?
37
38 K Maybe as our friends. All types of people, different types. Ok. Never
39 mind.....
40
41 Researcher No carry on. I think you were getting on to the right track about Lord
42 Hanuman but you didn't explain yourself properly.
43
44 K Yes I don't know how to explain myself.

1 H She said all of us were friends. *[laughter]*
2
3 K Like maybe we were all together.
4
5 Researcher Are you trying to talk about our common ancestors? Remember in class
6 we learnt that we all didn't evolve from the apes but we had common
7 ancestors.
8
9 K Like we all evolved together. Some of us survived natural selection and
10 then only with survival of the fittest, some survived.
11
12 O I have no idea why, but I would like to ask why we all have different
13 complexions.
14
15 Researcher Yes please share that with us.
16
17 O Maybe, it was a skin pigmentation that came out in early India, in one of
18 the tribes, why some of us have straight hair and some of us curly hair.
19 'Cos people were not faithful in their tribes and slept around. I don't think
20 prehistoric life forms fit into evolution.
21
22 Researcher How do you view the process of evolution in the Hindu faith? Is there a
23 similar belief to evolution? Remember in evolution we started as simple
24 forms and gradually evolved into more complex ones. Is there something
25 like that in the Hindu religion.
26
27 K No, I haven't heard anything.
28
29 H No, I don't think so.
30
31 S No, I don't think so.
32
33 O I believe that if you can't prove something then why believe it because
34 there's no proof but Science does prove everything that they talk about.
35
36 Researcher Is there no place for your religion then for your faith? Where would that
37 fit in?
38
39 O Yes but I would say not in evolution. Everything else yes, but just not in
40 evolution.
41
42 Researcher So do you think that learning about evolution in school is going against
43 your religious beliefs?
44

1 S No.

2

3 H No.

4 Y There is proof for evolution already so I don't think it's going against our religion.

5

6

7 K No, because its facts and it's just helping us to understand the world we are living in.

8

9

10 H I say no, because our religion does not state that we should not learn other stuff and how we came to this earth.

11

12

13 O I don't think it contradicts with our religion, I just think it gives us an open mind about different aspects.

14

15

16 Y It's just like helping us to be more open-minded. I don't think it's going against it.

17

18

19 S I think your religion instills morals and values in you, it shows you right from wrong but Science backs everything up about evolution. Your religion shows you a way of life. Religion teaches you how to live life but science proves, like I said earlier.

20

21

22

23

24 K No its fact.

25

26 Y My religion comes first but because I am listening to people talk about the facts of evolution makes me more open-minded and that I don't only look at things from one aspect. In Hinduism there is no specific way that humans evolved so Science gives you the information to picture what happened in a way.

27

28

29

30

31

32 Researcher You have studied evolution since Grade 10, like I have said, but why do you think that all the other topics that you have studied like the cardiovascular system, the heart, the eco system are not as controversial as evolution.

33

34

35

36

37 It does not clash with any religious beliefs.

38

39 Researcher How?

40

41 S I think that everybody has different opinions on evolution and some people really don't even believe in it.

42

43

1 K I also think some people just believe in their religion and refuse to look at
2 science and the facts.
3

4 Y Evolution is basically telling us from where we originally came from or
5 how we evolved whereas if you look at the other topics, it's basically
6 telling us about what we have in our bodies now. With our bodies, we
7 have absolute proof that it is there but with evolution we cannot be
8 absolutely sure that it happened – it was so long ago.
9

10 H I think Y is 100% correct – evolution tells us where we originated from
11 whereas the other topics that's what we have in us and gives us life.
12

13 Researcher So after studying evolution in Grade 10, do you think it was a good idea to
14 introduce evolution into High School Life Science? It is since 2008 that
15 evolution has been taught.
16

17 H Yes especially if it does not interfere with your religious belief.
18

19 K I think that every religion has something to say about how they came
20 about.
21

22 H Christianity does not give evolution a chance to explain whereas Hinduism
23 is open to everything. OF
24 JOHANNESBURG

25 Y I don't think we know whereas Christianity states that God created all
26 beings and that Hinduism is open to other things
27

28 S Yes I think it is good that we study evolution because it makes you more
29 open-minded to see how we were instead of just the religious aspect.
30

31 O I think it is a good idea. I think it's very interesting. I loved learning about
32 the heart, the different chambers and things.
33

34 Y I don't necessarily think it's a bad thing to teach evolution in school
35 because it gives you something different to look at other than your own
36 religion. If you are Christian, and you can open your mind to evolution,
37 then you can question which one you prefer to believe or what sees more
38 realistic to you.
39

40 Researcher Do you understand what is meant by the scientific method of the Nature of
41 Science and can you provide a brief idea of what this method entails?
42

43 S When you have a theory and you have to prove it and do investigations
44 and once you have a result you can then come to a conclusion.

1 H You have a theory which is a hypothesis, we take all our info, we
2 investigate it with a controlled experiment and come up with a conclusion
3 that confirms our hypothesis.
4

5 K You have to do several investigations to come up with a theory, do some
6 experiments and then come to a conclusion. To be sure to prove things.
7

8 Researcher I think that when we talk about theory and hypothesis – you mix the two
9 up a little. Remember that hypothesis comes before the theory.
10 Hypothesis is something that you think and then it's only after you have
11 proven that (after repeated investigations) that it becomes a theory. Do you
12 think that the concept of evolution should be referred to as a theory? What
13 do you understand by the term theory in Science?
14

15 K When do they have a theory before birth of Christ? How do they know
16 that there was life before Christ?
17

18 Researcher Well what about the Old Testament?
19

20 Y So does that mean that **there was life on earth before Christ?**
21

22 Researcher Yes, Joseph and Mary. Remember our time line starts from 2000 years
23 ago, so the time before him – there were other nations on earth and there
24 was life forms – definitely.
25

26 O Talking about Christianity – you know they say Adam and Eve were the
27 first people on earth and then they had a child but where did that child find
28 another person to carry on the line.
29

30 Researcher Yes we question that in Genesis but I do not know if the Christian people
31 question it.
32

33 O Don't they ask themselves – where did the other people come from?
34

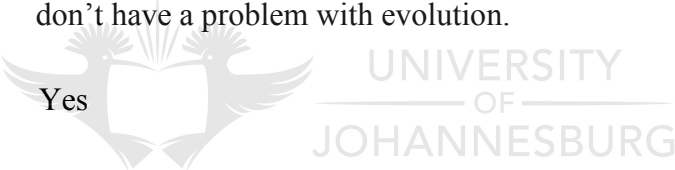
35 Researcher That's a very good question but I don't believe that they do question it but
36 that could be one of the reasons that in evolution you accept everything
37 you read. There is some contention in Christianity but we are not going to
38 talk about that in this discussion.
39

40 S I think if it stopped being called a theory people would accept it more.
41

42 O I think that we are confused because even though we are Hindu's, we hear
43 about **what Christians say and some of us accept what they say.**
44

1 Researcher Where do you think the confusion came from?
2
3 O Science started questioning how life began on earth and questioning
4 evolution and everything that they were taught.
5
6 Researcher If people are not taught about the scientific method and theory. Even if
7 you were not taught that – how do you think your perception of evolution
8 would have changed?
9
10 *Phone rings*
11
12 Y I think I would have a lot more questions because I would not know what
13 was the process of them coming to their theories.
14
15 Y It would actually make me doubt Science and lean more towards religion
16 and be more open.
17
18 S I would not want to believe something just because that's what a person
19 believes.
20
21 O I have always questioned it and I am glad we are learning about evolution.
22
23 K But then what about the fossils found?—I still think that people would
24 believe in evolution then.
25
26 O But remember we were told how people can fake fossils so then would
27 you still believe it?
28
29 K Yes but then you do research to prove it – that wasn't real fossils.
30
31 O If we evolved from something and those fossils look different from what
32 we look but the question about life on earth is questionable.
33
34 K But some Christians come up with theories without telling the people how
35 they got there.
36
37 Researcher So basically the nature of science helps you to put things into perspective.
38
39 H Yes. It helps us to understand.
40
41 Researcher So you can see that there is some method to how they are getting to
42 arriving at the theory.
43

1 Researcher Is there any aspect of evolution that disturbs you in any way in terms of
2 your religious view or personal beliefs?
3
4 O No, my parents find it interesting in what I have to say when I go home.
5
6 Y I think it makes a person grow intellectually and makes them analyse
7 things differently whereas if there was only religion, there's only one way
8 of thinking about things.
9
10 O No, I think it's very interesting and gives us a different way of thinking
11 other than religion.
12
13 Researcher Do you think it is more important to accept evolution or to understand it?
14
15 S I think that if you accept it then you should understand it.
16
17 H I think you must understand it first before accepting it.
18
19 K Your religion is there to guide you and put you in the right perspective.
20
21 Y I think you need to understand what and how evolution is before you can
22 accept it. Once you accept something it really means that you understand
23 why it's there and why it happened. So I think understanding much come
24 before accepting. JOHANNESBURG
25
26 S I think that you should understand it first and then once you accept it –
27 nothing should change your mind about it.
28 O I will have to agree with everyone else. You have to understand it before
29 accepting it.
30
31 H Otherwise you will just confuse yourself more.
32
33 O Yes. Understanding is the way to go.
34
35
36 Researcher So you are saying that both go together – you can't do one without the
37 other?
38
39 All Yes
40
41 Researcher But do you think that you can understand the processes involved in
42 evolution but you don't believe in it?
43

1 S That's were religion comes in, **your religious views affect the way you**
2 **think.**
3
4 S So people might understand it but because of their religious view, they
5 choose not to accept it, even though the facts are there they still don't want
6 to accept it.
7
8 Y I think it's personal. You can understand what evolution is and your
9 religion tells you something and you are very staunch and you follow your
10 religion precisely. I don't think there is a specific way of accepting it
11 because you already accept what your religion says. There can be possible
12 cases where you understand it but you don't choose to accept it.
13
14 H Yes I agree with Y. **You have to understand something before you accept**
15 **it. I don't think your religion should interfere with your decision.**
16
17 K To **understand it 1st** before accepting it. There can be possible cases where
18 you understand it but you don't choose to accept it.
19
20 Researcher So is it correct for me to say from our discussion this afternoon that you
21 don't have a problem with evolution.
22
23 All Yes  UNIVERSITY OF JOHANNESBURG
24
25 Researcher And that it does not conflict with your religion?
26
27 K No because I do not pray to any **one creator God that said that I created**
28 **everything.**
29
30 Researcher So what you are saying is that you do not pray to any specific creator God.
31
32 O And it's **not stated anywhere that there is a creator God.**
33
34 Researcher But remember that your knowledge of the scriptures is not very high so
35 maybe somewhere it is stated that there is a creator.
36
37 S **I know of a creator of the world but not of people**
38
39 K **I have not heard of a creator of human kind.**
40
41 Y I just think that it comes down to the person if you follow religion word
42 for word – it kind of makes you one of those ignorant people to things that
43 are proven and that are there and other ideas whereas being open to ideas
44 and theories and all of that because it helps you as a person and to

- 1 understand different aspects. Learning about these things at school is
2 definitely not a problem, it depends on the person. **If the person is not as**
3 **open minded it makes it very difficult for them to come to terms with**
4 **science.**
- 5
- 6 S **Religion tells you how to live your life – it shouldn't tell you what you**
7 **should believe in.**
- 8
- 9 S It should guide us.
- 10
- 11 Researcher So you think science is telling us what happened, evidence?
- 12
- 13 S If we had no religion then we would be wild, although there are wild
14 people. **I think religion shows you the right path to take.**
- 15
- 16 *End of discussion.*



FOCUS GROUP INTERVIEW – TRANSCRIPT 2 – 13 May 2011*Transcribed by: L. Glaus*

- 1
2
3 Researcher (*Introduction*) First of all, just to get the ball rolling – do you consider
4 yourself a practicing Hindu?
5 Sa Yes.
6 Ys Yes
7 Yt Yes
8 De No, because we don't do everything we are supposed to.
9 Researcher So why do you consider yourself a Hindu then?
10 Sa Well we do what we are supposed to do in accordance with religion but its
11 not that we carry it out to the point every day. We don't carry out the
12 rituals.
13 Researcher: Okay, I see you have a dot. Why do you wear that then?
14 Sa Its one of the things I do.
15 Researcher: So you are
- 16 Sa I think I am a practicing Hindu but our customs are very different and I
17 don't believe that we should do rituals. When we ask our parents, they
18 don't have all the answers as to why we should do these rituals so we don't
19 know why we are doing it. It's just my Mum said this and my Dad said that
20 so in my family we don't practice any rituals.
- 21 Researcher Do you have anything to add to that? Okay let's move to the next question.
22 So you all said yes to some extent. What kind of activities do you perform
23 to say that you are a Hindu?
- 24 Yu When I wake up in the morning I wash and say a prayer. Then every Friday
25 or Saturday we go to the temple.
26 U I fast and on Sunday I go to the temple.
27 D I fast and light the lamp every day.
28 Y I fast every Monday and light the lamp. I am a Lord Shiva devotee. I pray
29 every day. On Sundays I go to temple to attend the morning service.
- 30 Researcher So you're doing all these rituals and you don't understand why?
31 Y No I don't think it's like that. All the things like slaughtering and preparing
32 the Siva Lingum. I don't understand why.
- 33 Researcher As a Life Science learner, you have learnt about Evolution since you were in
34 Grade 10. Do you have any difficulty accepting what you have learnt in the
35 classroom as a result of what Hinduism teaches you?
- 36 U As a Hindu I believe that all Humans were created by God. I believe its
37 Gods creation not from monkeys.
38 S I think that all the scientific stuff contradicts all the religious stuff. We have
39 Darwin's theory but our religion says that everything was created by Lord
40 Shiva.
41 Y I am a God fearing person and what I have heard about Evolution – I tend to
42 keep myself open-minded about it. I do accept it although I still do believe
43 in God and that part of it.
44 D I too believe that evolution and our religion does not go hand in hand.

1 Y In our religion I don't think anyone knows how we were created so that's
2 why we believe in Evolution as well. They don't really tell us so we don't
3 know. I think that's why most of us have some sort of belief in evolution.

4 U I believe in our religion and that we were not created as apes but created as
5 man by God.

6 S I just keep whatever we learn at school separate from my religion.

7 Researcher According to your knowledge of Hindu Scripture what was written about
8 the origin of life here on earth? Do you know much about Hindu scripture?

9 Yt I think that there is no proof.

10 Researcher If you then lack the knowledge, does this not then give you the thirst to go
11 and find out more about it or do you just accept not knowing.

12 U I guess that we justwe don't have to accept it fully. If we can ask
13 the priest we would but there is a lack of leadership at the temple.

14 Ys I think that there is lack of clarity and when we ask someone who is older,
15 they don't know about it either. That why we ourselves don't know the
16 answer.

17 Researcher Have you heard anything at all about what we believe in, about how we
18 came to be on earth?

19 S I think that we make a lot of excuses and that we deliberately put our
20 religion behind. We look at it as an when we feel comfortable. Because if
21 we were honest – we would look at everything else before we look at
22 religion.

23 Researcher Do you want to elaborate on that?–What do you mean?

24 S We would make excuses. We could read the Gita for 15 minutes but we
25 don't do it and we make excuses.

26 U The scriptures are all written in Hindi or Tamil. We haven't learnt those
27 languages. It is hard for us to understand. The Bible is written in English
28 but I have not seen one English Hindu scripture.

29 Researcher There are English translations. Anybody want to add to that?

30 Researcher According to your religion what is the approximate age of the earth.

31 Yt According to our religion –5112.

32 Researcher Is that how old you think the earth is?

33 Yt Oh no that's the calendar so I'm not sure how old the earth is.

34 S I don't believe that our religion began at a year. I don't believe that the
35 earth started in a year.

36 D Not much knowledge.

37 U I'm not sure.

38 Researcher So we have not got much knowledge here. So we know that the Bible says
39 that the earth is 6000 years old. So how different do you think evolution is
40 from that?

41 I think the calendar exists ever since man was created. So roughly about
42 5112 years.

43 Researcher So you are saying basically that man was created about 5000 years ago and
44 he was created as we are today and he didn't need to have any civilization

1 because if man was created, he wasn't created with a calendar. So he would
2 not have got up one morning and decided to create a calendar.

3 Ys You know in evolution we learned about pre-historic life forms like
4 Cambrian explosion for instance. Do you think there is a place for this in
5 the Hindu religion? I do believe that **Hindus in general lack discipline** like S
6 said. We choose to do things only when we want to compared to other
7 religions **where children go to formal school to learn about their religion. ,**
8 **we don't.**

9 U Yes, I think there should be a place for all types of life forms. **Hindus value**
10 **all life forms.** There should be a place – for all we know it could be a life.

11 Researcher How do you view the process of evolution in the Hindu faith? In other
12 words, is the belief in Hinduism very similar to the process of evolution?

13 S I don't hear our religion speak about extinct life forms. I think science is
14 just curiosity. We are more inquisitive.

15 U No I don't think so.

16 Yt Not it all ways, for example in the Hindu faith you have to be cremated
17 when you die and not just turn into a fossil. As Hindu person you go
18 through cremation when you die so no place for fossils. I think we value all
19 life forms and we haven't heard of any mass explosions or extinctions at
20 temple.

21 D We value all animals. As Hindus but I don't see a place for prehistoric life
22 forms.

23 Researcher So what you're saying is that cremation negated the presence of fossils.
24 Okay, but maybe I should explain a bit more. Life forms started off being
25 very simple and then they became more complicated. So is there something
26 like that, where we start off simple and get to something more complex in
27 Hinduism.

28 Yt As far as I know they say **Hindu's are reincarnated.** They started off from
29 smaller, a lesser being and as your soul passed this life it becomes a human.

30 Researcher Do you think that learning about evolution in school is going against your
31 religious beliefs?

32 S **No I don't think so;** I think it helps us expand our knowledge and teach us to
33 be more open minded. Just because we learn about it does not necessarily
34 force us to believe it. It just gives us another idea of a life form.

35 U **It gives us a broader view of the planet and everything that's occurred.** I am
36 **not very clued up on the Hindu religion** part but evolution does give us an
37 idea of how we could have started. In school they teach us about it but it
38 **doesn't really affect me.**

39 S Basically I think that we should not accept everything as black and white
40 and we should consider all sides. I'm more broad minded and try to make up
41 my own mind.

42 Yt I actually keep **what I have learnt in school apart from my religion.** I don't
43 mix the two. After looking at all sides we can then more or less put the
44 pieces together.

1 Researcher So it doesn't influence you in any way? Like you learning about evolution.
2 Some people are totally against it because of their religion.
3 S I think what also contributes to us not being totally against it is **we don't**
4 **really have a theory in Hinduism about evolution.**
5 Researcher You've learned about evolution since Grade 10. How would you regard this
6 topic compared to any other topic you have studied in Life Science eg the
7 Digestive System or the cardiovascular system? How are those topics
8 different to Evolution?
9 Sa In their relationships?
10 Researcher No contents sense.
11 U I can say that Evolution is a bit more interesting because we are learning
12 about what was there before us rather than what's around us now.
13 Ys It's more interesting, it impacts on us.
14 D It encourages us to know more and how it impacts on our religion.
15 S Basically it teaches us not to be ignorant and accept everything we are told
16 and then we consider all sides.
17 Researcher You say you can't compare them. Is this because of the factual knowledge
18 that these different topics have or is it because of the belief system that you
19 have?
20 Yt Factual because we keep our school knowledge and religious knowledge
21 **separate.**
22 Researcher Is it facts that are making you see the difference or is it your belief.
23 S I think it's the facts whatever interests you more, because our belief systems
24 are very different so if you have got to think about it it's going to cause
25 pain. You religious beliefs conflict with this knowledge in school and you
26 won't want to learn anymore.
27 Researcher Okay I asked about the topics in Life Science. Previously you have learned
28 about things like the heart, digestive system, etc. Now you also learn about
29 Evolution and there is a lot of controversy when it comes to Evolution but
30 not a lot on the other topics so do you think that that controversy for
31 Evolution is the cause of the factual knowledge or is it because of the belief
32 system that you hold?
33 Ys I think it is the belief system because you **grew up with this belief system**
34 **and were taught this by your parents. You tend to take on their beliefs.**
35 Researcher So the controversy comes about because of people's belief systems rather
36 than because of the facts.
37 U Yes
38 Yt Yes
39 Ys Yes
40 Researcher So after studying Evolution since Grade 10, do you think it was a good idea
41 to include this topic in Life Science?
42 U Yes we **never learnt about it** in our religion.

1 Ys Actually it was because it provides a healthy debate in which us as students
2 can share all our views and it helps us become more open minded and to
3 accept other peoples beliefs.

4 Yt I think it should be included in the syllabus and it's just an idea to us but it
5 could cause problems but it's good if a person wants to study it at the end of
6 the year. As U said, we have not learnt enough about it in our own religion
7 before or anywhere else so as Hindu's, it could be good to include it into the
8 syllabus. Due to the fact that it is coinciding with many other religions, it
9 could cause problems. Say for instance a person would not want to study it
10 for end of year examinations; it could cause conflicts like that.

11 S I don't think it's a bad thing but I think that if we went home and spoke
12 about it to our family it would upset them in some sense. I think it provides
13 us with just another viewpoint so it's not really a bad thing. At the same
14 time, it's not like, I mean our parents know more about our religion than we
15 do, so if we talk about evolution to them, it might upset them.

16 Researcher Have you tried speaking to them yet? Have any of you tried speaking about
17 Evolution to your Grandparents or your parents for that matter.

18 S No, we tried but they don't like it. These stories happened thousands of
19 years ago. As the years went by the stories changed so I'm not really sure.
20 Unless we read the books or something.

21 Ys I think they get very upset because they come from a different generation
22 and have all their religious beliefs. Most of them don't recognize Science
23 and the ways of it.

24 Researcher But what aspect of it would cause them to get upset?

25 Ys I feel that they are quite ignorant when it comes to Science. It is new to
26 them and they are old.

27 Researcher But when you say this, are you speaking about anybody in particular.
28 Someone that you have spoken to already? And when you speak to them,
29 what have you told them so far?

30 Sa How we evolved, and the origins and how things expanded and their
31 reaction was that they did not have any regard for it.

32 Researcher But was there any part of that story that they did not like.

33 Ys Yes, the story of the Apes.

34 Yt The fact that our parents come from and older generation, they are not open
35 to new ideas.

36 S I think that they have so much regard for scriptures and they don't know too
37 much about Science, like we said and they have been around longer than us.
38 They don't really like to part about the origin of Life Sources.

39 U My mother speaks about that Lord Ram was the first man on earth.

40 Researcher Let's go to the next aspect. In Life Science you learn about the scientific
41 nature, the nature of science – are you familiar with that. You have learnt
42 about Hypothesis Testing – that's the nature of Science. So do you
43 understand what this method entails? I just want you to give me a brief idea
44 of what you think that the Scientific method is all about.

1 Ys A **theory** that you put forward. You do some tests to see if something works;
2 if it doesn't work then you **try again** and you reject your **hypothesis**.

3 D I agree with Ys.

4 Yt I believe that it is investigations and experiments to find out how the world
5 started, gravity etc. Its helps in many ways but there is room for error.
6 There can be space for change. It can be wrong and it can be right. It's not a
7 100%.

8 S I think it's a good thing since it aids discovery and most discoveries are
9 made by chance. So I think it's a good thing to have.

10 Researcher If you were not taught the nature of science as part of evolution, what do
11 you think your perception of evolution would be? In other words would you
12 be more or less accepting of the theory of evolution?

13 Yt I think I would be **less accepting** because we wouldn't understand that it's a
14 person's theory or a person's feeling and we would think that this is exactly
15 how it is. This is how our world started and there is nothing to explain it but
16 because it's just a theory – it could be wrong and religion could be right.

17 S I think it's a good thing if we didn't learn about it then we would not be so
18 curious and we would be more critical about things. Now that we know of
19 these things, there is a big difference now.

20 U I'd say we would be **less accepting** because then people would just guess
21 these things. There wouldn't be any proof.

22 Ys I think we would be **more accepting** if we did not have the nature of science.
23 We wouldn't really know if it's proven. We call it a theory and we are open
24 about it.

25 Researcher Is there any part of evolution that you find disturbing in any way?

26 D & S **Nothing**, nothing.

27 U It's always impressive to learn what was here.

28 Yt If this is what's true, **I'm a very accepting person**. It's just a theory and I
29 don't fully believe in it. **I'm not very questionable**.

30 Researcher Do you find learning about evolution to be in conflict with your religion? I
31 know I have asked this before but just to clarify.

32 Yt I have to see it before I make a judgment.

33 D,S,U **No**

34 S Hinduism doesn't have a theory so I cannot compare, **no conflict**.

35 Yt I have two separate beliefs, I keep them **separate**.

36 Ys It's just a **theory**, so no.

37 Researcher Do you think that it is more important to understand evolution or to accept
38 it? There is a difference between the two.

39 Yt I think it's more important to **understand it because if you don't fully**
40 **understand it then you can't accept it**. You cannot just accept it before you
41 understand what it is all about. I think it's more important to accept it.

42 S Yes you need to **understand it first** before you can accept it.

43 D **Understanding is more important**.

- 1 Researcher So who thinks that we need to accept and understand evolution from a
2 religious point of view?
- 3 Yt I think that as long as we know there is a **God and that He created the earth**
4 and the things that exist in it, then we can accept **maybe God created**
5 **evolution as well**. So **I think Hinduism will give you the space to accept it**.
- 6 S I don't really think so. I think religion is a strong belief on its own. There
7 isn't much place for other beliefs.
- 8 U It should have a place. There isn't much difference between Hinduism and
9 evolution like in **reincarnation** – the one dies and another is born.
- 10 Ys It does give us a space to understand and accept it but we should not forget
11 that God does exist and our beliefs should still be there.
- 12 Researcher We have reached the end of this discussion. Once again I thank you for
13 your participation. Your comments have given me many different ways to
14 see this issue. You will each receive some feedback when the study is
15 complete. Thank you very much for your time.
16



1 FOCUS GROUP INTERVIEW – TRANSCRIPT 3

2 *Transcribed by L. Glaus*

3

4 Researcher Do you all consider yourselves to be practising Hindus?

5

6 All Maybe.

7

8 Researcher Maybe, what do you mean by maybe?

9

10 Sa Not sure.

11

12 Researcher When you say not sure, are you not sure whether you're a Hindu or whether
13 you are a practising Hindu.

14

15 Sa Practising Hindu.

16

17 San Sort of.

18

19 Researcher What do you mean by sort of?

20

21 K I am Hindu – practicing but we do follow all the rituals but not everything.

22

23 Researcher Ok since you all said that you are not really sure – what do you think you
24 will have to do to make yourself a practicing Hindu?

25

26 San Follow the culture, like the way we do things, like the prayers and the way
27 that each prayer is said and why we do it.

28

29 Sa The appropriate **dress code**.

30

31 Researcher How is a practising Hindu supposed to dress?

32

33 K Sari, not married (black dot). A widow must wear a white dot.

34

35 Researcher And what should a man wear, a practising Hindu male.

36

37 K A Kurta?

38

39 Researcher So as a Life Sciences learner since Grade 10 you have learnt about
40 evolution. Do you have any difficulty accepting what you have learnt in the
41 classroom as a result of what Hinduism probably teaches? I mean you come
42 to a Hindu school so you must have learnt something about Hinduism here,
43 I assume. I spoke to your Principal and he tells me that you did Hindu

1 Studies or Cultural Studies or something. Do you have a problem accepting
2 what Evolution has to teach compared to what Hinduism has to teach?
3
4 K Not that we know of.
5
6 Researcher Okay. So you are quite happy accepting what evolution has to say.
7
8 Sha I'm not sure.
9
10 Researcher But you do Life Sciences, right?
11
12 San Yes.
13
14 Sam I accept, I have no problem.
15
16 Researcher How do you rate your scriptural knowledge, you know the Hindus, we have
17 scriptures.
18
19 K I don't know much about them.
20
21 Sam Clueless!
22
23 Researcher Did you not come to this school from the time you were in Primary School?
24
25 San No, no. Came in Grade 8, Started middle last year etc etc.
26
27 Researcher I just presumed that because this is a Hindu School you would have a little
28 more knowledge of the scriptures.
29
30 Researcher Have you not even heard stories of the scriptures like the story of Rama and
31 Sita.
32
33 All (chorus) Yes yes
34
35 Researcher Okay so what have you heard about those stories.
36
37 San They just tell us about Diwali, we have some insight about it. We have been
38 given some history about it.
39
40 Researcher So what does the history of Rama and Sita tell you. What is the basis of the
41 Ramayan? Do you remember? Ok what is the message behind it?
42
43 San No message.
44

1 Researcher No message – oh ok.
2
3 Sha, K We are sure there is a message but we are not sure what.
4
5 Researcher There is a message – definitely but when it is Diwali what do they say to
6 you about the Ramayana then.
7
8 K Basically they tell us the story of Ram and Sita and that is a festival of
9 lights, that they use light as a guide.
10
11 Researcher And the triumph of good over evil. Is that not the message for Diwali?
12
13 Researcher You know that Lord Rama had to battle the demon Ravana. So that
14 symbolizes the battle of good over evil. That’s also a message for Diwali
15 because is a festival of light and light is supposed to disperse evil and
16 badness so that’s very briefly what Ramayana is about. So because your
17 knowledge of Hindu scripture is almost non existent [laughter] I need to ask
18 you if any of you have maybe heard from your parents or grandparents
19 about life on earth. How did life on earth begin and how did man arrive on
20 earth? Does Hinduism say anything about that?
21
22 K Honestly, I don’t know.
23
24 Researcher Nothing?
25
26 Sha That’s how I was brought up - I only know about Adam and Eve.
27
28 Researcher That’s from a Christian prospective. So from a Hindu background – you
29 don’t have any.
30
31 Researcher So do you go to Temple?
32
33 K Yes. What we do know is Lord Shiva is the Creator so I assume that he
34 created man in the world and everything around us.
35
36 Researcher Okay that’s what you believe and how did you come to this belief.
37
38 K When we were small, they used to tell us that (our parents and
39 Grandparents). Lord Shiva is the creator.
40
41 Researcher So that is what you were brought up to believe and does that conflict with
42 what you have been learning in school about evolution.
43
44 Sha It doesn’t.

1 Researcher Why do you say that?
2
3 K Because everyone has a different perspective on how things work. We all
4 have different opinions. She believes in evolution and I believe in Lord
5 Shiva, so if she has her own opinion and I have my own opinion – it's not
6 going to interfere with anyone.
7
8 Researcher So you believe that we should be tolerant of everybody's beliefs?
9
10 All Yes.
11
12 Researcher If you take the views of the other learners in your class, the Christian
13 learners – do they also share this tolerant approach or is there some
14 difference.
15
16 K The rest of the class is also very accepting. We treat each other as equals. I
17 think they are all tolerant and accepting even the Muslims.
18 Researcher So they don't believe what Islam teaches them. Is that a stumbling block for
19 them to accept the theory of evolution?
20
21 K We are not sure.
22
23 Researcher So there are no debates or heated arguments going on.
24
25 Sam, K, Sha No, no.
26
27 Researcher Nothing?
28
29 Researcher In Hinduism that you heard of any processes that go on that can be
30 compared with evolution. What I'm trying to say is that we have this theory
31 that in evolution, life form began with very simple and then evolved to more
32 and more complex organisms. Now is there anything in Hinduism that is
33 similar to that?
34
35 Researcher Where something starts off simple and becomes more and more complex.
36
37 All [Silence]
38
39 Researcher Nothing.
40
41 Sha Maybe the dress code, it's like in the olden days when the people used to
42 wear traditional clothes like Punjabi's and be simply dressed to go to
43 prayers and nowadays they just wear jeans and stuff like they are going for a
44 fashion parade.

1 Researcher But do you think that's because of Hinduism or some other influence.
2
3 K, Sh I think its other influences.
4
5 Researcher So it's not a Hindu process.
6
7 Researcher What does Hinduism tell us about our soul? You know that Hinduism does
8 have a start and a soul. And what happens to our soul after we pass on.
9
10 Sha We are reincarnated again.
11
12 Researcher So what do you know about reincarnation.
13
14 San Basically if you are good in this life, then you come back reformed into
15 something else which is good. If you are a bad person then you will come
16 back as something bad.
17
18 Researcher So what happens to your soul then ever time you get reborn?
19
20 San It's just passing through.
21
22 Researcher Is the soul supposed to be learning from this or is it just passing through?
23 K Yes learning from the mistakes that you made in your previous life.
24
25 Researcher So what's happening to the soul each time?
26
27 K It learns from its mistakes and its going to carry on reincarnating.
28
29 Researcher So can you find a link between that and evolution?
30
31 All [Silence]
32
33 K Evolution has many theories.
34
35 Researcher What do you mean?
36
37 San Everyone has a different view of things and those keep getting passed on.
38
39 Researcher You've learnt about evolution since Grade 10, how would you regard this
40 topic compared to any other topic that you have studied in Life Sciences e.g.
41 the heart, the nervous systems, ecosystems.
42
43 K There are more theories in evolution than in those topics. Like the heart we
44 learn the different parts but in evolution it's all theory and the people who

1 make up the theory. And we learn to look at our own point of view and
2 what we think of it.
3
4 Researcher In terms of controversy surrounding evolution in comparison to the other
5 topics that I've just mentioned is there a difference?
6
7 Sam Yes, there are a lot of theories in evolution that have never been proved.
8
9 Researcher And with the other topics. How is our knowledge with these other topics?
10
11 Sam We know everything about these topics or basically 95%.
12
13 Researcher And with evolution – we still do not know everything. You have agreed that
14 there are differences between these topics. Do you believe that that is
15 because of fact or a belief system? In other words how people were brought
16 up and what their families told them and so on. Is it that or is it a factual
17 difference?
18
19 K **Can be both.** It's what we learn from our parents and grandparents.
20
21 San We learn from our parents and they learnt from their parents. Its more
22 belief than facts because when come to school and learn about the facts of
23 evolution so there is **in fact an imbalance.**
24
25 Researcher So have any of you ever mentioned what we learn about evolution in
26 school? Have you ever mentioned this to your parents or grandparents?
27
28 All No, No
29 Researcher So you wouldn't know how your parents or grandparents feel about you
30 learning about evolution.
31
32 San Even if they do have a problem with it, there is nothing they can do about it
33 because it is **part of our syllabus.**
34
35 Researcher Yes, I understand that but would they not have some kind of opinion about
36 it.
37
38 K I think our parents nowadays are more modified about it, they don't have
39 opinions or problems about what we are learning at school.
40
41 Researcher So they accept that you are studying it?
42
43 All **Yes** [in chorus]
44

1 Researcher So do you think it was a good idea to include the topic of evolution in High
2 School?
3
4 All Yes [chorus]
5
6 Researcher That's one emphatic yes, that's wonderful! So why do you say so – why so
7 adamant that it was a good idea?
8
9 San It teaches us more about the things that have happened before us and it is
10 interesting. You learn more in school than what you learn from your
11 friends.....
12
13 Researcher So did you all learn about the Nature of Science as an introduction to the
14 topic of Evolution? Another way in which the Nature of Science can be
15 described is the Scientific Method or Hypothesis Testing.
16
17 Sam There is a difference between theory and Hypothesis.
18
19 Researcher Okay what is the difference?
20
21 Sam Theory has evidence to support it and Hypothesis is just an intelligent guess
22 which leads to a theory.
23
24 Researcher So the Theory of Evolution now, do you think that the Nature of Science fits
25 into the Theory of Evolution or not. Remember what you said about a
26 Theory, you said it has to do with evidence. So where does the evidence
27 come from?
28
29 Sam I'd say fossils.
30
31 Researcher So how is this evidence found? Or how is it used rather – to add to the
32 theory of evolution, to support.
33
34 Sam To find out how old the fossils are. Look at the structure of fossils.
35 Researcher How about the Nature of Science? Do you know anything about Hypothesis
36 testing of the Nature of Science besides just the difference between theory
37 and Hypothesis? Is there anything else that you know about it? Like how
38 Scientists use Scientific Methods to arrive at their different theories. What
39 are the steps involved.
40
41 All [silence]
42
43 Researcher Nothing. So you have to look at for instance your religion, Hinduism and I
44 know at the beginning you said there was conflict between your religion and

1 evolution. You said with your religion that Lord Shiva was the creator and
2 with evolution we say that it all happened by chance. So is that a conflict
3 for any of you? How do you deal with those two different sides to the
4 story?
5
6 Sam Not really. I think that it's just an opinion.
7
8 Researcher So are you saying then that evolution is just a whole bunch of Scientists
9 opinions?
10
11 Sam No.[mumbled]
12
13 Researcher Why?
14
15 Sam It can't be an opinion because they can prove what they are saying.
16
17 K No, they can't prove all they are saying.
18
19 Researcher So how do you deal with these issues? Is there a way to deal with it or just
20 ignore it?
21
22 San Just ignore it unless you are put in a situation where you have to think about
23 it.
24
25 Researcher Earlier you said you go to the temple. When you go to the temple, what do
26 you go for?
27
28 San, K To pray.
29
30 Researcher Is that the only reason you think the temple should be there for?
31
32 San It should be there for guidance and to give us more insight about our
33 religion and why we follow it.
34
35 Researcher I'm not even going to ask you the questions that I have prepared because I
36 cannot believe the lack of knowledge that you have about Hinduism. It's
37 just blowing me away but I have to record this as a result of this interview.
38 I just want to ask now – after I have been asking you these questions, what
39 are you feeling about being a Hindu.
40
41 San, K We need to learn more about our culture. We need to go home and get the
42 books and start reading.
43

1 Researcher So how are you going to change that, what are you going to tell your
2 children?

3

4 San First we need to learn about our religion and why we are following it in
5 order for us to pass on what we believe in to our children.

6

7 Researcher So do you think by me speaking to you know might have some kind of
8 interest or not?

9

10 All Yes, yes.

11

12 Researcher So can I come back in say three months time and interview you all again?
13 Maybe in July just after the holiday? Can I do that – a follow up interview?
14 So you remember some of the questions I asked you – you need to find out
15 what does Hinduism say about life on earth. Is there a Hindu stance on
16 evolution because in the text books you have learnt about creation and
17 intelligent design which both talk about evolution from a Christian
18 prospective? So what does Hinduism say about it.

19

20 Researcher Thank you very much.

21

22



1 **FOCUS GROUP INTERVIEW – TRANSCRIPT 4**2 *Transcribed by L. Glaus*

- 3 Researcher You all say you are Hindu. Do you consider yourselves to be practicing
4 Hindus?
- 5 N Yes
- 6 A Yes
- 7 C Yes
- 8 Researcher Yes, you do. Since you have all said yes, what is it that you do that makes
9 you believe that you are a practising Hindu?
- 10 N Our rituals that we do.
- 11 Researcher Can you name some of the rituals?
- 12 C { Actually I feel that I was born and raised into a family of Hinduism so
13 obviously like my father taught me all of the rituals. My Grandmother as
14 well so I just like learn from them.
- 15 Researcher Okay, so it was like your upbringing.
- 16 A I am pretty much the same, it involves a lot of daily prayers, lighting the
17 lamp, meditation, retrospection and things like that.
- 18 Researcher And you practise those. Okay, that's good. Natasha do you want to add to
19 what you said earlier about the rituals.
- 20 N There is like a lot of various rituals that we do. Some like lighting the lamp
21 everyday and others might be over a month.
- 22 Researcher How do you mean, over a month?
- 23 N Like, we start with a prayerand in that month we even fast or we do
24 a different type of prayer. We pray to a certain God.....lights
- 25 Researcher Can you name that month that you are talking about in terms of Hinduism?
- 26 N What's the Monday prayer called?
- 27 Researcher Oh the nine days prayer. Okay. That's nine days right. And is there a
28 monthly one, you said?
- 29 N Well we do fast for Kavadi.
- 30 Researcher So you've mentioned the activities that you engage in. Right, that makes you
31 a practising Hindu. That's great. So now I want to ask you because you all
32 mention the rituals that you do. Do any of you have any knowledge of the
33 Hindu scriptures?
- 34 C Like the Baghavad Gita?
- 35 Researcher Like the Baghavad Gita.
- 36 C I am actually currently reading it but obviously you can't understand it
37 yourself so I go for classes.
- 38 Researcher Okay....
- 39 C It's actually going to take three years.
- 40 Researcher Fabulous!
- 41 C So I am still learning but it's interesting because you want to know. There
42 is so much and I am only 17 so I don't know a lot so I'm still learning.
- 43 Researcher So who has motivated you to go to these classes? Is it compulsory?

1 C No my Dad is in the Hare Krishna movement so they give classes so I want
2 to learn everything so ...

3 Researcher So where about are you in the Gita at the moment?

4 C Chapter 2.

5 Researcher Oh.

6 C There are quite a few classes.

7 Researcher And what do you know about the Baghavad Gita so far?

8 C It's likemost of it. It's like stillI don't
9 know what it is but it has the answers to most of the questions that we don't
10 even know today. And it's one of the things that my father says that he is
11 going to leave for us so that one day when my father is not there then I can
12 teach my kids or anyone who asks questions or if something happens
13 because everything happens for a reason. I will know the answers then.

14 Researcher Okay that's amazing. That's really very good. I'm so impressed. That's
15 wonderful. And you don't find that that conflicts with what you've learnt
16 about evolution in school?

17 C No .

18 Researcher No you don't. And the two of you?

19 A Well I'm actually a Sai devotee so as part of my daily thing, I read a lot of
20 Sai literature.

21 Researcher Okay.

22 A I've learned the Vedic chants so that's an ongoing thing. I've learnt about
23 them so yah, it's the meaning behind it, how and the power and vibrations
24 behind it.

25 Researcher And how about you Natasha, anything along those lines?

26 N No, nothing.

27 Researcher Okay so generally now for the three of you, how do you feel that what
28 you've learnt in your religion Hinduism, do you feel that there is anything
29 there that is conflicting with what you have learnt in school about
30 evolution?

31 A Not really.

32 C I know that Christians don't believe in reincarnation and we do. Like it
33 depends on your karma, good, bad or how you've lived your life. What is
34 the next form that you will be reincarnated into, anything like a bird, an
35 animal maybe. It depends like if you've lived like good in your previous life
36 then you will be born into a rich family. If you did bad and committed a lot
37 of sins then I just know we believe in reincarnation.

38 Researcher So my initial question was do you think that there is any conflict between
39 Hinduism and evolution?

40 C No, not really.

41 A I don't think so because for me Hinduism in itself might as C said, it's a
42 very scientific religion so most of our rituals and most of our beliefs come
43 down to a science. There is always a deeper meaning to it and as Hindus we
44 believe that the creation should start with a sound "OM" and that resounds

1 in everything and from that creation I think the steps and things that we
2 learn in school, I think those steps are followed but the creation, the sound
3 was essentially the big bang that we followed.

4 Researcher That's brilliant, yah. So have you read about this theory or is it just
5 something you have come up with?

6 A Its my interpretation of it because I know that Om created the cosmos and
7 the five elements and everything but I'm actually trying, after I heard about
8 this, I've been trying to find out what they actually believe in terms of
9 evolution and it's not much but the teachings does not say much about
10 evolution. Most of the scriptures were worded thousands and thousands of
11 years ago. They focus more on spiritual matters. Next to spirituality, the
12 matter of evolution is feeble, it's pointless. So yah, I think that's why it's
13 not covered so much so from my interpretation of what I know and what
14 I've read, that's what I've come up with.

15 Researcher Um, that's very interesting. Natasha would you like to respond?

16 N Yah, I do believe in what we do now as in evolution. It does fit in our
17 religion as well.

18 Researcher Can you explain a little bit more? As in why do you say that evolution fits in
19 with Hinduism?

20 N Because if you look at some of your Gods and how they perceive
21 themselves to be. Some of them are half animal, half human so then you
22 can actually derive that from...well what we learnt that man came from
23 monkeys, but that's not the right term, but that's how we evolved. So that's
24 how it looks.

25 Researcher And you don't think that you are being disrespectful by thinking in that
26 way?

27 N No.

28 Researcher Okay. Great. Okay that's wonderful so do you all agree that there is nothing
29 conflicting between evolution in school and Hinduism, your religion?
30 We've reached consensus on that.

31 A Yes.

32 Researcher Do you want to add anything to that?

33 C I just know that as Natasha was saying about howit's
34 just likeit's actually kind of the sameit's just like
35 science. [inaudible on recording]

36 Researcher It's a science?

37 C Yah.

38 Researcher Okay um, I'm quite impressed that you are quite well versed in the Hindu
39 scriptures and things. That's really wonderful. Do you know anything
40 about what our scriptures say about how old the earth is?

41 N I don't know how old the earth is but they have timing on you know
42 2011..... for Christian people
43

1 A { 5112, that's the Tamil calendar..... Also when you go back to the
2 scriptures, they don't only speak about life on this plane of existence, it's
3 also on different levels of existence so maybe the world could be 6 billion
4 years old but life on different planes have always continued, so I'm not sure
5 about the age of the earth.

6 Researcher So you said something about 6 billion years?
7 A No I'm just saying.
8 Researcher *[Laugh]* Okay just something arbitrary.
9 A Yah.
10 Researcher So do you know anything about what is written about how humans came to
11 be on earth according to Hinduism?
12 Researcher Nothing? Did you want to say something about the age of the earth?
13 C Age - No but in the Science that we learn today it's about 6 billion years.
14 Researcher Um, there about.
15 C **It doesn't say much in our religion.**
16 Researcher From the Hare Krishna perspective, C?
17 C We haven't got to that chapter yet.
18 Researcher Okay. In studying the Bagvhad Gita, is there no like summary that you all
19 have, that you've learnt about so far?
20 C We actually go through the verses and we take our own notes and he
21 explains to us
22 Researcher And how often are these classes?
23 C Every Sunday.
24 Researcher Where about?
25 C In Pretoria, Church Street.
26 Researcher Oh okay, that's really nice. And that's run by the Hare Krishna?
27 C Yah.
28 Researcher So do you think there's a place for prehistoric life forms in Hinduism?
29 A **Definitely.**
30 Researcher Definitely. Why? Alright, let's hear.
31 A { Because given the fact, what I said about creation, right, from the creation
32 perspective, I believe that it fits in exactly from what we know in Biology
33 that's what I took from what I've read.
34 Researcher In terms of...evolution?
35 A { Yah, but I mean prehistoric life form is part of evolution so I definitely think
36 that it has a place but then like also in the Ramayan, in terms of Lord Rama,
37 they were depicted as very large, very tall people and they started to find
38 skeletons of people, of beings that size. So I think yah, definitely, there's a
39 place for prehistoric life forms.
40 Researcher In Hinduism? C?
41 C I agree with A. Exactly what he said I also believe. Smallest bacteria like
42 what we have now evolved further.
43 Researcher N?
44 N I agree with both of them.

1 Researcher *[laugh]* Okay you are all very amenable to each other. Do you agree with
2 them because of what they are saying to you now or did this occur to you
3 before, before I asked A the question?
4 N I was aware of it before and that some of that which we can see and now
5 that he mentioned it, I can make the correlation.
6 Researcher Okay. That's great so do you believe that there's a process of evolution in
7 Hinduism like we've learnt about evolution in terms of Biology where we
8 talk about organisms evolving. Do you think that there's something like
9 that in Hinduism. We're not necessarily talking about physical organisms
10 evolving but some kind of other evolution. Is there a place for that in
11 Hinduism?
12 A Definitely that's what Hinduism says about Karma and from what the
13 scriptures say, it says that everybody in existence now was in fact demi-God
14 and we have abused our powers so the higher Gods decided to hide the
15 divinity within us because it's more difficult to find there. If they hid on the
16 mountains we would have learnt to climb them. It is essential we all started
17 off from birth to rebirth to get to this divinity hidden within us. Some people
18 maybe started as an evil force whereby they evolved from animals to human
19 so spiritual evolution has a very similar principal in that things change
20 according to you environment. So how you live your life, and your
21 environment and things you did, determine how your soul will progress.
22 Demonic to human to the divine – that is the order in which we evolve.
23 Researcher That's fascinating.
24 C Yah definitely, that's also like reincarnation. We don't know if all people
25 are just going to disappear. They probably just reincarnate into animals and
26 that's probably how they die off. Or we could be still living until the world
27 comes to an end.
28 Researcher We don't know that. Okay Natasha?
29 N I think reincarnation and your spiritual being might be the same because you
30 do evolve in your spiritual being like maybe in this life you might not be as
31 spiritual but in the next life you might see that maybe I should be more
32 spiritual to maybe have a better life, so that evolves as well.
33 Researcher Okay, that's brilliant answers, thank you very much for that. So once again
34 just to recap just a little bit before we move to the next section. Do you
35 think that learning about evolution in school is going against your religious
36 beliefs?
37 A **Not at all.**
38 Researcher C?
39 C No because if you don't know then what is the point?
40 N I don't think it contradicts in any way but maybe if they brought in the
41 Christian way of thinking like Adam and Eve, they might be conflicting.
42 Researcher But in terms of your religious beliefs?
43 N No.

1 Researcher Okay just to get a little more specific now, you've learnt about evolution
2 since Grade 10, right and you've also learned about other topics like the
3 Heart, the Digestive System and all of that. Do you think that there is any
4 kind of comparison in terms of controversy between these two fields of
5 topics, Evolution and the other ones I've mentioned?
6 [Silence]

7 Researcher Because what I'm trying to say is or ask is that with evolution there is a lot
8 of controversy in terms of religion and all of that but when it came to
9 studying the other topics, there wasn't. We were never faced with any type
10 of contradiction.

11 A I suppose that's because evolution comes down to a theory at the end, like
12 Darwin and Lamarck. I mean like it's all just theories. Essentially not
13 everything in it can be proved. Some of it can but not everything but as you
14 said with the heart, that's physical and tangible things. That's definitely
15 what happened, and what's going to happen. So I don't think anyone can
16 argue those points because it's what's happening. It's just how it is.

17 C Yah, I agree because the hand has five fingers or whatever so we can't
18 really disagree to other people because of our knowing. We can say
19 whether it is right or wrong. I don't think there is a problem.

20 Researcher Okay, N?

21 N I do agree. [laughter]

22 Researcher That's why you wanted to be asked last. [laugh]. The next question you are
23 going to answer first!

24 N No, but it is a bunch of theories which are very hard to put together because
25 there is also a lot of debate about it because if you look at the way a whale
26 was evolved and a whale was a land animal and now evolved to a sea
27 animal so then that theory is pretty much fool-proof but with humans there
28 is a lot of - like there's the missing link and and how to find the seven
29 sisters that moved to Europe so it's a lot of theory.....

30 Researcher So in terms of evolution, do you think it was a good idea to include this
31 topic in school? N?

32 N In my personal opinion, I don't think it was very good to include it because
33 there is a lot of debate and maybe in five years time what we learnt now is
34 going to change completely because they've found something else so then
35 our understanding of evolution is going to be wrong according to new
36 technology and what they found so I don't think they should include it.

37 Researcher Okay.

38 C I think that it's good that they included it because if you don't learn about it
39 then how do you know then who are our ancestors. How do we know where
40 we came from and how we landed up here and where we are going so I
41 think that it's nice and and I agree with N that it's obviously going to change
42 but it's nice to learn about it now so we have an understanding of our
43 ancestors.

44 Researcher Okay

1 A I think that it shouldn't be included in terms of that we shouldn't have such
2 a controversial topic. If you look at the Hindu's who do accept it, I'm not
3 sure but Islam and Christianity obviously doesn't. So that does bring out,
4 even in class, they ask questions and it does bring out a bit of uneasiness, so
5 that's why it shouldn't be included. In terms of our understanding our
6 origins and the workings of the world, from the time of creation I think it's
7 an important part of what we need to know and need to learn.

8 Researcher But from a Hindu perspective, do you think it was a good idea?

9 A Yah.

10 Researcher C?

11 C Yah.

12 Researcher N? From a Hindu perspective.

13 N From a Hindu perspective. It is interesting to learn about it but I still think
14 there is a lot of arguments within evolution itself so I still don't think it
15 should be a good idea even though it is nice to know all these things but it's
16 really not.....

17 Researcher So you don't have the opinion or the belief that knowledge changes and that
18 it is not static in any case so that no matter what you learn today, in five
19 years time they change anyway, not necessarily just evolution because
20 technology is advancing so rapidly so anything can change for instance the
21 fluid mosaic model of the cell membrane. That's also just a model because
22 nobody has really seen the way it looks. So that model can also change. So
23 with knowledge, not just with evolution so with knowledge of everything
24 can change.

25 N No but with evolution, you've also got the spiritual thing with it so that
26 causes a lot of arguments as well but in the human body, like the heart, you
27 can't really say there's a spiritual thing in it even though there's love in my
28 heart, you know it's not the same thing, it's not actually spiritual but with
29 evolution there's a lot of spirituality.

30 Researcher Do you think that spirituality comes from somewhere?

31 N Well to be honest, I think that humans created the spiritual being so.....

32 Researcher What I'm asking is that the spiritual nature of evolution, surely when you
33 coming to school it must come from somewhere like your home, your
34 religious leaders. Somebody has put that idea into your mind. You know
35 your origins because that's what you're talking about, right in terms of
36 evolution? So what gives you that spirituality? Is it your own or is it
37 coming from an external source.

38 N I was born into a Hindu family so I guess the traits from my parents rubbed
39 off on me.

40 Researcher Okay. C?

41 C Yah. I agree with what N says. I could just ignore it and be like whatever
42 but I choose to believe in it and I still will. It's like my interpretation.

43 Researcher A?

1 A For me its basically the way I was brought up but I am a very analytical
2 person so I read whatever I needed to read and did whatever research I
3 needed to do and made up my own mind about spirituality and things like
4 that.

5 Researcher And is this a norm in your family where each person is entitled to make
6 their own decision and make their own mind up.

7 A Oh yes.

8 Researcher It is?

9 A Yah because in my mind your can't force religion on anyone, you can't
10 force spirituality on anyone because everyone's at a certain stage in their
11 spiritual transformation and are not ready to do anything that they don't
12 think is right or to be forced on them.

13 Researcher Do you want to add to that?

14 C Yah. Obviously maybe my father doesn't know much or my Grandfather so
15 that's why I am going to these classes so that I can learn more. And I want
16 to be able to tell someone, if they ask me, to give them the right answer
17 so yah, that's it.

18 Researcher So, personally for you it's important to know about your religion?

19 C Yah because I was taught it but I want to know more and that's why I'm
20 reading the Bagavad Gita and that's where I get most of my answers.

21 A From my parents and stuff but in general people especially the older people,
22 they do the stuff – prayers – but they don't know why. They just do it
23 because their mothers did it and their grandparents did it and there is not
24 understanding of the spiritual significance behind it. So I think it is
25 important to find things out and understand why.

26 Researcher So do you think its important then to worry about how to do certain prayers
27 or is it more important to worry about your spiritual growth?

28 C and A Definitely!

29 A For me the rituals and prayers enhance your spiritual transformation and the
30 way things are done has a lot of significance like it helps with your
31 transformation like the chanting of certain mantras lifts vibration, your food
32 prayers lifts vibration of your food and the way you say your prayers
33 starting with a Ganesha prayer or the way you turn Arti or whatever, it all
34 comes down to a science and there is a reason for everything and if you do
35 something wrong, you are not necessarily going to be punished for it but
36 you won't be getting the utmost benefits from the prayer which you are
37 doing. And that prayer, is for God but it's also for you self to transform you
38 self so I think it's very important to know.

39 Researcher Okay. That's great. C?

40 C I think you have to know because you can't just do something just because
41 your parents did it. Like take for example a plant – I see my father watering
42 it so I'll probably water it but I won't know why. You see you water it for it
43 to grow and the same with religion. You water it for it to grow so you

1 become more spiritual or depends what you want in life. You do that
2 certain prayer for something. **There's reasons that behind everything.**

3 Researcher N?

4 N I do agree that **you need to know the reason behind why you do something**
5 **because if you just do it for the sake of doing it then you don't have the**
6 **understanding so then in turn you won't really have the spiritual growth.**

7 Researcher So the understanding is important? Okay. So just to move away a little bit
8 from the evolution in Hinduism, do you understand what is meant by the
9 Scientific method? Have you learnt the scientific method? I am sure you
10 would have. The Nature of Science, hypothesis testing. So can you briefly
11 say what the Nature of Science or the hypothesis testing is about? N?

12 Researcher Yah. What have you learnt about it? What does it entail? The processes.

13 N The processes? For.....?

14 Researcher For anything. Any scientific method, any investigation or anything.

15 N If you want to want to find out something you have to one, come up with an
16 aim, like what's your test and then before you do anything else you have to
17 come up with a hypothesis and that just says what you think is going to
18 happen and then you do your experiment. Well that's the main purpose of
19 the experiment so once you have your experiment you can answer your
20 questions. Which is your aim basically and through that you draw up a
21 conclusion. And well if your hypothesis is wrong, that's what you found
22 and now you know what it is really. That's basically the whole procedure.

23 Researcher C?

24 C Same thing [laugh] she has basically said everything.

25 Researcher Same thing?

26 C Yah.

27 Researcher Ok. So do you agree that the concept of evolution, or as a theory of
28 evolution, what do you understand about this term theory in scientific terms.
29 What is a theory not in everyday terms but in scientific terms?

30 N Its basically a hypothesis so to me for evolution as I've said its very
31 unknown basically so they still have to come up with an actual experiment
32 to draw up a conclusion to answer the hypothesis, if its right or wrong.

33 C Yah. It's just like what you believe. It's just like Darwin has his theory
34 what they believe, what they thought.

35 Researcher So you are saying that a theory and a hypothesis is the same thing.

36 C Yah

37 Researcher Is that what you are saying?

38 N Yes. That basically is it.

39 Researcher A do you want to add to that?

40 A I think it's just a generally accepted idea.

41 Researcher A theory?

42 A Yah. A generally accepted idea or hypothesis.

43 Researcher And why do you think it's generally accepted?

1 A Well I think through some testing and some sort of evidence. I mean the
2 evidence or whatever couldn't have been conclusive otherwise it wouldn't
3 have been a theory. It would have been a confirmed fact so I think there is
4 something behind that ideal and idea but it's still an idea.

5 Researcher So you said confirmed evidence.

6 A Yah. If it was confirmed then it would be a fact and not a theory. So I
7 would say that there is some evidence but nothing conclusive.

8 Researcher So do you think that all of the evidence that they provide for evolution,
9 where do you think that fits in with what you've said about the evidence?

10 A Um, they have found evidence but even with human evolution there is
11 missing links and there are still questions and until those questions can be
12 answered and until those links can be slotted back into place, it will still be a
13 theory because we don't know what happened in that gap, in that time frame
14 where there's nothing so I think, yah..... what was the question?

15 *[laughter]*

16 Researcher The question was theory or what do you think a theory is?

17 A Oh yes.

18 Researcher But that's good, that's fine, you are giving very good responses. That's
19 great. So do you think it was important to learn about the nature of science
20 before you learnt about evolution? Do you think that was an important
21 topic?

22 N I think it was because from that you could understand how you would
23 question it. If we didn't have the science theory then we would just say
24 okay, this is evolution, this is right but despite the science we can still
25 question evolution like we have done.

26 Researcher C?

27 C I think that it's good that we learnt about it because if we didn't learn about
28 it how would we question the reason why it happened?

29 Researcher You liked it in the end. A?

30 A I agree with them.

31 Researcher So basically you agree as well that the nature of science is a good idea to be
32 taught before evolution? So do you think if you were not taught the nature
33 of science as part of evolution, you think then that your perception of
34 evolution would have been different?

35 N In a way we would just believe what was said so we wouldn't question it
36 and if there wasn't science at all to support anything we wouldn't actually
37 believe in evolution.

38 C I agree, because if we didn't have it, we wouldn't know.

39 Researcher But if you didn't learn it then how would that have changed your perception
40 of evolution?

41 A I actually don't know.

42 *[laughter]*

43 I think it would have been like blank, you know.

1 A Yah, we would have just accepted it as okay that's what you are teaching.
2 We wouldn't have questioned it.

3 C You actually never know, there might have been something better than the
4 science theory that we don't know about so if we didn't have the science
5 theory then we

6 Researcher So is there any aspect of the topic of evolution that is disturbing you
7 personally in terms of your religious background?

8 C No.

9 A Not at all.

10 Researcher No, nothing?

11 Researcher So you all say that as a Hindu learning about evolution is not conflicting
12 with your religion. Do you still stand by that?

13 [YES from all]

14 Researcher Okay. Great. Do you think it is more important to accept evolution or to
15 understand it?

16 N Understand it because if you just accept it then you don't understand the
17 whole experiment thing, and things like that so you wouldn't actually know
18 that. If you understood where it comes from and how it comes from them
19 you'd have more of this knowledge which is what we look for.

20 C I think we have to understand it first and then accept it because you can't
21 just accept it without understanding it.

22 A I think it's important, not just evolution, everything, to be able to understand
23 before you accept otherwise people could basically tell you anything and
24 you would just go with it.

25 Researcher So do you think there is a place in Hinduism for both, accepting evolution
26 and understanding it?

27 A I think the understanding comes before the acceptance so I think it's
28 important to accept it but it is more important because you have to
29 understand it before you accept it.

30 [End]

INDIVIDUAL TEACHER INTERVIEW - 28 MAY – TRANSCRIPT 5*TRANSCRIBED BY L. Glaus*

- 1
2
3
4 Researcher How long have you taught life sciences for?
5
6 J With or without evolution?
7
8 Researcher Without evolution.
9
10 J I've been teaching for almost 30 years.
11
12 Researcher The subject of teaching evolution was only introduced in 2008. How did
13 you approach teaching this topic for the first time?
14
15 J I found it a bit difficult, especially the black children that we are
16 teaching. They don't believe in evolution although we showed them, I
17 took them the Cradle of Humankind and they have seen the evidence but
18 still.
19
20 Researcher Why do you think they have difficulty?
21
22 J Because it is something that happened in the past and they are not
23 interested in that, they want to know what's going to happen in the
24 future.
25
26 Researcher So it's got nothing to do with their belief system.
27
28 J No. Oh to some of them, yes. They believe but when I tell them that
29 their ancestors were apes, they look at me a laugh.
30
31 Researcher But mainly you teach Christian learners?
32
33 J Yes.
34
35 Researcher So when you were studying to be a teacher did you ever encounter the
36 topic of evolution?
37
38 J { No but now that I am doing the ACE course we do evolution. Although
39 there is scientific evidence, from my point of view, when I ask my Guru
40 about it he says "Does it make a difference in my life at the present and if
41 it doesn't then I mustn't"
42

1 Researcher So were you as a Hindu personally having problems dealing with this
2 topic?
3

4 J { Not really, when I saw the evidence, I knew there was something and we
5 are heading somewhere but at this present time when I think about what
6 I'm doing or what I'm supposed to be doing, philosophically it makes
7 no difference. Scientifically, yes. There is proof.
8

9 Researcher Having not encountered evolution before, in 2008, when evolution came
10 along and you had to teach it, how did you prepare yourself?
11

12 J { I went through books, I got resources, I went to the Cradle of Human
13 Kind, I read up and also, many years ago we went to Mpumalanga and
14 there they have the models of the dinosaurs so that gave me an idea that
15 there was something on earth before us.
16

17 Researcher So was that the way you were introduced to evolution?
18

19 J Ja.
20

21 Researcher So you didn't have any knowledge of it beforehand?
22

23 J No.

24

25 Researcher So as a Hindu person, would you consider yourself a practising Hindu?
26

27 J Yes I'm a practising Hindu?
28

29 Researcher Why
30

31 J I light the lamp. I pray. I do meditation and introspection be good and
32 live the righteous way of life.
33

34 Researcher And of course you make your annual pilgrimage?
35

36 J Ja.
37

38 Researcher So being a practising Hindu, do you find a need to read scriptures and
39 things? And what is your scriptural knowledge?
40

41 J My scriptural knowledge, I relate my everyday experiences to perhaps
42 the Ramayan because even in the Ramayan when you look at the
43 scriptures, there was somewhere a little bit of this evolutionary trend.

1 { When you think about Hanuman and you look at Ganesha and you look
2 { at Lord Shiva and so on, somewhere there is a little bit of mysticism and
3 { so on.
4
5 Researcher And do you find that that relates closely to evolution.
6
7 J Ja.
8
9 Researcher And what other scriptures besides the Ramayan do you read?
10
11 J Gita, Mahabaratha. Now that I am on this philosophical path, we mourn,
12 we look at the Adigranth and all of them have the same thing. We
13 believe in the law of Karma and what we do in our previous life – we
14 have to pay for. They all say that. The fact that we are sitting and
15 talking, it's Karmic. It was destined and I believe a lot in destiny.
16
17 Researcher And what do you feel about the law of Karma. Where is it taking us
18 really?
19
20 J To me, the way I look at it. If I create new Karma, I have to pay for it
21 either now or in my next life. So whatever I have of my previous Karma
22 I must pay off and not bring about more Karma.
23
24 Researcher So do you think that's ever going to end?
25
26 J { It will, when the Lord decides. When he wants to take you he will take
27 { you and he will place you in a situation where you will be able to finish
28 { off what you have left. For example, you are pregnant and the child is
29 { stillborn, you carry for nine months. What relationship, how do you
30 { explain that? That is Karma. That little child had that much Karma with
31 { you. The Karma is finished and now they must go on.
32
33 Researcher I have also heard that before.
34
35 J The mere fact that we are sitting and talking, its destiny, its Karma.
36
37 Researcher Just to get back to the topic of evolution, because we have digressed a
38 little bit. As a Hindu teacher, do you find that there is any aspect in the
39 topic of evolution that is conflicting with Hinduism?
40
41 J Not really because when you look at Darwin, he said survival of the
42 fittest and then you adapt no matter where you are you've got to adapt. It
43 flows so you have got to look at it as a thing that is moving all the time.

1 You look at it in that light, then it is not so frustrating but if you look at it
2 in isolation then it will frustrate you.
3
4 Researcher So do you find that there is no conflict then?
5
6 J **Not really** because the mere fact that we have adapted to our way of life,
7 **the climate, etc. we are evolving, at any stage.**
8
9 Researcher And you find that Hinduism is able to allow that?
10
11 J **Ja**
12
13 Researcher There is this quote by Dobzansky, I don't know if you've heard of this.
14 He says that nothing makes sense in Biology except in the light of
15 evolution. Do you agree with that?
16
17 J { Ja, I mean look a fire or a flood. We don't find big tall trees still
18 standing up. Somewhere there must be a beginning or procreation. So
19 that is evolution in itself, to me so it is true. Pioneers will come first and
20 they will die off and you will get the next group and the next group.
21
22 Researcher Ja succession.
23
24 Researcher When you are teaching this topic of evolution, you say that you mainly
25 have Christian learners so you don't have any Hindu or Muslim learners.
26
27 J No. This year it's totally black.
28
29 Researcher Did you have any experience with non Christian learners and how did
30 they deal with the topic of evolution?
31
32 J { At the moment I am giving tuition to a Muslim child and to me it seems
33 they don't believe it. Islam does not believe it, they feel that when you
34 die you go to Allah and that's the end. So they don't believe in a soul but
35 I do.
36
37 Researcher Do you think that the religion should be brought in with the teaching of
38 evolution?
39
40 J I think it is a matter of choice. I bring it in incidentally.
41 Researcher How do you do that?
42

1 J I tell them that if you are going to do bad, definitely you are going to be
2 punished.
3
4 Researcher And they don't feel that that is something farfetched?
5 J No they believe it. I mean if I do wrong, I tell them that I am going to
6 get hurt or cut myself or something will go wrong. Then I sit back and
7 say but I did something wrong. And I start probing.
8
9 Researcher So how does that relate to evolution then?
10
11 J Again the theory of Karma and that has been going on for eons.
12
13 Researcher Okay, so in terms of religion and evolution, you think that there is a
14 place for it in the classroom?
15
16 J Ja.
17
18 Researcher And how do you handle conflict when it arises in the classroom?
19
20 J I tell them that they are entitled to their views and if a question like that
21 arises in the exam, they have to agree and disagree and give their
22 reasoning.
23
24 Researcher So in the exam, do you question them on their religious views?
25
26 J Not really but if I ask them do they believe in the theory of evolution
27 they will say no. Then I will ask them why and then they have to
28 substantiate.
29
30 Researcher And then they are allowed to give their religious perspectives. And how
31 do you mark it?
32
33 J Well that's open ended; if it makes sense to me then we give them to
34 benefit of the doubt. I mean it's their views as long as they can justify it.
35
36 Researcher Since you say that you have scriptural knowledge, is there anything in
37 the scriptures that talks about the age of the earth.
38
39 J I think somewhere in the Ramayan there is because remember if you
40 look at Kanyakumarie they say there is a tunnel that is going through,
41 have you heard about that.
42

1 Researcher I didn't know about the tunnel but I heard about a temple that was right
2 in the middle of the ocean.
3

4 J And then how did the people get through, there is a sort of a tunnel. And
5 recently will I was in India, they did photographs from the air into the
6 sea and they did find a ... Oh no, not a tunnel, it was a bridge sorry and
7 they have evidence of this.
8

9 Researcher In terms of the age, what do you think is the age is according to the
10 scriptures you've read.
11

12 J It may be a couple of millions of years old.

13

14 Researcher Really in terms of Hinduism?
15

16 J I mean the mere fact that there was Lanka. and there was the sea, there
17 was a forest. You now it tells you that there was the earth. Hanuman
18 had to go and get the mountain.
19

20 Researcher So how does this compare with what you are teaching with regard to the
21 age of the earth? Can you find some kind of common ground there?
22

23 J You know in evolution they talk about millions and millions and millions
24 of years ago. I don't know when you look at the fossils that they have
25 gathered it could be possible. Like when you look at the shape of the
26 earth and continental drifts and now they are saying that the continents
27 are drifting together. It makes you think.
28

29 Researcher So in terms of the age of the earth, do you think that there was some
30 common ground when it comes to Hinduism and evolution?
31

32 J Yes there is.

33

34 Researcher Do you think in Hinduism there is a place for prehistoric life forms?
35

36 J Ja because they talk about Hanuman and other creatures that were here. I
37 remember seeing a movie that was in black and white, many years ago,
38 about this person who had to go through various stages in order to get to
39 his goal. There were all different types of creatures that he had to face
40 and go through all these tormenting situations before he could get to the
41 goal. An Indian movie and it relates to my thinking that no matter how
42 much we go through there is always a goal at the end. We are so
43 materialistic that we cannot see it. We are bound so much by

1 materialism that we cannot see that because it's keeping us down. And
2 there are creatures that are here, like ET's. They are here.
3
4 Researcher You believe that?
5
6 J Ja, I mean we are not alone.
7
8 Researcher In terms of our religion, do you feel that in Hinduism that something is
9 lacking, something that we don't prescribe enough?
10
11 J We are so overshadowed by modern things and modern living, especially
12 the younger generation. They don't want to believe it. I suppose that
13 their life style is such that there is no time for religion.
14
15 Researcher Do you think that's a good thing?
16
17 J No it's not a good thing. Remember they said that Hinduism started in
18 the East and then it spread so Hinduism is the oldest religion and then
19 people started believing in Christianity and Islam and so on but
20 Hinduism started in the East and spread from there and that it is where it
21 originated. And I'm proud. There is evidence, there's temples and
22 caves. You go to India and you see proof of the age of Hinduism.
23 Nowadays people don't have the time or the enthusiasm to look at
24 religion. They think we are born, we are here to earn money, have fun
25 and we are gone but what happens thereafter? The youth don't want to
26 subscribe to anything.
27
28 Researcher Do you think that when you are teaching evolution it is necessary to
29 include the nature of science?
30
31 J What do you mean by the nature of science?
32
33 Researcher You know the nature of science is the scientific method, hypothesis
34 testing.
35
36 J You know they should start becoming aware, start testing for themselves
37 whether it is true or not, so yes it's necessary.
38
39 Researcher You travel once a year to India, do you ever speak to people about
40 evolution in India and how do they regard this process?
41
42 J You know there is proof, even in India. They do find fossils and so on
43 like I said, they do believe, I think. There is evidence.

1
2 Researcher And the people are they generally accepting of it?
3
4 J Ja, because in India there is not that much scope in their daily life, they
5 are not exposed. They get up in the morning, they do their thing, they
6 pray. They are more religious orientated. More trying to make a living
7 than thinking about evolution. So even if you talk they will say that it
8 did exist. They are people that will say that there was something here on
9 this earth before us.
10
11 Researcher Do they have a time frame for that?
12
13 J I don't know.
14
15 Researcher It would be very interesting to find out from them in India about this.
16
17 J You should try and find out from the people that are here from India that
18 are working here.
19
20 Researcher I am just confining it at the moment to South African Hindu's but it
21 would be interesting to get that perspective.
22
23 J Most of the teachers that have come from India are mostly Christian but
24 there are odd ones that are Hindu but you could speak to them and they
25 will tell you how they feel here being in South Africa and their views. I
26 can give you the details of a teacher in Lotus Gardens. She is Tamil and
27 comes from India.
28
29 Researcher That will be nice, I know in Midrand there are a few people from India
30 but they are not teachers.
31
32 Researcher Do you think it's important for learners to accept evolution or to
33 understand it?
34
35 J I think if they understand it then they will be able to accept it.
36
37 Researcher Do you think that it's necessary for them to accept evolution?
38
39 J It's their own decision.
40
41 Researcher So it's more important for them to understand it.
42
43 J Ja, if they understand it then naturally they are going to accept it.

1
2 Researcher In Hinduism did you come across some similarities of how evolution and
3 life began and progressed? Like is there any process or story that
4 happened in Hinduism that is very similar to the process of life evolving?
5 Something that you can draw a parallel with.
6
7 J Not really.
8
9 Researcher That's the end of this interview. Do you have anything to add?
10
11 J What are your views?
12
13 Researcher My views I will have to put off the record.
14
15 END
16



1 **INDIVIDUAL TEACHER 2 INTERVIEW – TRANSCRIPT 6**

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Transcribed by L. Glaus

Researcher Good Morning T, thank you for being part of this interview and agreeing to take part. Just a few questions because you are Hindu and because you are teaching Life Sciences. So because my study is about how Hindu's view the topic of evolution, part of my interview process is to interview teachers who are teaching Life Science so that is why you have been chosen.

So the first question is how long have you taught Life Sciences for?

T For the past 11 years.

Researcher The topic of evolution, however, has only been introduced into the syllabus in 2008 so how did you approach teaching this topic for the first time?

T It's very difficult, extremely difficult but getting a little background on evolution helps but the problem was with respect to the different perspective. The different religions, evolution and how the kids actually interpreted it and that was the biggest problem I had. I never looked at a case where you actually brought about an argument with the kids because that is opening up a whole can of worms so just as the syllabus required – is just the way I taught it. I think that was the best way to approach the situation.

Researcher Have you encountered the topic of evolution in your studies to be a teacher?

T No, the first time I did it was in 2007 with Jose De Beer.

Researcher Do you mean like when we did Zoology and stuff like that?

T No we never did that.

Researcher you've said no, so how did you prepare yourself to teach it?

T Self study and then all the workshops that we attended at UJ and at Wits. Then there was also training in 2006 at the schools in Johannesburg.

Researcher Who was the service provider there?

T It was the GDE.

Researcher So how would you rate your knowledge of evolution? With a scale of 1 – 5 with 5 being excellent?

T I would say 3.

1 Researcher Then relating to that how would you rate your pedagogy? That means the way
2 you teach it?
3
4 T With respect to teaching it I would also go with 3, because if you look at the
5 individuals that are coming into the classroom whatever you are going to
6 discuss with the kid is in relation to their perspective as well. So that's how I
7 would rate it also at a 3 because specifically with our learners here, you need to
8 go into a lot of background knowledge because they find it very very difficult to
9 deal with the terms and with actually accepting all of the information that is
10 presented to them.
11
12 Researcher Why do you think they have a problem accepting it?
13
14 T I think it's because of their maturity levels.
15
16 Researcher How do you mean?
17
18 T { Their ability to actually function at a certain level and also the fact that there is
19 a lot of information out there so it conflicts with what they are learning at
20 school and from what they are learning from other media and all those sorts of
21 things.
22
23 Researcher So as a Hindu teacher, is there any part of evolution that you find to be in
24 conflict with your religion?
25
26 T { Well it's taken for granted that it's taken from the Christian religion but they
27 never take into consideration what we have to say about it and that where I have
28 a problem. The Hindu learners don't exactly pick on it because the whole class
29 is dominated by the aspect of Christianity in itself so they never bring it up. If
30 we had to bring in reincarnation and rebirth, they are not going to understand
31 anything about it. If you take the way Hanumanji came about – for me to
32 actually explain that to the learners from a different cultural origin, is very very
33 difficult. They are not going to understand the content and it will mean me
34 taking them way back to the scriptures. In a sense, as a Hindu teacher, I think it
35 should be part of the syllabus if we approach it from that aspect but otherwise
36 the only thing that the kids are only going to learn one aspect of it.
37
38 Researcher So being a Hindu person, you don't feel that there's something you have to
39 teach conflicting with your religion?
40
41 T { Absolutely, because as I said if you look at the way Hanumanji came about and
42 then you look at the way evolution transcends it's difficult to put that in
43 context. How is it possible for Hanumanji to be brought about in that aspect and
44 then if we look at it from a scientific aspect then evolution says that we got
45 individuals or organisms that adapt to that environment and go through a
46 process of change in relation to their environment so there is conflict.
47

1 Researcher How do you deal with this aspect of conflict in the classroom? In other words
2 do you teach it as pure fact or as speculation? In terms of what you've just said
3 now where evolution talks about the gradual change of organisms and what
4 your belief system is telling you.
5

6 T I actually teach it from the theories and on the facts and evidence that is given
7 to us. If we approach it from the religious aspect, it's going to create a whole
8 debate and that's going to prevent us from looking at what is present and how it
9 actually influences our living. So I think it's best to teach it from the facts that
10 are given and the evidence that is given. I'm not saying that we should exclude
11 it totally; you can include it but most probably after you have presented all of
12 the evidence to them. From there they can decide we want to go the route of
13 evolution or we want to go the route of creationism. So give them the
14 opportunity to decide what they want.
15

16 Researcher Can you explain if there is any way in which Hinduism is in harmony with what
17 evolution is trying to teach? Is there any aspect of evolution that is not
18 conflicting with Hinduism?
19

20 T Well there's nothing that I have actually come across.
21

22 Researcher Is there any part of Hinduism, from the scriptures or your world view of
23 Hinduism, where you feel that there is some kind of link to evolution?
24

25 T The only part that would be that way is the part of creation of an organism.
26 When we bring about the barriers and things like that. That would be the only
27 part that would be in harmony with evolution but other than that, if you think
28 about what our scriptures tell us, I don't see anything.
29

30 Researcher So how do learners respond when the topic of evolution is taught compared to
31 any other topic in Life Science is taught?
32

33 T Argumentative. They want to prove what they know is correct. I have
34 experience that a lot this year. The group that we have got (names learners in
35 class). They don't want you to tell them that there is another perspective that
36 you can look at. So there was a lot of debating. Although from the beginning
37 we presented the information to the last part of it, they wanted from the
38 beginning to go into that state. It must be an argument.
39

40 Researcher So they didn't really just accept the facts?
41

42 T No they want to know more and they want you to tell them that their way is the
43 right way. And they don't want it to be abstract, they want absolute concrete
44 proof. Those simulations that we showed them, while they were sitting here –
45 didn't even want to know about it. The ones about Darwin's Theory and the
46 giraffe – that was one example. They did not want to accept stuff that was being
47 told to them.

1
2 Researcher In my classes, they were fascinated with it and just accepted it.
3
4 T No for them, it was always “but” never just okay so that’s how it occurred.
5
6 Researcher That’s good in a way.
7
8 T But even what we are doing now with the Drugs and stuff – you should hear
9 them. They all bring their own experiences into the class. Ester for example
10 said that in Holland dagga was legal for example. They went into a whole
11 argument about that. **Those situations you have to take into consideration.**
12
13 Researcher But that’s very good with the kids. It’s good that they are questioning and not
14 just accepting.
15
16 T It can also be dangerous especially when it comes to exam times.
17
18 Researcher Can you account for this difference in the response because in other topics, they
19 just accept it.
20
21 T The difference in the topic is that they want to see **concrete evidence** but for
22 instance if you look at the brain – you can actually look at the brain. If you
23 **looking at fossils** and all of that they want to know, where did that come from?
24 How did it get there? How long has it been there? And if you tell them the
25 method that is used then they want to know why the method is used. So it’s
26 quite abstract for them to understand. And I think that’s one of the reasons they
27 find it so difficult.
28
29 Researcher So the trip we took them on, did that help in any way?
30
31 T Yes it did help but they also said that its stuff that they already knew. So that’s
32 the issue there. Maybe what we can do next time is take them there first and
33 then teach it afterwards. We must consider that in the future, especially for the
34 grade 10’s.
35
36 Researcher Should religion be brought in with the teaching of the topic of evolution?
37
38 T Yes different religions **should be taught** but not in a sense of debate but in a
39 sense of comparing it to evolution. To show them where the differences lie.
40 Maybe in that aspect but not in the sense of an argument.
41
42 Researcher Why do you think, not in the sense of an argument?
43
44 T { Because an argument is going to become personal and you are going to have to
45 deals with a situation where a child is going to be offended and things like that
46 and you don’t want that situation.
47

1 Researcher Can you describe the nature of science?
2
3 *Interviewee exclaims, not happy!*
4
5 Researcher The nature of science is just another name for the scientific method which is the
6 hypothesis testing we've been teaching them.
7
8 T I would say that the nature of science is being involved in the actual practice of
9 science as you said the methods of science and the testing, the practical and
10 physically finding out where the evidence comes from and how it got there and
11 things like that.
12
13 Researcher So you think it's the evidence basically?
14
15 T Well the evidence supporting the observation that you make.
16
17 Researcher So do you use the nature of science when teaching any topic in life science?
18
19 T Yes.
20
21 Researcher Particularly evolution?
22
23 T Yes in the excursion, that was the one aspect of it but actually physically going
24 out there and finding the evidence, it's beyond our control to do something like
25 that.
26
27 T But if you look at a topic like photosynthesis, that's something that we can do.
28
29 T Yes.
30
31 Researcher But when you were teaching this topic of evolution did you ever explain the
32 nature of science first and then tell them about evolution?
33
34 T **Yes we did do that.**
35
36 Researcher By doing it like that, do you think it helps the learners understand how
37 evolution takes place and how the theory came to be?
38
39 T **Yes it did. It definitely does.**
40
41 Researcher Is there an official standing on teaching evolution in Hinduism? For example
42 with creationism from a Christian point of view, we know that many churches
43 forbid it. Even that it may have been agreed on by the Pope but many churches
44 don't regard evolution as something that should be taught. In Hinduism, is
45 there anything like that?
46

1 T I don't think that the Hindu religion would do something like that because if
2 that were the case then we wouldn't accept any other religion. I have not seen
3 any evidence of it being disregarded in our scriptures or anything of that sort.
4
5 Researcher Do you think there is a reason for that?
6
7 T I think it's because Hinduism is a science as well and is open to understanding
8 and to reason that's why it hasn't opened itself to ignoring the theory of
9 evolution.
10
11 Researcher Your knowledge of the Hindu scriptures. Where do you think you stand with
12 regards to that? Do you have any knowledge of Hindu scriptures?
13
14 T Just bits and pieces of it. If you look at our Hindu texts and stuff, I haven't
15 completely read all of them.
16
17 Researcher But you have read some of it?
18
19 T { Yes, not completed it. Just a bit of the Ramayan. I know a little bit of the
20 functions that we have but I haven't gone directly into reading the whole
21 scriptures end to end.
22
23 Researcher But you know aspects of it?
24
25 T Yes.
26
27 Researcher So in reading those scriptures, was there any reference made to evolution and as
28 to how old the earth could be?
29
30 T { No I haven't come across that but Hinduism is the oldest religion and it might
31 have been mentioned somewhere along the line but I really haven't taking
32 cognizance of it.
33
34 Researcher As a Hindu, what stance do you use when dealing with learners from other
35 faiths whose religion conflicts with evolution like e.g. Christians and Muslims
36
37 T { Well obviously in order for you to accept what they are saying, you have to
38 know what their religion says and in that respect it's important to be neutral
39 because of the conflicts that can arise and that is why I wouldn't offend any of
40 the learners . You have to give them their little say so I am neutral when it
41 comes to the religious part.
42 Researcher So do you ever try to convince them?
43
44 T I have tried and that's why I'm saying that I'm neutral.
45
46 Researcher How do you try to convince them?
47

1 T Well if you look at science with us being science educators you will obviously
2 have this information towards evidence, scientific evidence and theories on how
3 these things are put together although you make have a little bit of background
4 on scriptures and things like that. Now putting that in perspective with respect
5 to the learners and if you look at the different religions that we have, do we
6 have the time of giving it the time and importance that it deserves?
7

8 Researcher That's a problem. The time factor.
9

10 T You can't bring up Christianity and then the bell goes and you can't discuss it
11 any further
12

13 Researcher So you mainly go with scientific evidence?
14

15 T Yes but you can give them the opportunity to bring that idea in but I would
16 put forward more of the evidence.
17

18 Researcher So you don't ever bring in Hinduism?
19

20 T I might have done it once or twice but the majority of the kids here are Christian
21 and then we also are looking at the different cultural backgrounds. You can't
22 just focus on one, the minute you do that they are going to say that that is your
23 belief. So I try to do it here and there but not all the time.
24

25 Researcher So as a Hindu teacher teaching Life Science, do you think it's more important
26 for the learners to accept evolution or believe in it?
27

28 T I think in order for them to accept it, they will have to believe it. If they don't
29 believe what you are telling them then they won't accept it. They need to make
30 sense of it.

31 Researcher So do you think it's necessary to believe evolution?
32 T No just to understand it. If they don't understand it they can't believe it.
33 Researcher But what if they don't want to believe it but they do understand it? Do you
34 think there's a place for that?
35 T There's a possibility, yes but that will only come about through conflict.
36 Researcher So the understanding is key?
37

38 T Yes, they must understand or they won't believe in it.
39

40 END
41

1 INDIVIDUAL TEACHER 3 INTERVIEW – TRANSCRIPT 7

2 *TRANSCRIBED BY L. Glaus*

3 *Introduction*

4

5 Researcher How long have you taught Life Science for or involved in the Life
6 Sciences curriculum?

7

8 C For 35 years. First it was Biology and then it was Life Science.

9

10 Researcher Wow, that's truly remarkable.

11

12 Researcher So the topic of evolution was introduced into Life Science in 2008. How
13 did you deal with it when it was introduced?

14

15 C In 2008 I was already a facilitator so I had to prepare myself first, go
16 through a lot of books and write up a summary because you know there
17 was not a lot of books that we could really consult with at that time. So
18 in the beginning it was very difficult because we didn't know what depth
19 to go, what order to follow so all that had to be collected from different
20 books. Evolution was one of my subjects when I did BSc so that helped
21 me a lot. I made a summary of what I thought should be introduced and
22 what shouldn't be but then Mr Isaacs book came out which was a great
23 help. The depth and the content – made it very much easier. The first
24 year it was difficult to place it in order of what to do and what not to do.

25

26 Researcher I agree with you, Dr Isaacs book was a very big help.

27

28 C Ja, it was a very big help.

29

30 Researcher I see that you mention that you did do evolution in your BSc.

31

32 C It's such a long time ago.

33

34 Researcher Do you remember what you actually learnt about?

35

36 C You know, in evolution, we started off with Darwin's Theory and what
37 Darwin believed and all the snippets of what we are studying now but
38 not in greater depth.

39

40 Researcher So you did encounter evolution before.

41

42 C Ja, and I enjoyed it. It's a very interesting topic but a schlep to teach.

43

- 1 Researcher Okay so how would you rate your teaching skills, your pedagogy? You
2 can use a scale from 1 to 5 with 5 being excellent.
3
- 4 C I think I would scale it as 4 because there isn't enough practical
5 knowledge about how to teach it practically. There's a lot of theoretical
6 knowledge but how to bring this theory in a classroom situation becomes
7 difficult. That's where my lack is. There aren't enough practical
8 examples that you can use. There are pictures and things but you can't
9 go into laboratory situations which would really bring it to life.
10 Otherwise we are dealing with pictures and that doesn't make it very
11 exciting. So I would say about 4 because theoretically it's not a problem,
12 it's the practical part.
13
- 14 Researcher What is your knowledge of evolution from 1 – 5
15
- 16 C With the new things coming in I would say 4. That's with the new
17 things coming in – you can't be abreast of every text, you know.
18
- 19 Researcher So as a Hindu teacher, is there any aspect of evolution that you find to be
20 in conflict with your religion?
21
- 22 C No.
- 23
- 24 Researcher That was very quick!
25
- 26 C Ja.
27
- 28 Researcher Why would you say that?
29
- 30 C Because Hinduism doesn't regard evolution as..... it doesn't not
31 believe in evolution but they have their own aspect of how they believe
32 in evolution because if you look at life everything goes through a cycle
33 of change, everything. I mean you give birth, you become a baby, you
34 go through adulthood, you die. That process in itself is an evolution.
35 You look at your cells, they mature and they die. So in life, if you look
36 at the rhythmic cycles of climates, you look at all the changes in the
37 climatic factors and you adapt to it. Also Hinduism doesn't have any
38 problem with evolution as such because it's all built in the religious
39 aspect of it so it's not a problem.
40
- 41 Researcher In the classroom or with your teachers did you ever find that there was
42 some conflict?

- 1 C Yes the Christian teachers were very against it to teach evolution. They
2 were adamant, at first they were adamant that they were not going to
3 teach it but you had to tell them that you not teaching it as a religion, you
4 teaching it as scientific facts. Not even scientific facts, it's still a theory.
5 You must present it in such a way that you are just giving the available
6 facts that we have now and available facts can also change. So you have
7 to talk to your teachers in such a way – don't teach it as a religion but
8 teach it as scientific facts that we have available now and be very
9 impartial and let the learners decide if they want to accept or not, because
10 there are a lot of facts that are available so you can't negate that . But at
11 the beginning there was a lot of resistance especially with the white
12 Christian teachers.
13
- 14 Researcher So you didn't really experience conflict from the Hindu teachers in your
15 district?
16
- 17 C You know that in our district are no Hindu teachers.
18
- 19 Researcher Okay, so that's not a good question.
20
- 21 Researcher So basically then, you encourage that evolution should be taught as pure
22 fact?
23
- 24 C Ja
- 25
- 26 Researcher Not as a speculation?
27
- 28 C No, no as the evidence is available, you teach it as such.
29
- 30 Researcher Do you regard yourself as a practising Hindu?
31
- 32 C Yes, I do.
33
- 34 Researcher Why do you say so?
35
- 36 C I believe in all the principles of Hinduism and I try to put it into practice.
37 The principles of honesty, unconditional love, gratitude, not worrying.
38 You know all those principles. And the universe will take care of it. I
39 meditate. In my house there are always prayers in the morning, prayers
40 in the evening. We go to all the major festivals and we enjoy doing it.
41
- 42 Researcher So by being a practising Hindu, do you find that rituals are very
43 important in your life?

1
2 C Look, there are a lot of rituals but you have to go beyond the rituals. You
3 have to know that rituals are just the doing part of it. There are essences
4 behind these rituals. At the beginning rituals are necessary for you're to
5 evolve, again using the word for the spirituality of your religion. So
6 rituals are important to start you off but once you know what the rituals
7 are, you go beyond it and then rituals are not necessary. I don't light the
8 lamp every day but I meditate every day and I hope that would give me
9 some of the answers that I need. We have answers, and I meditate
10 regularly and I ask for answers to whatever questions I have. So I think a
11 lot of them have been answered so I'm happy with that. I don't force my
12 children to take part in whatever I am doing. My children want to pray
13 then they pray, at least when I ask them to pray at least to the higher self.
14 With children it's important to bring them the best that's why I take them
15 to these functions so they know what Hinduism is all about that it's
16 beyond that, it's not just rituals. The religion is not the spiritual side.
17 It's like saying Swaha but just saying it with one hand, not knowing what
18 it means.
19
20 Researcher So you touched on a very important part, where you said you don't do
21 everything everyday and you don't force your children to do it, so do you
22 think that's one of the tenets of Hinduism?
23
24 C Hinduism is a very individual religion, it doesn't prescribe things, it
25 doesn't say you must pray morning and evening but it does say that it
26 helps your ascent, your soul to ascend. So if your one to understand
27 yourself better, then praying is a good thing but it isn't enforced on you.
28 One of the aspects of Hinduism, is that it's very individualistic and then
29 you bear the consequences of what every you are going to do.
30
31 Researcher We will touch on that point just now.
32
33 Researcher Do you have any knowledge of the Hindu scriptures, of our Hindu
34 scriptures?
35
36 C Very little. The original scriptures?
37
38 Researcher No, any of them.
39
40 C Yes some of them but you need a Guru to help you interpret them. They
41 can have so many interpretations. The Ramayan, the Gita can have so
42 many aspects of your life. Both the Ramayan and the Gita is actually
43 teaching you how to live your life everyday and to interpret it, it is a very

1 involved so you do need a Guru to help you. Just reading it doesn't
2 always explain everything. So we do read the Ramayan and ask people
3 around us who are more knowledgeable than us to help us understand it
4 better.

5

6 Researcher So at least you do have an idea of what the scriptures are about.

7

8 C Not as far down as the Ramayan. I know about the Gita but the Vedanta
9 is very philosophical and difficult to understand.

10

11 Researcher So the reason I ask about your scriptural knowledge, is I want to know if
12 there is anything in the scriptures that talk about evolution?

13

14 C Yes there's lots of aspects in the **Scriptures but only in the Vedanta** part.
15 If you listen to your Guru's they are always talking about how you
16 evolve and how the earth evolved. But what it comes down to is that the
17 energies have developed you and from there you evolved so there is
18 **supreme energy that resulted in your soul being formed**. From there you
19 could have evolved into whatever.

20

21 Researcher That's interesting; you are saying lots of important things. Do you
22 understand, well I know you do, the fundamental issues regarding
23 evolution and what are the main principals behind evolution itself?

24

25 C Shoo, now I must put it in words. It's difficult.

26

27 Researcher The main idea is that the children have to learn.

28

29 C Yes the main idea is that the children have to learn that these cells – if
30 you want to start with that – evolved. The earth went through changes
31 therefore these cells had to change to fit into the changing universe.
32 Then changes occurred in bodily structures. **Those structures that**
33 **weren't needed were left aside and those structures that were needed**
34 **evolved into other structures**. There are similarities in lots of these
35 structures depending on the life of that particular organism. I think that's
36 the basic or the one aspect of it and the other aspect of evolution is what
37 did the people of that time think about what was going on. We have also
38 made mistakes like the Theorists so it's not an absolute truth.

39

40 Researcher So do you think that learners respond differently to when they are taught
41 any other topic for example Nervous System?

42

- 1 C Yes I think so, **teaching evolution as it is now at school, is very boring.**
2 It's a very interesting topic but it's been presented – all the theorists, all
3 the changes, what are the reasons for the changes, what dates this
4 happened – it becomes very boring. I'm saying don't delete the topic –
5 find another way of teaching it and perhaps leave out some of the
6 aspects.
7
- 8 Researcher So you don't think as a teacher the field trips and things would help.
9
- 10 C { How many schools can afford to go on field trips? It would help for
11 primary schools to go on field trips. I worked in a black school, so I
12 used this as an example. The schools are very far away and they are very
13 poor, they can't afford a bus to come to Marapeng or even Wits and to
14 tell you the truth the Wits lecturers are just as boring. Ja Really, I mean
15 one of the lecturers we had was just presenting everything he had on
16 PowerPoint and eventually I even stopped thinking. It was very boring
17 for me Who was it?
18
- 19 Researcher Do you think that religion should be brought in with the teaching of
20 evolution?
21
- 22 C I think that you should respect the children's viewpoint otherwise you
23 negate the idea of **teaching evolution scientifically.** You can't say leave
24 your religion aside. You must say some religions don't agree and some
25 religions do agree but you have to make your own choices according to
26 what you feel comfortable with. If you don't bring religion in at all –
27 there will be a certain amount of conflict. You have to **somehow try to**
28 **bring the two together.**
29
- 30 Researcher At the moment in the syllabus they only talk about creationism and
31 intelligent design as alternative theories. Do you think there's a place for
32 other religious view points as well?
33
- 34 C { Yes there is place – if you look at African culture, although I haven't
35 read it widely, just a little bit – they also believe in evolution. Their
36 thoughts were very eastern – a lot of them now have become Christians
37 and they don't believe in it. I do believe there is a place for other
38 religious beliefs – Judaism.
39
- 40 Researcher Hinduism?
41
- 42 C Well I would say there is a place for it but it will bring a lot of conflict
43 where you have in a classroom multi religious and I don't believe that

1 our children are mature enough to accept the religious point of view.
2 Just to bring one of the aspects – if you show a Christian child Kali-Ma,
3 for them it's like frightening. It's because they were not brought up to
4 understanding that. Even adults, they don't really have enough
5 knowledge or they don't want to. Teachers don't have enough
6 knowledge so it will be very difficult to bring it in. Just one aspect of it –
7 reincarnation- to explain to a person who doesn't believe in it. To
8 explain this to a Christian person is very difficult so it's going to cause a
9 lot of conflict in multi religious classrooms. I think it would be accepted
10 in a Hindu school as such but the teacher will have to be very well
11 prepared. So in a way, the way we are doing it now is good enough by
12 just saying that there is **creationism and intelligent design. Remember**
13 **that Hinduism believes in creationism plus evolution** – that's an added
14 factor.

15
16 Researcher How do you mean that we believe in creationism as well?

17
18 C { We believe that our souls are born from the Almighty and that our souls
19 are created there but our souls have the ability to evolve. The soul can
20 evolve in that it can become better, it can go backwards so although the
21 soul never dies, it has the space to evolve and make a better place on
22 earth.

23
24 Researcher Do you think there's a place in Hinduism for biological evolution so far
25 you've mentioned spiritual evolution?

26
27 C { Ja, I did mention that if you look at your body growth from one single
28 cell and conception, it develops into two, it develops into four – isn't that
29 evolution? If you think amount a simple thing like amoeba evolved into
30 multi cellular. If you go the way zoology is taught, the way zoology is
31 demarcated, you start teaching amoeba, then you go on to the hydra,
32 then you go on to Planaria and all of those things, isn't that a form of
33 evolution.

34
35 Researcher Is there a part of for that in Hinduism?

36
37 C Yes because **we are always changing and our environment can effect that**
38 **change.** There might come a time when hydra's will all disappear
39 because there is no need for that because if you look at embryology, the
40 beginning factors of development from that one cell is so much similar
41 so there's biological evidence.

42
43 Researcher As Hindu's do we believe that?

1
2 C Ja we do.
3 Researcher Okay so there's no contradiction there on that side?
4
5 C { No, everything goes through a process of evolution from birth to death so
6 why can't a Phylum go through evolution from birth to death?
7
8 Researcher So there's nothing in Hinduism that says that this does not happen?
9
10 C { No, from what I know. In the scriptures, never have I come across a
11 saying that evolution does not occur. But for some the belief is
12 creationism and then evolution.
13
14 Researcher That's interesting. With regards to Hinduism do you have any idea what
15 Hindu's believe the age of the earth to be.
16
17 C There is some conflict about that. I can't remember the exact age itself
18 but it's much much more than what is recorded in the Western world.
19 It's much much more. I've read a book called Comparisons of World
20 Religions and because this book is written by a Western person they
21 never acknowledge that recordings were done in the east a long long time
22 before. So I think its millions of years ahead, what has been recorded in
23 the Western world. I don't have the exact age.
24
25 Researcher So you have this perception in your mind that the earth is very old,
26 millions of years old, so how do you bring that into the teaching or
27 dealing with the teachers?
28
29 C { You know to tell you the truth, I never brought it in because then it
30 creates a conflict. And remember that I was the only Hindu in my
31 district. So it creates a conflict as to why isn't the recorded accepted and
32 I have no answer for that so there are certain times that you leave things
33 alone. As it is, there's enough conflict about teaching evolution. I don't
34 want to bring more problems.
35
36 Researcher Is there any aspect in Hinduism that looks to how evolution occurs?
37
38 C I have no idea. I can't comment on that. I mean I don't have anything
39 like Darwin recorded.
40
41 Researcher No, nothing like that, I mean any other principles of Hinduism that
42 occurred that is very similar to evolution, that makes it easier for Hindus
43 to accept.

1 C There are but I can't specify any. When you read Deepak Chopra's book
2 you will get a lot of that in there but I can't put it in a sentence. That's
3 the difficult part of it.
4
5 Researcher Okay that's fine.
6
7 Researcher What stance did you take with other learners whose faith conflicted with
8 Hinduism?
9
10 C What I did with my teachers was to provide them with all the
11 understanding of the religious groups understanding of evolution. I went
12 on the Internet and found how what the Islam believe in evolution, what
13 the Hindu believes in evolution, what the Jews believe in evolution. I
14 provided these notes to my teachers and we then set up a research
15 questionnaire which they provided to the learners. The learners had to
16 choose two religious groups and provide their ideas on evolution and
17 eventually give their own idea on evolution.
18
19 Researcher Do you think that method helped to make it easier to accept?
20
21 C You know what; it's difficult to say what teachers accept. They just do
22 what we tell them. I haven't done any research but I saw the assignment
23 in the books. This was done with or without understanding – I can't say.
24 There is no scientific way I can say that my teachers accepted this – no
25 way. They might have accepted it because I'm saying so or they may
26 have believed something totally different. There is no way of knowing.
27
28 Researcher I have been asking students this question about what they think is more
29 important – to understand the process of evolution or to accept it. What
30 do you think?
31
32 C I don't think we can force anybody to accept this, that's the major thing
33 that comes out of this. You can give them the facts and it is up to them
34 to accept it. You give the teachers the facts but you can't enforce it.
35 You can say teach it but you can't say that's what you must believe. That
36 is very personal.
37
38 Researcher Do you think understanding it is important?
39 C Yes I think so because a lot of acceptance comes from understanding. A
40 lot of acceptance of the principles of evolution comes from
41 understanding.
42 End
43

- 1 **N Interview – 13 May**
- 2 Researcher: ¹Okay. Hello N.
- 3 N: ²Hello.
- 4 Researcher: ³My name is Mrs Reddy as you know and I'm gonna just be
5 asking ⁴you a few questions, because what I'm basically doing
6 is a study ⁵to look at how Hindu teachers and learners view
7 the topic of ⁶evolution. Because we know that, umm, in, in
8 class we are always ⁷teaching the learners about a Christian
9 perspective of evolution ⁸and maybe in your case, because
10 you're in an Islamic school, ⁹umm, a Muslim perspective. But
11 we don't really do much about a ¹⁰Hindu perspective, so that is
12 what my study is about. So I just got ¹¹a few questions to ask
13 you and, umm, you must please be as ¹²honest and as open
14 as you can. Umm, and please feel free to, to ¹³chat, and ask
15 questions and whatever. Okay. So, the first ¹⁴question, just to
16 establish everything, is how long have you taught ¹⁵life
17 sciences for?
- 18 N: ¹⁶Umm, now co-continuously it's now, nine years.
- 19 Researcher: ¹⁷Okay, and before that?
- 20 N: ¹⁸Before that I was in a primary school teaching mathematics
21 and ¹⁹natural sciences.
- 22 Researcher: ²⁰And in that natural science there was no evolution?
- 23 N: ²¹Evolution, no.
- 24 Researcher: ²²Okay. So the topic of evolution has been introduced into the
25 ²³syllabus since 2008. How did you approach teaching this
26 topic for ²⁴the first time?
- 27 N: ²⁵Okay. **At first it was a bit difficult for me because I, you must**
28 **remember I never did it at school myself.**
- 29 Researcher: ¹Mmm.
- 30 N: ²And even when I went to, when I, in my studies, of my post-
31 matric ³studies, it wasn't a topic that was very dealt with in-
32 depth and it ⁴was like brushed over by the lecturers and
33 things.
- 34 N: ⁵In fact, even in our examinations...
- 35 Researcher: ⁶Mmm.
- 36 N: ⁷...they didn't even ask us anything about, they didn't question
37 us, it ⁸wasn't part of the exams or anything. So, there was this
38 ⁹knowledge that there was this theory of evolution...
- 39 Researcher: ¹⁰Mmm.
- 40 N: ¹¹...and whatever I knew about it, is whatever I gleaned from
41 ¹²television, uh, reading **a bit about it and things like that.** And
42 being ¹³in the biology field at that time, when it was called
43 biology.

1 Researcher: ¹⁴Mmm.

2 N: ¹⁵Uh, it wasn't really necessary to know much about it.

3 Researcher: ¹⁶Mmm.

4 N: ¹⁷So I really never bothered to go in-depth with studying it,
5 studying ¹⁸it and things like that.

6 Researcher: ¹⁹Ja.

7 N: ²⁰Like I had to do now. So, when it started off now in 2008 it
8 was ²¹something new and I was a bit, uh, I'd say a bit unsure
9 of myself ²²because I didn't want to give the, have the wrong,
10 uh, perspective ²³of it and give the learners the wrong
11 perspective.

12 Researcher: ²⁴Mmm.

13 N: ²⁵So, it was a bit trying at first.

14 Researcher: ¹Okay. So you say that you did encounter the topic of
15 evolution ²when you were training to be a teacher?

16 N: ³Ja.

17 Researcher: ⁴But do you know, do you remember what aspects were, were
18 ⁵taught to you?

19 N: ⁶No, basically they just discussed that, well Darwin went, he
20 ⁷studied this and he came up with the, umm, [*inaudible*] with
21 his ⁸boat, the HMS Beagle...

22 Researcher: ⁹Mmm.

23 N: ¹⁰...and he went to the Galapagos Islands and stuff like that.

24 Researcher: ¹¹Mmm.

25 N: ¹²But not in detail and they didn't look at, uh; natural
26 succession ¹³and they didn't look at natural, sorry, natural
27 selection.

28 Researcher: ¹⁴Ja.

29 N: ¹⁵They didn't, ah, discuss, ah, the teachings of that.
30 Lamarckism ¹⁶and things like that. We didn't learn, learn all
31 that stuff.

32 Researcher: ¹⁷Aha.

33 N: ¹⁸It was just a brushed over...

34 Researcher: ¹⁹Mmm.

35 N: ²⁰...very, very quickly.

36 Researcher: ²¹Do you think, do you have any idea why they would've
37 brushed ²²over it?

38 N: ²³I think at that time, possibly, those that were actually
39 lecturing to ²⁴us, they themselves didn't have much knowledge
40 about it ²⁵themselves.

41 Researcher: ²⁶Mmm.

1 N: ¹And very much under the Apartheid, it was during the old
2 ²Apartheid government, the Christian National Education
3 thing.
4 Researcher: ³Ja.
5 N: ⁴They didn't want to go into detail with it.
6 Researcher: ⁵Okay.
7 N: ⁶Okay, uh, and so I think everybody just toed the line and
8 brushed ⁷over, because we needed to know that there was
9 such a thing as ⁸the theory of evolution.
10 Researcher: ⁹Mmm.
11 N: ¹⁰And that's it.
12 Researcher: ¹¹Okay, and also because it wasn't in the syllabus.
13 N: ¹²Yes.
14 Researcher: ¹³So you were not, there was no details given?
15 N: ¹⁴Ja.
16 Researcher: ¹⁵Okay. So, you've already said that you've prepared yourself
17 to ¹⁶teach it to learners by, basically educating yourself.
18 N: ¹⁷Yourself, ja.
19 Researcher: ¹⁸Ja. So did you attend any workshops? Or anything?
20 N: ¹⁹Umm, 2008 there was a **workshop that, uh, held by the**
21 **²⁰department at, at, the National Zoological Gardens.**
22 Researcher: ²¹Mmm.
23 N: ²²I had to go. I, I actually, I went for that and, umm, what are
24 we ²³doing is, uh, we're getting handouts and things like that
25 we're ²⁴going through that. Uh, I use a lot of the internet,
26 Googling and ²⁵finding out things.
27 Researcher: ¹Mmm.
28 N: ²Um, like when you came across, uh, Erasmus Darwin...
29 Researcher: ³Mmm.
30 N: ⁴...right? Umm, uh, prior to that I only knew of Charles
31 Darwin...
32 Researcher: ⁵Yes.
33 N: ⁶...I never even knew...
34 Researcher: ⁷Ja.
35 N: ⁸...that his father was, or it was his grandfather...
36 Researcher: ⁹Mmm.
37 N: ¹⁰...was actually involved in it. **So I had to Google and find out**
38 **what ¹¹Erasmus Darwin took.**
39 Researcher: ¹²Ja.
40 N: ¹³A lot of it is coming to my own, own research...
41 Researcher: ¹⁴Mmm.
42 N: ¹⁵...and things like that.
43 Researcher: ¹⁶Mmm.

1 N: ¹⁷And then looking at the textbooks, looking at the variety of
2 ¹⁸textbooks and then trying to find, because some of them give
3 you ¹⁹different ver... If you look at the textbooks they all don't
4 give you ²⁰exactly the same...

5 Researcher: ²¹Yes.

6 N: ²²...emphasis and things like...

7 Researcher: ²³Mmm.

8 N: ¹...to find the middle of the road, kind of thing, which
9 addresses the, ²the, the, the syllabus as well.

10 Researcher: ³Mmm. Okay. So, you are a Hindu teacher in an Islamic
11 school, ⁴okay, which puts you in a very, ah, interesting
12 position. Okay. So ⁵as a Hindu person, how, do you find any
13 aspect in the topic of ⁶evolution that is conflicting with
14 Hinduism?

15 N: ⁷If you look at a, uh, a, the Hindu teachings, as, as far as I'm
16 ⁸concerned...

17 Researcher: ⁹Mmm.

18 N: ¹⁰There's no real mention made of anything like evolution and
19 ¹¹things like that. We, we learn that, uh, uh, basically the
20 universe ¹²itself was created by, uhh, one of the Gods
21 churning up the, umm, ¹³I don't know, some kind of, uh,
22 primordial...

23 Researcher: ¹⁴Mmm.

24 N: ¹⁵...ocean or something like that and that's how the planet was
25 ¹⁶created and how life was created.

26 Researcher: ¹⁷Mmm.

27 N: ¹⁸But there is no, uh, umm, mention of, of anything about
28 evolution, ¹⁹but in the same breath, ah, **Hinduism is not so**
29 **dog-dogmatic that** ²⁰**it prescribes that you should not be**
30 **open...**

31 Researcher: ²¹Mmm.

32 N: ²²...to learning anything new. So for me I, **I've had this open**
33 **approach**. If, if it is something which is acceptable and which
34 ²⁴makes sense and it, and it can be proved scientifically then I
35 must ²⁵accept it.

36 Researcher: ²⁶Mmm.

37 N: ¹And, um, my point of view about it is that if I look at
38 everything, my ²point of view is that everything could not have
39 occurred by ³accident...

40 Researcher: ⁴Mmm.

41 N: ⁵...evolution around different lines cannot have occurred by
42 ⁶accident. Where we have, if you look at all the, the, the, the,
43 where ⁷we share the same genetic markers...

1 Researcher: ⁸Ja.

2 N: ⁹...as different species, completely different species, it, it
3 cannot be, ¹⁰it could not have happened by accident, right?

4 Researcher: ¹¹Mmm.

5 N: ¹²Umm, I, **I believe in a form of controlled evolution.**

6 Researcher: ¹³Mmm.

7 N: ¹⁴That's my personal way...

8 Researcher: ¹⁵Okay.

9 N: ¹⁶Ah, evolution **was controlled by some higher being.** That's
10 what I ¹⁷believe. Umm, unfortunately I dare not mention that in
11 my school.

12 Researcher: ¹⁸Ja. So, so tell me about what happens at, in your school...

13 N: ¹⁹Okay.

14 Researcher: ²⁰...Islamic students.

15 N: ²¹Okay, when you start a lesson like that, this year for
16 example, this ²²year was particularly difficult, right? Most of
17 them, in, in the matric ²³class, and I'm looking at the boys...

18 Researcher: ²⁴Mmm.

19 N: ²⁵Are what they call [*hafeziz*].

20 Researcher: ¹Okay.

21 N: ²They study the Koran off by heart...

22 Researcher: ³Ja.

23 N: ⁴...and they very, very set and, uh, orthodox in their approach.
24 So, ⁵they believe that the earth is no more, **according to the**
25 **Islamic ⁶teachings, the earth is no more than a million years**
26 **old.**

27 Researcher: ⁷Oh!

28 N: ⁸Okay? That is it, the earth is a million years old these,
29 therefore ⁹these things could not have occurred.

30 Researcher: ¹⁰Okay.

31 N: ¹¹Okay? Man could not have been those things didn't exist.

32 Researcher: ¹²Mmm.

33 N: ¹³There is something wrong with the dating process...

34 Researcher: ¹⁴Mhmm.

35 N: **¹⁵They say there is something wrong with radiometric dating;**
36 **¹⁶there is something wrong with relative dating...**

37 Researcher: ¹⁷Hmph.

38 N: ¹⁸It, it cannot be correct and, umm, so and that's it.

39 Researcher: ¹⁹So how do they account for when man came to be on earth?
40 ²⁰What, what is their reasoning for that?

41

1 N: ²¹They believe that God created Adam and then from Adam...

2 Researcher: ²²Ja

3 N: ²³...we came.

4 Researcher: ²⁴So, do they have a time, timeframe for that?

5 N: ¹Well, there's no set timeframe and they, their, their beliefs are

6 ²quite simple. Adam was created by God...

7 Researcher: ³Mhmm.

8 N: ⁴...and Adam was a giant.

9 Researcher: ⁵Oh, a giant?

10 N: ⁶Yes.

11 Researcher: ⁷Right.

12 N: ⁸and Adam, and, and from Adam's rib, extra rib, whatever...

13 Researcher: ⁹Ja.

14 N: ¹⁰...Eve was created...

15 Researcher: ¹¹Mmm

16 N: ¹²...and Eve was a giant as well.

17 Researcher: ¹³Okay.

18 N: ¹⁴And they lived in the Garden of Eden or Eden or in paradise

19 ¹⁵which they call Jannat.

20 Researcher: ¹⁶Mmm.

21 N: ¹⁷And they did something wrong, which angered God and he

22 cast ¹⁸them out and they became small like ordinary humans.

23 Researcher: ¹⁹Ohh. So do they have a reason for why they were giants?

24 N: ²⁰No, they cannot account for that and also it's very difficult for

25 me ²¹to ask them directly...

26 Researcher: ²²Mmm.

27 N: ²³...to substantiate.

28 Researcher: ²⁴Ja.

29 N: ¹Because I will be seen as questioning their religion...

30 Researcher: ²Their religion.

31 N: ³...and their teachings.

32 Researcher: ⁴So is there, is there any, anything in the Koran that, that

33 actually ⁵specifically says they were giants?

34 N: ⁶Yes.

35 Researcher: ⁷Is that what they are saying there?

36 N: ⁸Yes.

37 Researcher: ⁹Ohh. Okay, that is very interesting; I never knew that about

38 Islam. ¹⁰Mmm.

39 N: ¹¹Ja, I also never knew that...

40 Researcher: ¹²Ja.

41 N: ¹³...until they told me.

42 Researcher: ¹⁴Okay.

1 N: ¹⁵And coz when we looked at the diff, the different species and
2 how ¹⁶ah, basically, ah, ah, man, ah, evolved to, ah, well,
3 according to ¹⁷the theory of evolution...

4 Researcher: ¹⁸Mmm.

5 N: ¹⁹...they changed and things like that. To Homo erectus...

6 Researcher: ²⁰Ja.

7 N: ²¹...and we looked at them and I said, actually they were, **they**
8 **were ²²a bit shorter than us.**

9 Researcher: ²³Ja.

10 N: ¹And they said: "No! It can't be, if they were the first, if they
11 were ²the first individuals they had to have been giants, so this
12 thing is ³wrong."

13 Researcher: ⁴Oh. So, they, they directly equating...

14 N: ⁵Ja.

15 Researcher: ⁶... the Koran to...

16 N: ⁷Ja.

17 Researcher: ⁸...the theory of evolution basically. Okay, that's, that's really
18 ⁹fascinating. I never knew that.

19 N: ¹⁰Okay. So eventually I had to actually go to the principal and,
20 and ¹¹the board members...

21 Researcher: ¹²Ja.

22 N: ¹³And tell them look, **this is part of the syllabus,** whether you
23 like it ¹⁴or not, it has to be taught in this way.

24 Researcher: ¹⁵Mmm.

25 N: ¹⁶These are the requirements.

26 Researcher: ¹⁷Ja.

27 N: ¹⁸And these are the things that, that must be met.

28 Researcher: ¹⁹Mmm.

29 N: ²⁰So, I actually had to give them a list...

30 Researcher: ²¹Ja.

31 N: ²²...looking at the pacesetters and things, give them a list and
32 tell ²³them look, this is what you need to know, this is what you
33 need to ²⁴do and this is what you need to know. And I am
34 going to teach it ²⁵to you in that way. **Whether you accept it**
35 **personally or not is your ²⁶business...**

36 Researcher: ¹Mmm.

37 N: ²...but in the exams it will be tested, you, if you, if they test
38 you, **³they are gonna test your knowledge on that aspects.**

39 Researcher: ⁴Mmm.

40 N: ⁵Not on your personal aspects so much. It might, they might
41 ask you ⁶in your personal opinion...

42 Researcher: ⁷Ja.

43 N: ⁸...but, it's not gonna carry much weight.

1 Researcher: ⁹Mmm.

2 N: ¹⁰So you have to learn this, whether you like it or not.

3 Researcher: ¹¹Mmm. Okay, so, so you emphasized the, the facts...

4 N: ¹²Ja.

5 Researcher: ¹³... that they had to know the facts basically. So, when it
6 comes to, ¹⁴for example, you now, as a Hindu person, how do
7 you deal with ¹⁵that kind of conflict in your class? With the
8 Muslim learners?

9 N: ¹⁶Okay, umm, the first thing that I'll have I, I, I tell them is look,
10 a-a-¹⁷according to my religion there's...

11 Researcher: ¹⁸Mmm.

12 N: ¹⁹...no mention made of evolution. So what I am teaching you
13 first ²⁰of all, is not my religious belief.

14 Researcher: ²¹Mmm.

15 N: ²²It's got nothing to do with my religion as such...

16 Researcher: ²³Mmm.

17 N: ²⁴...uh, I'm teaching you what's in the textbook.

18 Researcher: ²⁵Ja.

19 N: ¹So I am not teaching you my religion. I am not trying to
20 undermine ²your religion...

21 Researcher: ³Mmm.

22 N: ⁴...uh, my religion comes no-, has nothing to do with it. I'm
23 teaching ⁵it to you purely as a life sciences educator.

24 Researcher: ⁶Mmm.

25 N: ⁷And, uh, if there's something that affects you as a Muslim,
26 ask it to ⁸me as, ah, as an individual, ah, ah, as a fellow
27 human being rather ⁹than questioning a Hindu about why is he
28 teaching this or trying to ¹⁰change and I think, uh, when I clear
29 that up with them...

30 Researcher: ¹¹Mmm.

31 N: ¹²...they will, okay, I don't, I don't know if they were accepting,
32 they ¹³allowed me to give the lesson.

33 Researcher: ¹⁴Okay. So do you think they would not have been receptive at
34 all ¹⁵to hearing about the Hindu perspective?

35 N: ¹⁶No.

36 Researcher: ¹⁷They wouldn't have? And how did they deal with learning
37 about ¹⁸creationism then, from the Christian perspective?

38 N: ¹⁹Umm...

39 Researcher: ²⁰Because that is...

40 N: ²¹Ja.

41 Researcher: ²²...the syllabus.

42 N: ²³Umm. You see there's lots of common points between the
43 ²⁴Christian religion and, and Islam.

1 Researcher: ²⁵Mmm.

2 N: ²⁶As far as that, cr-creationism is concerned...

3 Researcher: ¹Ja.

4 N: ²...so they don't question much, they may differ here and
5 there...

6 Researcher: ³Mmm.

7 N: ⁴...okay, but generally they, they believe in the same things
8 where ⁵on the first day **God created**, on the second day...

9 Researcher: ⁶Ohh.

10 N: ⁷...God... They do believe in that.

11 Researcher: ⁸Ja.

12 N: ⁹Right? In fact, they would equate everything in, even the, the,
13 the, ¹⁰the, the look at the prophets mentioned in the Old
14 Testament...

15 Researcher: ¹¹Mmm.

16 N: ¹²...and, and, wha-whoever's mentioned in, in the new, in the
17 New ¹³Testament.

18 Researcher: ¹⁴Mmm.

19 N: ¹⁵Basically, they us, they are also mentioned, may have been
20 given ¹⁶a slightly Islamic or Arabic, uh, name or...

21 Researcher: ¹⁷Ja.

22 N: ¹⁸Right? But they, ah, they believe in the same things
23 basically.

24 Researcher: ¹⁹Mmm.

25 N: ²⁰Right?

26 Researcher: ²¹Ja.

27 N: ²²Because generally if you look at it, it's basically, ah, ah, a
28 religion ²³which is Semitic in its origins...

29 Researcher: ²⁴Mmm.

30 N: ¹Right, since, umm, Asia Minor, whatever...

31 Researcher: ²Ja.

32 N: ³So, they have lots and lots, ah, lots of things which are the
33 same.

34 Researcher: ⁴Mmm.

35 N: ⁵So, they got their, except, lots of the *[Inaudible]* the theory,
36 the ⁶creationism...

37 Researcher: ⁷Ja.

38 N: ⁸...and things like that, because it has got to do with them.
39 Like, uh, ⁹we...

40 Researcher: ¹⁰Mmm.

41 N: ¹¹...we talk about Adam and Eve, they say, they call them
42 Adam ¹²and Hawa.

43 Researcher: ¹³Okay.

1 N: ¹⁴Okay, it's basically the same and everything, even the
2 prophets, ¹⁵Abraham is Ebrahim, everything, so...

3 Researcher: ¹⁶Mmm.

4 N: ¹⁷...they don't really question much, ah, creationism.

5 Researcher: ¹⁸Okay.

6 N: ¹⁹Okay, but they do differ here...

7 Researcher: ²⁰Ja.

8 N: ²¹...and there.

9 Researcher: ²²So if it was a Hindu perspective they would definitely be...

10 N: ²³They won't...

11 Researcher: ²⁴...be opposed to it?

12 N: ¹Ah, I wouldn't be teaching in that school...

13 Researcher: ²Ja.

14 N: ³...if it had to come to that.

15 Researcher: ⁴Ja, I know. They would be totally opposed to it.

16 N: ⁵Ja.

17 Researcher: ⁶And to you.

18 N: ⁷Ja.

19 Researcher: ⁸Ja, that's, that's really, that is the crux of my study, you see?
20 It's to ⁹look at this Hindu perspective...

21 N: ¹⁰Perspective, ja.

22 Researcher: ¹¹...because, because it hasn't been given any, ah, ah space
23 in the ¹²curriculum.

24 N: ¹³Curriculum.

25 Researcher: ¹⁴So probably that's also why there is so much of, umm, ah,
26 conflict ¹⁵when it comes to Islamic people.

27 N: ¹⁶Ja.

28 Researcher: ¹⁷Accepting it or, or wanting to know about it.

29 N: ¹⁸Ja.

30 Researcher: ¹⁹Maybe not accepting it, just wanting to know about it.

31 N: ²⁰Okay.

32 Researcher: ²¹So that's the problem. So, do you think that religion should
33 even ²²be brought in when teaching the topic of evolution?

34 N: ²³I suppose because man's existence...

35 Researcher: ²⁴Mmm.

36 N: ¹...can be explained scientifically and religious, is, is explained
37 ²religiously according to Islam, Christianity and Judaism.

38 Researcher: ³Ja.

39 N: ⁴Then you have, you, you will find yourself invariably having a
40 ⁵religious discussion in your class...

41 Researcher: ⁶Mmm.

42 N: ⁷...and strangely enough, even though I've got purely Islamic,
43 ⁸Muslim students in a class, you do get debate inside...

1 Researcher: ⁹Mmm.

2 N: ¹⁰...because they have different views within their religious

3 group.

4 Researcher: ¹¹Ja.

5 N: ¹²So that also comes about...

6 Researcher: ¹³Oh...

7 N: ¹⁴...as well.

8 Researcher: ¹⁵Okay.

9 N: ¹⁶I mean I had, I had a heated debate about, uhh, some-

10 something ¹⁷to do with evolution.

11 Researcher: ¹⁸Mmm.

12 N: ¹⁹Umm, whether, umm, for example, like, umm, you know

13 when ²⁰you looked at patterns. We looked at, uh, things, they,

14 they ²¹attempt, they use something actually from the book, the

15 Da Vinci ²²Code...

16 Researcher: ²³Mhmm?

17 N: ²⁴...one learner used the, the concept of the, the divine, umm,

18 ratio ²⁵phi...

19 Researcher: ¹Oh, yes, yes.

20 N: ²You read that right?

21 Researcher: ³Ja.

22 N: ⁴He used that and he said that that can't be in every, in umm...

23 Researcher: ⁵In...

24 N: ⁶...in everything, all aspects of life if it happened by accident.

25 Researcher: ⁷Ja.

26 N: ⁸And I said okay, that is something that I would agree with and

27 the ⁹others said no, why you bringing something that comes

28 out from a ¹⁰Christian teaching or, well maybe something

29 related to ¹¹Christianity and things like that. And then they had

30 a debate about ¹²basically that, uh, there is certain things in

31 Christianity that are ¹³part of Islam.

32 Researcher: ¹⁴Mmm.

33 N: ¹⁵And the one day [*cell phone rings words inaudible*] Excuse

34 me.

35 Researcher: ¹⁶Okay.

36 ¹⁷[*Cell phone continues to ring and is shut off*]

37 Researcher: ¹⁸Okay, so, so do you think that different religious beliefs

38 should be ¹⁹taught alongside evolution? Besides just

39 Christianity and ²⁰Islamic...

40 N: ²¹Uhh, I think there is a space for the, this, the, the, the, this

41 ²²teaching but I don't think so much in life sciences.

42 Researcher: ²³Mmm.

43 N: ²⁴I think more in, in, in life orientation...

1 Researcher: ²⁵Ja.

2 N: ¹...so that they get this kind of, of background...

3 Researcher: ²Mmm.

4 N: ³...that different re-religions have certain beliefs about
5 creation...

6 Researcher: ⁴Mmm.

7 N: ⁵...how, ah, life came about...

8 Researcher: ⁶Ja.

9 N: ⁷...and they learn to respect that.

10 Researcher: ⁸But at your school now with life orientation, do they even
11 teach ⁹different religious perspectives?

12 N: ¹⁰Ummm.

13 Researcher: ¹¹Or is it just focusing on Islam?

14 N: ¹²They actually, they do know a bit about different religions...

15 Researcher: ¹³Mmm.

16 N: ¹⁴...but personally as a Hindu, I find that what they know about
17 Hinduism stems from them watching Indian movies...

18 Researcher: ¹⁶Ohh...

19 N: ¹⁷...they watching Indian movies...

20 Researcher: ¹⁸...the Bollywood movies?

21 N: ¹⁹Yes. Whatever they see them with their little [*Inaudible*] the
22 guy ²⁰praying to the deity or...

23 Researcher: ²¹Mmm.

24 N: ²²...for help and things like that. They know most of the deities.
25 In ²³fact, I was quite surprised; they know most of our deities.

26 Researcher: ²⁴Mmm.

27 N: ¹And probably, I don't know, maybe somewhere they been,
28 uh, ²spoken to about it or given talks about it and stuff like
29 that. And ³they have an, uh, an opinion about it, but I am quite
30 clear that ⁴when I came to the school, we made an agreement
31 that they don't ⁵talk religion to me, which they don't stick to.

32 Researcher: ⁶Mmm.

33 N: ⁷And I don't speak religion to them.

34 Researcher: ⁸Okay.

35 N: ⁹That's it. To learn learners or teachers, but they do
36 sometimes say ¹⁰things. They ask me and it tell them look I am
37 not allowed to, I, I ¹¹don't want to discuss it.

38 Researcher: ¹²Mmm.

39 N: ¹³So, what in a biology class or a life science class, if it's, if it
40 ¹⁴pertains to the, the subject, then I'm going to have to do it.

41 Researcher: ¹⁵Mmm.

42 N: ¹⁶That's what I think.

43 Researcher: ¹⁷Okay. So, ja, you wanted to add?

1 N: ¹⁸Ja, okay, like when you, uh, in fact like last year when we did
2 re- ¹⁹human reproduction...

3 Researcher: ²⁰Ja.

4 N: ²¹...and they looked at us and they asked about, umm,
5 ²²contraception, what's the Hindu perspective about it?

6 Researcher: ²³Mmm.

7 N: ²⁴And I said look, uh, there is nothing concrete given in
8 Hinduism ²⁵that says no contraception...

9 Researcher: ²⁶Ja.

10 N: ¹...and neither does it said yes, you can use con-
11 traception, but ²also you look at it and as far as Hinduism it
12 says you may not take ³a life.

13 Researcher: ⁴Ja.

14 N: ⁵So, in a, that kind of thing...

15 Researcher: ⁶Mmm.

16 N: ⁷And, umm, well, they didn't ask much af-further than that.

17 Researcher: ⁸What does the, what do they say Islamic people...

18 N: ⁹Uhh, contraception...

19 Researcher: ¹⁰...about contraception?

20 N: ¹¹...is, is forbidden.

21 Researcher: ¹²Mmm.

22 N: ¹³Uh, if it's Allah's will that you have a child then you will have
23 a ¹⁴child.

24 Researcher: ¹⁵Mmm. Okay.

25 N: ¹⁶That's it.

26 Researcher: ¹⁷So, just to move away from the religious aspects a little bit,
27 can ¹⁸you describe the nature of science? The scientific...

28 N: ¹⁹The nature?

29 Researcher: ²⁰...you know the scientific method, hypothesis, testing, the bit
30 that ²¹we teach them in, in class.

31 N: ²²Okay. Uh, wha-what basically do you wanna know? What
32 ²³method?

33 Researcher: ²⁴Do you understand that concept? How the scientific method
34 ²⁵works?

35 N: ¹Ja, basically science is more about enquiry...

36 Researcher: ²Mhmm.

37 N: ³Umm, enquiry, umm, experimenting, umm, and all things
38 related ⁴to, to experimenting and finding and discovering...

39 Researcher: ⁵Mmm.

40 N: ⁶...and learning through discovery.

41 Researcher: ⁷Okay.

42 N: ⁸That's what it, it means to me.

43 Researcher: ⁹And have you taught the learners nature of science?

1 N: ¹⁰Umm...

2 Researcher: ¹¹Because remember now in the curriculum...

3 N: ¹²Yes.

4 Researcher: ¹³...lots of questions are on the nature of science.

5 N: ¹⁴The nature of science.

6 Researcher: ¹⁵Ja.

7 N: ¹⁶Look it doesn't come in directly. It comes; you've got to link
8 it...

9 Researcher: ¹⁷Mmm.

10 N: ¹⁸...at different points in, in the curriculum.

11 Researcher: ¹⁹Ja.

12 N: ²⁰Like when you do, umm, like what we did now, umm, DNA
13 and...

14 Researcher: ²¹Mmm.

15 N: ²²...nucleic acids and things like that. When we looked at
16 ²³experimenting and finding out and we actually did things like,
17 ²⁴umm, uh, DNA extraction...

18 Researcher: ¹Ja.

19 N: ²...at school...

20 Researcher: ³Ja.

21 N: ⁴...then we had to look at why are we doing this?

22 Researcher: ⁵Mmm.

23 N: ⁶Wha-Why do we want to find out about DNA? What is the
24 purpose ⁷of it?

25 Researcher: ⁸Mmm.

26 N: ⁹And why do we use all these different steps and that's
27 basically ¹⁰the enquiry...

28 Researcher: ¹¹Ja.

29 N: ¹²...and finding out...

30 Researcher: ¹³Mmm.

31 N: ¹⁴...and, umm, I had to do it that way because, uh, well I, I had
32 to ¹⁵explain to them first. We, we, this is why we gonna do
33 this...

34 Researcher: ¹⁶Mmm.

35 N: ¹⁷...and, umm, some of them will ss, would, would debate
36 could we ¹⁸do this or could we use that and that well, for me,
37 was, okay, they ¹⁹learning basically...

38 Researcher: ²⁰Ja.

39 N: ²¹...scientifically, because they asking, they questioning, they
40 not ²²blindly accepting.

41 Researcher: ²³Ja, ja, that's good.

42 N: ²⁴Okay, so, so that was for me, that was good.

1 Researcher: ¹Okay, because why I am asking you is, you know, with
2 evolution, ²because it's such a controversial topic, umm, the
3 textbook that we ³are being, that we're using at the moment,
4 has a bit on the nature ⁴of science...

5 N: ⁵Science.

6 Researcher: ⁶...first. Before it introduced the whole topic...

7 N: ⁷The topic, ja.

8 Researcher: ⁸...and I think the reason for that is because they want to
9 present ⁹the evidence for evolution...

10 N: ¹⁰For evolution.

11 Researcher: ¹¹...and maybe that will convince the learners...

12 N: ¹²The learners.

13 Researcher: ¹³...that this theory, you know, it is out there, and, umm, it was
14 ¹⁴arrived at because of the evidence...

15 N: ¹⁵The evidence.

16 Researcher: ¹⁶...and not just because somebody dreamed it up.

17 N: ¹⁷Okay, no even, uh, I mean we did that, right? Even [Stutters]
18 even ¹⁸when we looked at the evidence...

19 Researcher: ¹⁹Mmm.

20 N: ²⁰I found lots of them were concentrating on the evidence
21 against.

22 Researcher: ²¹Ohh.

23 N: ²²Okay, and they were very critical of the textbook, the
24 textbook we ²³use is the textbook by Isaac's...

25 Researcher: ²⁴Oh yes, Understanding Life Science.

26 N: ¹Ja and umm, they said, umm, they're not paying, they're not
27 ²giving, umm, enough evidence against, because they came
28 up ³with all different things and they gave the Islamic
29 perspective.

30 Researcher: ⁴Ja.

31 N: ⁵But what about the fact that the earth is only a million years
32 old?

33 Researcher: ⁶Hm-mmm.

34 N: ⁷Okay. And how they, how, how, umm, how sure are they that,
35 ⁸umm, radiometric dating is accurate...

36 Researcher: ⁹Ja.

37 N: ¹⁰...and things like that. They ask questions like that and where
38 is ¹¹the missing link? And who, umm, you know things like
39 that.

40 Researcher: ¹²Mmm.

41 N: ¹³Surely if the whole earth is, is, earth is such a big place, you
42 know ¹⁴things like that...

43 Researcher: ¹⁵Ja.

1 N: ¹⁶...so they looked at all these things that were not given in the
2 ¹⁷textbook. You see and then they said you don't, you can't
3 say that ¹⁸the one is correct...

4 Researcher: ¹⁹Ja.

5 N: ²⁰...and the other is incorrect because, uh, there's more
6 reasons ²¹given because they haven't probably haven't looked
7 deeper into ²²it to give reasons against. And, umm, I'll be
8 honest with you, I was ²³like okay, I, there's nothing I can say
9 against that.

10 Researcher: ²⁴Mmm.

11 N: ²⁵What you said because it makes sense.

12 Researcher: ²⁶Ja, because I suppose they are using the Koran...

13 N: ¹Ja.

14 Researcher: ²...and whatever is written in there as another reference book.

15 N: ³Ja.

16 Researcher: ⁴And they are using that as a comparison to what you are
17 ⁵teaching...

18 N: ⁶Yes.

19 Researcher: ⁷...them in the classroom.

20 N: ⁸Yes.

21 Researcher: ⁹That's basically what they were doing, isn't it?

22 N: ¹⁰And also that, you know thing you like, uh. Where they said
23 the ¹¹missing link?

24 Researcher: ¹²Ja.

25 N: ¹³They said the earth is so big; a man has got such advanced
26 ¹⁴technological tools and things like that. They can't find one
27 fossil ¹⁵or one remain of something? One, umm, one tooth or...

28 Researcher: ¹⁶Mmm.

29 N: ¹⁷...something. So, that means that it didn't exist.

30 Researcher: ¹⁸Mmm.

31 N: ¹⁹So there is no link, coz it never existed.

32 Researcher: ²⁰So, don't they understand how fossils form then?

33 N: ²¹Yes they do understand that. We, we did that.

34 Researcher: ²²Ja.

35 N: ²³So they said not one of them, you know that not one of them
36 ²⁴became fossil fossilised. There's nothing, its un-, impossible.

37 Researcher: ¹Mmm. Ja, well, I guess in that way...

38 N: ²Ja.

39 Researcher: ³...you have nothing to say...

40 N: ⁴Ja.

41 Researcher: ⁵...as a teacher. Because if you go against their religion...

42 N: ⁶Yes.

43 Researcher: ⁷...it's gonna be big problems...

1 N: ⁸Ja.

2 Researcher: ⁹...and then there'll be more conflict.

3 N: ¹⁰Ja.

4 Researcher: ¹¹So, uhh, according to Hinduism is there an official stance as
5 to ¹²whether evolution should be taught or not?

6 N: ¹³Uh, **to my knowledge, no, I don't think so.**

7 Researcher: ¹⁴Is it?

8 N: ¹⁵I do know what the South African Hindu Maha Sabha says...

9 Researcher: ¹⁶Ja, what do they say?

10 N: ¹⁷I, no, I said I don't know...

11 Researcher: ¹⁸Oh, you don't know, oh okay.

12 N: ¹⁹No, I don't know what they say but, generally, umm, for me
13 the ²⁰point of view is, ah, **I don't particularly agree with the**
14 **theory of ²¹evolution...**

15 Researcher: ²²Mmm.

16 N: ²³...but it needs to be taught so that the learners get a different
17 ²⁴perspective.

18 Researcher: ¹Ja.

19 N: ²So, umm, I really have the, actually, umm, ignored it. in fact,
20 you ³are asking me the question, and it made me now to think
21 I must ⁴actually find out what do they want us to do.

22 Researcher: ⁵Mmm. Thing is, you see that's why when, umm, doing this
23 study ⁶that's what I am looking at. What does Hinduism say
24 about it?

25 N: ⁷Okay, I actually I don't know what they say about it.

26 Researcher: ⁸Mmm.

27 N: ⁹But I know what the, our teachings say basically.

28 Researcher: ¹⁰Ja.

29 N: ¹¹But generally, the official stance about it, is an official
30 ¹²interpretation from the **Gita and all the Upanishads** and all,
31 doesn't, ¹³well, uh, non official is in the learned scholars...

32 Researcher: ¹⁴Mmm.

33 N: ¹⁵...and have not said much about it, I think.

34 Researcher: ¹⁶Okay. Now you mentioned the Gita and the Upanishads,
35 what, ¹⁷mm, how do you rate your knowledge of the scriptures,
36 Hindu ¹⁸scriptures? From 1 to 5, say 5 being very good.

37 N: ¹⁹I would say about 2 ½.

38 Researcher: ²⁰[Laughs] Have you read any of the scriptures?

39 N: ²¹Well, as a kid growing up and going, being part of the Hare
40 Krishna ²²movement, we'd go for lectures and things like that.

41 Researcher: ²³Ja.

42 N: ²⁴But, uh, what I found is reading the books; I mean you got
43 the ²⁵whole set of them at home – my mother's...

1 Researcher: ²⁶Mmm.

2 N: ¹...but, the language has, wasn't very, very child friendly...

3 Researcher: ²Mmm.

4 N: ³...at that stage and the stories from the **Gita and the story of,**

5 **of, of ⁴basically the story of Lord Krishna** and things. I knew

6 very well of ⁵that...

7 Researcher: ⁶Ja.

8 N: ⁷I know all that and these little adventures and...

9 Researcher: ⁸Mmm.

10 N: ⁹...things. He's ah, encounters with, ah, with all the other de-

11 deities ¹⁰and...

12 Researcher: ¹¹Ja.

13 N: ¹²...certain of our, our, our rituals and certain of our customs, I

14 know ¹³more or less why, why they done.

15 Researcher: ¹⁴Mmm.

16 N: ¹⁵But I wouldn't say I'm a absolute scholar on it.

17 Researcher: ¹⁶Ja. So don't you think that because we don't know that much

18 ¹⁷about our scriptures, that probably we don't know what

19 Hindu, the ¹⁸Hindu perspective...

20 N: ¹⁹Perspective is.

21 Researcher: ²⁰...is?

22 N: ²¹Yes that is, that, that is actually quite correct, hey?

23 Researcher: ²²Mmm.

24 N: ²³We, we don't actually, if I look at Hindus and I that is why

25 **even ²⁴though I find the Muslims are very, very dogmatic** in...

26 Researcher: ²⁴Mmm.

27 N: ¹...their approach through interaction with them. I must admire

28 them ²because they know their religion.

29 Researcher: ³Ja. I agree with you.

30 N: **⁴They know their religion.**

31 Researcher: ⁵Mmm.

32 N: ⁶And the reason why you would find and I, I look at it other

33 aspects ⁷of life as well, where, uh, in terms of leaving their

34 religion and, uh, ⁸and converting to another religion...

35 Researcher: ⁹Ja.

36 N: ¹⁰...it's a very, very, very small percentage of them.

37 Researcher: ¹¹Mmm.

38 N: ¹²Whereas you will find, umm, amongst Hindus they get

39 converted ¹³into other religions, you get a Christians that

40 become basically ¹⁴non-practising Christians.

41 Researcher: ¹⁵Mmm.

42 N: ¹⁶That's basically because they don't understand their own

43 religion.

1 Researcher: ¹⁷Ja. So are you a practicing Hindu?
2 N: ¹⁸Yes.
3 Researcher: ¹⁹How do, how do you define yes? What do you do to be a
4 ²⁰practising Hindu?
5 N: ²¹Okay, as a practising Hindu I believe first of all, besides
6 doing the ²²prayer and lighting my, ah, ah, my, my prayer lamp
7 every day...
8 Researcher: ²³Ja.
9 N: ²⁴...praying before I go to school, praying at night and things
10 like ²⁵that. I believe there's certain things. One thing that ji-uh,
11 Hinduism ²⁶teaches above anything else is humanity...
12 Researcher: ¹Mmm.
13 N: ²...and I believe that it's no use you praying a hundred times a
14 day ³when you don't look out for your fellow human beings.
15 Researcher: ⁴Ja.
16 N: ⁵And, uh, well I can give you a long story about the holidays
17 where ⁶I went on holiday and I found that two to three hundred
18 metres ⁷behind the beach front in Durban, there are people
19 that are ⁸homeless. Begging every day...
20 Researcher: ⁹Mmm.
21 N: ¹⁰...to make enough money to pay for a, uh, to go live in a
22 shelter. ¹¹And we were trying to figure out where, which
23 restaurant we're ¹²going to eat supper at.
24 Researcher: ¹³Ja.
25 N: ¹⁴And things like that and I well, my girlfriend, I told her look
26 this is ¹⁵it, we not gonna have an extravagant supper. We'll
27 buy take-¹⁶aways from somewhere and we'll pay for these
28 people...
29 Researcher: ¹⁷Mmm.
30 N: ¹⁸...to, this family to go and sleep. That's what I believe...
31 Researcher: ¹⁹Ja.
32 N: ²⁰...because you don't come and preach about being good and
33 ²¹even telling the children in the class, learn and whatever and
34 you ²²yourself don't do the same things.
35 Researcher: ²³Mmm.
36 N: ²⁴Right? And uh, I even, I, I, I even tell my mom...
37 Researcher: ²⁵Ja.
38 N: ²⁶...you pray every day...
39 Researcher: ¹Mmm.
40 N: ²...but if somebody comes here to help, you probably would be
41 too ³afraid to open your door.
42 Researcher: ⁴Mmm.

1 N: ⁵And I believe that, I mean I went now in holiday, I went into
2 Point ⁶Road. I walked into Point Road, I walked into an off-,
3 into a little alley ⁷off there. It was like the scene from, ah, ah a
4 sci- a sci-fi movie ⁸with, ah, people that actually approached
5 me and stuff. Okay, I ⁹want, I was armed...

6 Researcher: ¹⁰Mmm.

7 N: ¹¹...but I, umm, nobody would in right mind would go, go and
8 do it.

9 Researcher: ¹²Ja.

10 N: ¹³I did it in and I said look **I'm doing this for the good purpose.**
11 **My ¹⁴religion tells me you must be human...**

12 Researcher: ¹⁵Ja.

13 N: ¹⁶...you must be compassionate to others, so I'm going there
14 to ¹⁷help these people and God will see to me...

15 Researcher: ¹⁸Mmm.

16 N: ¹⁹God will protect me.

17 Researcher: ²⁰Mmm.

18 N: ²¹And I came out of there unscathed but that's how I see my
19 ²²religion. **Hinduism is not praying every day...**

20 Researcher: ²³Mmm.

21 N: ²⁴...reading the scriptures, reciting your scriptures and singing
22 the, ²⁵our Hanuman Chalisa and all that. That means nothing if
23 you ¹don't show your humanness and your compassion for
24 fellow ²humans.

25 Researcher: ³Mmm. I think that's very good. Brilliant.

26 ⁴[Laughter]

27 Researcher: ⁵I think that's why things go right for you when you want them
28 to.

29 ⁶[Laughter]

30 N: ⁷No, not always.

31 Researcher: ⁸[Laughter] Ja. Most of the time. But [colleague], how do you
32 explain, ⁹do you think there's anything in, in Hinduism that
33 could be in ¹⁰harmony with evolution? Is there any aspect of
34 Hinduism that has ¹¹similar kind of links to evolution?

35 N: ¹²Mmm, actually I'm, uh, I, I be honest with you, I am **actually**
36 **not in ¹³position to answer that question, coz I haven't really**
37 **thought ¹⁴along those lines where I equated Hinduism...**

38 Researcher: ¹⁵Mmm.

39 N: ¹⁶...with evolution.

40 Researcher: ¹⁷So, okay, maybe I can point you in the right direction....

41 N: ¹⁸Okay.

42 Researcher: ¹⁹...a little bit. Umm, see with evolution we talk about, uh, how
43 life ²⁰forms, uh, evolve from simple to complex.

1 N: ²¹Okay.

2 Researcher: ²²Okay, so is there anything like that in Hinduism?

3 N: ²³Umm, let's think about that. From simple to complex?

4 Researcher: ²⁴Mmm.

5 N: ²⁵Life forms?

6 Researcher: ¹Or, or any kind of evolution, you know, in Hinduism?

7 N: ²Well, if I look at it, if I look at it in terms of the Gita, the
8 teaching of ³the Gita, we look at the story of Krishna Himself...

9 Researcher: ⁴Mmm.

10 N: ⁵...he, there was lots of evolution in he-, in his life story. Like
11 where ⁶he lived as a simple cow herd.

12 Researcher: ⁷Ja.

13 N: ⁸And he evolved to be the leader of, of, of basically a, a whole
14 ⁹civilisation at that time.

15 Researcher: ¹⁰Ja.

16 N: ¹¹And, umm, how things change and how he uplifted his
17 people.

18 Researcher: ¹²Mmm.

19 N: ¹³Okay. And that in, in, in itself is a, a, uh, a, is a form of
20 evolution ¹⁴but I wouldn't say it's a physical evolution.

21 Researcher: ¹⁵Ja.

22 N: ¹⁶It's more, ah, umm, making them more aware, I know, a, a,
23 um, ¹⁷awakening their awareness of who they are and their
24 purpose on ¹⁸life and things like that. And that was...

25 Researcher: ¹⁹Ja.

26 N: ²⁰...but in terms of physical evolution...

27 Researcher: ²¹Mmm.

28 N: ²²...changing, no.

29 Researcher: ²³Well not necessarily physical, you know. It can be any kind
30 of ²⁴[Inaudible].

31 N: ¹Okay, uh, maybe is kind of a mental evolution, emotional
32 evolution ²whatever, where they, they learn that they have a
33 hi-higher ³purpose in life than merely just existing.

34 Researcher: ⁴Mmm.

35 N: ⁵And that in the end is the purpose of the Gita. Telling you that
36 your ⁶purpose in life eventually is to take all these births until
37 you reach ⁷that plane where you reach, uh, Godhead...

38 Researcher: ⁸Mmm.

39 N: ⁹...where you are at the same plane as God. Where, because,
40 at ¹⁰your lower planes you are not worthy at that stage.

41 Researcher: ¹¹Mmm.

42 N: ¹²You, through each rebirth you learn something...

43 Researcher: ¹³Mmm.

1 N: ¹⁴...so that in a form is a kind of evolution as well. Re- being
2 reborn ¹⁵every time is a form of evolution, I suppose.

3 Researcher: ¹⁶Ja, because that's that was my, uh, that was what I was
4 hoping ¹⁷you would say. You know, it's something to do with
5 the rebirths ¹⁸and reincarnation. Because that is where our
6 souls are evolving ¹⁹towards tha-that highest plane. And every
7 time we are reborn it is ²⁰to learn something new...

8 N: ²¹New.

9 Researcher: ²²...and to evolve to that level.

10 N: ²³Okay.

11 Researcher: ²⁴So in that, in that sense. And then the, the last question. A-
12 ²⁵according to Hinduism what is the age of the earth? Do you
13 have ²⁶any idea?

14 N: ¹Well, all I know is according to Hinduism, umm, uh; Lord
15 Krishna ²appeared more than 5000 years ago.

16 Researcher: ³Mmm.

17 N: ⁴Right? ⁵Prior to him it was Lord Ramachandra, the Lord Rama
18 ⁵who was about 10 000 years ago. Umm, and as honestly as
19 far as ⁶my religious knowledge goes that's as far back as I've
20 bothered to ⁷find out.

21 Researcher: ⁸Okay.

22 N: ⁹So I, I, I don't really know how, umm, how far Hinduism says
23 our, ¹⁰uh, umm, where we go...

24 Researcher: ¹¹Mmm.

25 N: ¹²...how old the earth and things is.

26 Researcher: ¹³Okay. So in terms of what the Islamic perspective says about
27 a ¹⁴million years old...

28 N: ¹⁵Million years, yes.

29 Researcher: ¹⁶...and in terms of Christianity which is 6000 years...

30 N: ¹⁷I believe so.

31 Researcher: ¹⁸...where do you place Hinduism? In terms of the age of the
32 earth?

33 N: ¹⁹Strictly, umm, Hindu ah, perspective, right?

34 Researcher: ²⁰Mmm.

35 N: ²¹Umm, ²²I would put the earth at about 50-60 thousand years,
36 umm, ²²from a Hindu perspective as a Hindu who hasn't
37 studied ²³evolution...

38 Researcher: ²⁴Mmm.

39 N: ¹...I would say they would say 50-60 thousand years to reach
40 that ²point where the, umm, the earliest books and things are
41 made, the ³sages and things like that.

42 Researcher: ⁴Ja.

1 N: ⁵Because even though they say lord, umm, like Rama
2 appeared ⁶10 000 years ago humans still existed prior to that.
3 Researcher: ⁷Mhmm.
4 N: ⁸Okay? And, umm, so I'd say 50-60 thousand and from a
5 Hindu ⁹perspective, but honestly have having, having learnt
6 about the ¹⁰theory of evolution, and looked at the evidence...
7 Researcher: ¹¹Ja.
8 N: ¹²...uh, well to me there is no, no, no refuting the evidence that
9 the ¹³earth is what's it? So many billion years...
10 Researcher: ¹⁴Four billion years.
11 N: ¹⁵Four billion years old.
12 Researcher: ¹⁶Mmm.
13 N: ¹⁷And, but I believe that the evolution for me has been
14 controlled by ¹⁸a higher order.
15 Researcher: ¹⁹Mmm.
16 N: ²⁰Okay, I cannot believe that the planets existence was big
17 bang ²¹and things like that and then from there it's, it's too
18 much of ²²coincidence. That from nothingness appeared
19 something as ²³organised and evolved as a human, human,
20 as a human people.
21 Researcher: ²⁴Mmm. So do you regard the human as the ultimate form of
22 ²⁵evolution then?
23 N: ²⁶On earth, yes.
24 Researcher: ¹Mmm. Alright, ja. Do you think humans with can still evolve?
25 N: ²Honestly if we looking at the theory of evolution and we
26 teaching it ³and you, you see patterns in it...
27 Researcher: ⁴Mmm.
28 N: ⁵I believe that we will never become extinct unless the earth
29 ceases ⁶to exist.
30 Researcher: ⁷Mmm.
31 N: ⁸Because we have already unknowingly over the last three
32 hundred ⁹years evolved.
33 Researcher: ¹⁰Mmm.
34 N: ¹¹I, if we take somebody that existed in maybe the 12th century
35 and ¹²put him here on earth now. That person would become
36 sick, he'd ¹³never survive.
37 Researcher: ¹⁴Mmm.
38 N: ¹⁵Because we have evolved over these centuries to survive
39 under ¹⁶present conditions.
40 Researcher: ¹⁷Mmm. What do you mean be, he'll be sick?
41 N: ¹⁸He'd become sick, the, the, the, if you look at the amount of
42 ¹⁹carbon dioxide in our air...
43 Researcher: ²⁰Mmm.

1 N: ²¹...the others, the axa-oxo the relative oxygen composition is
2 not ²²the same as it was before...

3 Researcher: ²³Mmm.

4 N: ²⁴...if you looking at pollution and things like that...

5 Researcher: ²⁵Mmm.

6 N: ¹...it's not the same.

7 Researcher: ²That's a very good point, I never thought of that before.

8 N: ³It would, I don't think they would. They would be sick...

9 Researcher: ⁴Mmm.

10 N: ⁵...and I think that if we had to go back in time, we probably
11 would ⁶be able to be, we'd be like almost super human, I, I
12 think.

13 Researcher: ⁷[Laughter]

14 N: ⁸Because we, we'd be able to cope with the higher oxygen
15 levels...

16 Researcher: ⁹Ja.

17 N: ¹⁰...lower carbon dioxide levels. So, umm, we'd be much
18 stronger I ¹¹think.

19 Researcher: ¹²Mmm. Okay, that's a very good point. So just to sum up then
20 as a ¹³Hindu do you feel that there's any conflict with your
21 religion and ¹⁴evolution? The theory of evolution?

22 N: ¹⁵Like for me as a Hindu who doesn't know much, like I said...

23 Researcher: ¹⁶Mmm.

24 N: ¹⁷...2 ½ out of 5.

25 Researcher: ¹⁸Ja.

26 N: ¹⁹Uh, who doesn't know much. I don't see much of a conflict
27 because my religion to me hasn't laid down ground rules and
28 ²¹says evolution took place...

29 Researcher: ²²Ja.

30 N: ²³...or evolution did not take place. In, in that terms, my
31 religions ²⁴deals more with the evolution like we said of the
32 soul.

33 Researcher: ²⁵Ja.

34 N: ¹Okay, rather than the body. Because the body has, is just, is
35 just a ²vessel that carries our soul.

36 Researcher: ³Mmm.

37 N: ⁴So the evo-, the conce-, the, the, the concentration on the
38 ⁵Hinduism is on the evolution of the soul rather than how did
39 you ⁶change over the years and I suppose as a Hindu you can
40 ⁷question, why was there a need for us to change?

41 Researcher: ⁸Mmm.

42 N: ⁹When it's the soul that needs to change not your body.

1 Researcher: ¹⁰Ja. Okay, that's, that's very interesting. So one, just one last
2 ¹¹question right? Do you think it is more important as a Hindu
3 to, ¹²ah, accept evolution or to understand it?
4 N: ¹³Okay...

5 Researcher: ¹⁴And would, would ah, Hinduism allow you to do both?
6 N: ¹⁵Umm, my religion, umm, Hinduism is about learning...
7 Researcher: ¹⁶Mmm.
8 N: ¹⁷...about being human and part of being human is learning
9 and ¹⁸understanding. So, I'd say mainly learning it, uh,
10 accepting I think ¹⁹partially I wouldn't say accepting everything
11 blindly.
12 Researcher: ²⁰Ja.
13 N: ²¹Because lots of things about evolution itself, umm, go
14 against ²²some of our religious teachings, such as...
15 Researcher: ²³Mmm.
16 N: ²⁴... how basically when creation occurred and things like that.
17 So, ²⁵yes.
18 Researcher: ²⁶Okay, so it's more important to understand...
19 N: **¹Understand it.**
20 Researcher: ²...rather than accept...
21 N: ³Accept it. I mean like, for me as a Hindu...
22 Researcher: ⁴Mmm.
23 N: ⁵I, I find that I have to understand what the Muslim think, I
24 need to ⁶understand what Christians think...
25 Researcher: ⁷Ja.
26 N: ⁸...but it doesn't mean that I necessarily accept...
27 Researcher: ⁹Accept.
28 N: ¹⁰... it.
29 Researcher: ¹¹Ja. So with the, with the Islamic children at your school what
30 do ¹²you, where do you think they fit in? Is it understanding or
31 well, I ¹³think it's definitely not accepting.
32 N: **¹⁴No, they will definitely not accept.**
33 Researcher: ¹⁵Mmm.
34 N: ¹⁶The minority of them understand. Okay, and well the majority
35 of ¹⁷them, they know that this theory is there, these are the
36 evidences ¹⁸in support of it...
37 Researcher: ¹⁹Mmm.
38 N: ²⁰...and they would not say no I don't, well they just say okay
39 this is ²¹the evidence. No comment is made on whether they
40 are ²²accepting it.
41 Researcher: ²³Okay.
42 N: ²⁴Not that I dare ask them, of course.
43 Researcher: ²⁵[Laughter] Ja.

1 N: ¹But sometimes when you teaching the learners and you see
2 that ²look on their face. If you know your learners, having
3 taught them ³over like four years...

4 Researcher: ⁴Mmm.

5 N: ⁵...you see that look on the face and then and you know, okay,
6 it ⁶struck this guy that, you know what, this could have
7 happened.

8 Researcher: ⁷Mmm.

9 N: ⁸You can look on their face and it's not there for a long period
10 of ⁹time...

11 Researcher: ¹⁰Mmm. Ja.

12 N: ¹¹...but you know okay...

13 Researcher: ¹²There's a shadow of a doubt.

14 N: ¹³There's a bit of doubt there.

15 Researcher: ¹⁴Ja. Ja that's, that's good. Okay. Do you want to add anything
16 else ¹⁵about what you feel about Hinduism and evolution?

17 N: ¹⁶No, now, all I wanna say is that ¹⁷you've made me, you made
18 ¹⁷actually that I must go and find out now. What does a Hindu,
19 ¹⁸what ¹⁸does Hinduism...

20 Researcher: ¹⁹Ja.

21 N: ²⁰...about how old is the earth? When did life begin? Because I
22 ²¹honestly, like I said, I didn't pay much attention to all that.

23 Researcher: ²²Mmm. Okay, so when you find out you must please share
24 that ²³information...

25 ²⁴[Laughter]

26 N: ²⁵That...

27 Researcher: ²⁶...with me. Okay, N, thank you...

28 N: ¹Okay.

29 Researcher: ²...very much, umm.

30 ³[End of recording]

31

32

33

INDIVIDUAL LEARNER INTERVIEW - 28 MAY – TRANSCRIPT 9

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Researcher My name is Camy as you know and I'm here to find out what you as a Hindu Life Science learner feel about the topic of evolution. I have a couple of questions that I'd like to ask you. Do you consider yourself a practising Hindu?

T Yes I do but I am not as devout as other people I know.

Researcher What makes you a Hindu?

T Well I believe in the customs and things like that. I may not follow it through as others but I do.

Researcher As a Hindu what kind of principles do you live your life by?

T I think I like to live my life by that I don't harm other people; you should always be polite, try and help as much as you can.

Researcher As a Life Sciences learner, you have learnt about evolution since Grade 10. Do you have any difficulty accepting what you have learnt about evolution as a result of what Hinduism teaches you?

T No not really. When I was younger they spoke about how God created everything and things like that. My idea of evolution is that first God created simple cell organisms and they developed to become to what we know today.

Researcher So you believe that God created the first simplest organisms?

T Yes

Researcher So you don't feel that there is a conflict between Hinduism and evolution or is there?

T No unless you want to go into Scientology but with evolution and Hinduism there is no conflict.

Researcher So according to your knowledge of Hinduism, do you know any of the Hindu scriptures.

1 T I know of them, I learnt a few of them when I was younger. What do
2 you mean, scriptures?
3 Researcher The Hindu religious books.
4
5 T No not exactly.
6
7 Researcher Have you heard anything about the Hindu's or Hinduism itself says
8 about for instance, the origin of life on earth?
9
10 T No but my Mum did kind of mention it when we were younger that God
11 created people in his image.
12
13 Researcher Anything about how humans got to be on Earth from a Hindu
14 perspective?
15
16 T No sorry.
17
18 Researcher According to your religion, what do you think is the approximate age of
19 the earth?
20
21 T According to religion I can't say but from a Life Science point of view
22 I'm going to say about 6 billion years.
23
24 Researcher And when you learn about such figures do you find that it conflicts with
25 what you have been brought up to believe?
26
27 T No
28
29 Researcher Do you think there is a place for pre historic life forms in Hinduism?
30
31 T There is always a place for pre historic life forms in Hinduism or in any
32 religion actually.
33
34 Researcher And the process of evolution, does it have any parallels in your religion
35 of Hinduism. Is there anything that you can relate it to?
36
37 T Sorry I don't think I understand the question.
38
39 Researcher Okay, say that in evolution you have been learning about the
40 development of organisms from simple to complex. Is there anything
41 like that idea in Hinduism?
42

1 T I'm sure that I've heard of it but I'm sorry I can't remember. In terms of
2 learning and education I think that's one way you can parallel it to but
3 not really.
4

5 Researcher Do you think that learning about evolution at school is going against
6 your religious beliefs?
7

8 T No. Sorry I know you want me to substantiate but um I know at some
9 schools that want you to learn about religion and all of that but there are
10 some theories that you have to learn like some of the Christians, they get
11 offended by evolution but from my side its fine.
12

13 Researcher You don't get offended?
14

15 T I understand that it's something that you have to do so I don't get
16 offended by it.
17

18 Researcher So you think it's something you have to do because of the exams your
19 writing or is there another reason?
20

21 T No, it's not just because of the exams. I feel that if I didn't learn about it
22 I would be missing out on something. I think everyone should have
23 basic knowledge and stuff but it's not an issue with me.
24

25 Researcher Okay, are there other Hindu's in your class who feel the same way?
26

27 T No, we are a predominantly white school.
28

29 Researcher Okay. How do you regard the topic of evolution in comparison to other
30 topics you have learnt in Life Science like the nervous system or the
31 heart or any of those topics?
32


33 T Well obviously there is more theory than practical work.
34

35 Researcher With evolution?
36

37 T Yes, except for looking at fossils and things like that, there is no actual
38 practical work in it so I think that it's not something extremely
39 important.
40

41 Researcher So is that the difference, the lack of practical work?
42

43 T Ja.

1 Researcher In terms of controversy?
2
3 T What do you mean?
4
5 Researcher Like you mentioned with evolution, Christian students get offended by it.
6 In terms of the other topics is there that kind of controversy as well?
7
8 T No because I'm guessing it's because Christians believe in **creationism**
9 and things like that so there is heated debates regarding evolution among
10 Christians but not with the other topics.
11
12 Researcher Do you think that these controversies and differences that they have, and
13 maybe that you have as well because of your practical's, are factual or
14 because of your belief system.
15
16 T I think mostly, half, is based on facts. I think that's a good way to think
17 about theories and things and **I think the controversies are pretty much**
18 **based on religion and things like that.**
19
20 Researcher Do you understand what is meant by the scientific method or the nature
21 of science?
22
23 T  Scientology?
24
25 Researcher No, no. Scientology is a different kind of religion. I'm talking about the
26 scientific method which is used by scientists when they come up with
27 their theories and things which I think you've learnt about it as
28 Hypothesis testing . You know what I'm talking about?
29
30 T Uh ha.
31
32 Researcher So can you explain what that method is about very briefly?
33
34 T { It's when someone has a problem or an idea or something and they want
35 to test if it's true or not so they go about certain steps in order to conduct
36 that experiment.
37
38 Researcher Knowing about this nature of science, do you think that it was a good
39 thing to teach you?
40
41 T The scientific method?
42
43 Researcher Yes.

1
2 T Yes I think it was a good thing to teach it because if I had anything to do
3 I would do it in the same steps, like concentrating sulphuric acid or
4 something, it's a good way of doing things. If I want to test if it's hot
5 *(points to tray of fried snacks)* – I would eat it.
6
7 Researcher Do you agree that the concept should be referred to as a theory in
8 evolution?
9
10 T Yes I do. I understand that there is facts but when something could
11 possible offend someone it should be known as a theory even though it
12 may have facts behind it.
13
14 Researcher So for you a theory is if it offends somebody?
15
16 T Not basically but it's one of the facts that should be considered.
17
18 Researcher So if you were not taught the nature of science as part of this topic, what
19 do you think your perception of evolution would be? In other words,
20 would you be more or less accepting?
21
22 T I don't think there would be a change in my acceptance in the theory of
23 evolution because I don't personally think of evolution as undergoing a
24 scientific process.
25
26 Researcher You don't think it undergoes a scientific process?
27
28 T It may or may not but I don't personally think of it like that. I
29 understand that it might but when I'm processing in my head it doesn't
30 come across that way.
31
32 Researcher Is there any aspect of the topic of evolution that disturbs you personally?
33
34 T No I can't really say that there is.
35
36 Researcher As a Hindu and again I am asking this question because I need to
37 confirm – As a Hindu do you find that learning about evolution to be in
38 conflict with your religion?
39
40 T No, I don't find it in conflict with my religion.
41
42 Researcher Do you think it's more important to accept evolution or to understand
43 evolution?

1
2 T You can really have either or. If you accept it then you must have some
3 or other understanding about it and if you understand it then you should
4 probably accept it or if you have something against it, then you
5 shouldn't. You should understand it because everyone should know
6 about their background and things like that.
7
8 Researcher So understanding it is more important than accepting it? Do you think
9 there is a place in Hinduism to allow you to do both?
10
11 T What to understand and accept?
12
13 Researcher Yes.
14
15 T Well like I just said that if you really understand it, then I'm pretty sure
16 you would accept it. If you understand it and don't accept it, then you
17 don't fully understand it. That's my perspective.
18
19 Researcher That's very interesting.
20
21 End



1 **Individual Interview Parent 1 – 17 May 2011 – Transcript 10:**

- 2 Researcher: ¹Okay. Hi K, thank you for agreeing to take part in my study. ²I
3 am looking at how Hindu life science teachers and learners
4 regard ³the topic of evolution in the life science curriculum.
5 Since you are ⁴Hindu, and your child takes life science, you've
6 been chosen to ⁵take part in the study. I am going to ask you a
7 few questions and I'd ⁶like you to be as honest and as open as
8 possible when you answer. ⁷I am interested in everything that
9 you have to say, so the interview ⁸will be audio recorded, so I
10 don't miss anything you have to say. So ⁹let us begin. They are
11 just a few questions, so don't be too nervous. ¹⁰Okay, the first
12 one: Does Hinduism play a role in your life?
13 K: ¹¹Yes, it does. I see Hinduism as, umm, a discipline, umm, for
14 self ¹²improvement.
15 Researcher: ¹³Mmm.
16 K: ¹⁴And it, it's, it's just as you have a **code of conduct and rules**. In
17 ¹⁵Hinduism as well, we follow that for self improvement. Ah,
18 yes, so I ¹⁶do.
19 Researcher: ¹⁷Okay. So, do you consider yourself a practicing Hindu?
20 K: ¹⁸Well, not only a practising Hindu, but I also I am a practical...
21 Researcher: ¹⁹Okay.
22 K: ²⁰...Hindu as well.
23 Researcher: ²¹What do you mean by that?
24 K: ²²Umm, I am a realist.
25 Researcher: ²³Mmm.
26 K: ²¹I also take things ... I, I need to look at reality and, and see
27 what **²²makes sense**, of it.
28 Researcher: ¹Mmm.
29 K: **²I just don't believe everything** that it, that's, you know, uh, laid
30 out ³in front of me.
31 Researcher: ⁴Mmm.
32 K: ⁵Uh, facts, figures, statistics...
33 Researcher: ⁶Ja.
34 K: ⁷...research, that's what plays a major role in my, umm,
35 deciphering ⁸and definitions of things.
36 Researcher: ⁹Okay. So, how strong would you say your Hindu beliefs are?
37 K: ¹⁰Not very strong, because as I mentioned earlier, I do have,
38 ah, a ¹¹Christian background
39 Researcher: ¹²Ja.
40 K: ¹³So, yes, but overall and above, I believe that there is one
41 God.
42 Researcher: ¹⁴Okay.
43 K: **¹⁵God takes in many forms.**

1 Researcher: ¹⁶So are there any, ah, umm, let's say tenets that you believe,
2 you ¹⁷know, you would practice as a Hindu? Uh, what makes
3 you a ¹⁸Hindu not, and rather, rather than a Christian, for
4 example?
5 K: ¹⁹Well, in the Hindu religion, you know, we follow the man's
6 culture. ²⁰So when I got married, or when I decide to get
7 married, I changed ²¹my religion because of my husband.
8 Researcher: ²²Right.
9 K: ²³So, I am following my husband's religion which is actually
10 Tamil.
11 Researcher: ²⁴Ja.
12 K: ¹Under Hinduism and, ah, yes I do. The reason for me
13 changing, as I ²said earlier, because I believe there is a God...
14 Researcher: ³Mmm
15 K: ⁴...and there is one God...
16 Researcher: ⁵Okay.
17 K: ⁶...but takes the **forms and shapes of different Gods** in other
18 religions ⁷as well.
19 Researcher: ⁸Ja, okay. So, do you have any knowledge of the Hindu
20 scriptures?
21 K: ⁹Not much.
22 Researcher: ¹⁰Do you know any stories, or anything, about the Hindu
23 scriptures?
24 K: ¹¹I don't know how the Darwin's theory fits into Hinduism, but
25 they, ¹²they use Darwin's theory, ah, since you, you mentioned
26 that we are ¹³going to be talking about evolution.
27 Researcher: ¹⁴Mmm.
28 K: ¹⁵Umm, the Hinduism, they did look at Darwin's theory and the
29 story ¹⁶about he came up with evolution theory, evolution, and
30 that's only ¹⁷when his daughter died.
31 Researcher: ¹⁸Mmm.
32 K: ¹⁹Um, and then he started looking at it and he became an
33 atheist ²⁰and stopped believing in God. So, um, **I do believe in**
34 **some way** ²¹**science and Hinduism are linked.**
35 Researcher: ²²Mmm.
36 K: ²³Uh, not really how, but it is linked.
37 Researcher: ²⁴Okay, so with the Hindu scriptures, coming back to that point,
38 you ²⁵don't really have any knowledge?
39 K: ²⁶No, not really, but, ah, in, in Hinduism especially, uh, the
40 Gods...
41 Researcher: ¹Mmm.
42 K: ²...or Goddess, the Lords.
43 Researcher: ³Ja.

1 K: ⁴They take the forms of, of, of different things, animals, fish.

2 Researcher: ⁵Mmm.

3 K: ⁶Umm, ja and in Hinduism it's called reincarnation...

4 Researcher: ⁷Mmm.

5 K: ⁸...and I said, science it's, it's, it's called evolution.

6 Researcher: ⁹Mmm. So, you're equating reincarnation with evolution?

7 K: ¹⁰Yes, yes I am.

8 Researcher: ¹¹Okay. That's interesting. So, according to Hinduism do you
9 have ¹²any idea how life came to be on earth?

10 K: ¹³Well, umm Hinduism is, exists far longer...

11 Researcher: ¹⁴Ja.

12 K: ¹⁵...than science.

13 Researcher: ¹⁶Mmm.

14 K: ¹⁷ So, I believe that Hinduism and their theories of evolution...

15 Researcher: ¹⁸Mmm

16 K: ¹⁹...or development, ah, and then science takes off from there.
17 So, I ²⁰don't know, I see it as Hinduism started off with it...

18 Researcher: ²¹Ja.

19 K: ²²...and then science continues it.

20 Researcher: ²³Okay.

21 K: ¹So in that sense, to me, both are linked.

22 Researcher: ²Alright. So, do you have any idea, from a Hindu perspective,
23 how ³old the earth is? The age of the earth?

24 K: ⁴Umm.

25 Researcher: ⁵Because you say you come from a Christian background.

26 K: ⁶Yes.

27 Researcher: ⁷So, in the Christian background, as far as I know, they say that
28 the ⁸earth is about 6000 years old.

29 K: ⁹Mmm.

30 Researcher: ¹⁰So with Hinduism, do you have any idea?

31 K: ¹¹I just know that it is thousands of years old and whereas
32 science, it ¹²is only hundreds of years old.

33 Researcher: ¹³Okay. So, are you aware that the topic of evolution is being
34 taught ¹⁴to your child at school?

35 K: ¹⁵Yes, I am.

36 Researcher: ¹⁶And how do you feel about this?

37 K: ¹⁷Umm, I don't have any negative feelings about it...

38 Researcher: ¹⁸Mmm.

39 K: ¹⁹...because as I mentioned, I am a realist.

40 Researcher: ²⁰Ja.

41 K: ²¹And there's lots of evidence and, and statistics showing that,
42 uh, ²²recently the, the fossil..

43 Researcher: ²³Mmm.

1 K: ²⁴...that was found.

2 Researcher: ¹Mmm.

3 K: ²Uh, I mean, if things like that are, are being, ah, found and, and
4 as ³in evidence, and **it's up to my daughter to make up her mind**
5 **in what ⁴she believes.**

6 Researcher: ⁵Mmm.

7 K: ⁶You know, I guess, when it comes to evolution.

8 Researcher: ⁷Okay, so you think that the evidence...

9 K: ⁸The evidence.

10 Researcher: ⁹...actually helps support that?

11 K: ¹⁰Definitely, **evidence helps to support it.**

12 Researcher: ¹¹Okay, so do you, ah, you did say that you had some idea that
13 ¹²evolution at school entails Charles Darwin?

14 K: ¹³Yes.

15 Researcher: ¹⁴Do you know anything else about what, ah, [your child] is
16 learning at ¹⁵school with regards to evolution?

17 K: ¹⁶No, just evolution. When you, when I think of science...

18 Researcher: ¹⁷Mmm.

19 K: ¹⁸...I am starting off with the **picture of an ape...**

20 Researcher: ¹⁹Right.

21 K: ²⁰...and then **developing and progressing to becoming a man.**

22 Researcher: ²¹Mmm.

23 K: ²²That's how I see ah, ah, **science as,** and then when I look at
24 ²³Hinduism, I am looking at **reincarnation when we die...**

25 Researcher: ²⁴Ja.

26 K: ¹...and then how we take ah umm ah the form of another life...

27 Researcher: ²Mmm.

28 K: ³...another being, for example, maybe another insect...

29 Researcher: ⁴Mmm.

30 K: ⁵...and then, ja, developing from there.

31 Researcher: ⁶Okay, so I, I see you are always trying to bring in...

32 K: ⁷I...

33 Researcher: ⁸...the Hindu aspect.

34 K: ⁹Yes.

35 Researcher: ¹⁰Okay, that's fine. Umm, do you feel that there's a conflict
36 between ¹¹what Hinduism says about life on earth and what
37 your daughter is ¹²learning at school in evolution?

38 K: ¹³According to Hinduism?

39 Researcher: ¹⁴Ja, between your religion and science in other words.

40 K: ¹⁵Okay, ah, wi-with Hinduism I feel there are **many viewpoints.**

41 Researcher: ¹⁶Mmm

42 K: ¹⁷Many theories, and with science it's based on a lot of research
43 and ¹⁸evidence as I mentioned earlier on.

1 Researcher: ¹⁹Ja.

2 K: ²⁰So, I don't know, in that sense, to me, is a conflict. Hinduism
3 are ²¹viewpoints...

4 Researcher: ²²Mmm.

5 K: ²³...theories and science is research and evidence. From my, so
6 ²⁴that's where to me, the conflict arises and as, as I mentioned
7 ²⁵earlier, I like to base my **deciphering on evidence.**

8 Researcher: ¹Ja. So, you don't think in science there are also theories?

9 K: ²Oh definitely, theories...

10 Researcher: ³Mmm.

11 K: ⁴...and theories are based on evidence.

12 Researcher: ⁵Mmm. And in Hinduism what are the theories based on?

13 K: ⁶Theories are [Long pause] umm, viewpoints, people's
14 viewpoints.

15 Researcher: ⁷Mmm.

16 K: ⁸Ah, based on that, umm, I can't say, ah, research. Ah, it's just,
17 it's, ⁹it's the laws that, that take on the different forms and the
18 question ¹⁰as to why...

19 Researcher: ¹¹Mmm.

20 K: ¹²...they take on different forms, and then that is how they, they
21 also ¹³talking about, ah, **reincarnation.** What happens when you
22 die?

23 Researcher: ¹⁴Mmm.

24 K: ¹⁵So, I don't think there is scientific evidence to say how you're
25 ¹⁶reincarnated.

26 Researcher: ¹⁷Ja.

27 K: ¹⁸[Inaudible] But to me they are just theories...

28 Researcher: ¹⁹Okay.

29 K: ²⁰...just people talking.

30 Researcher: ²¹Ja, so you keep talking about the different forms that the lord
31 ²²takes. So, is there any specific reference to that?

32 K: ²³When you say reference I I'm think of **lord Vishnu.**

33 Researcher: ²⁴Mmm.

34 K: ¹He does take in the form of, of a fish and, and, uh, this other
35 ²animals.

36 Researcher: ³Mmm.

37 K: ⁴Ja, so...

38 Researcher: ⁵Okay, so where, where have you heard about that from? Have
39 you ⁶read it somewhere?

40 K: ⁷I've read it somewhere, but I can't remember where. But, ah, I
41 think ⁸that, uh, our, the gods and goddesses...

42 Researcher: ⁹Mmm.

43 K: ¹⁰You see, there's demigods...

1 Researcher: ¹¹Ja.

2 K: ¹²...because they, we have one central God in Hinduism, but

3 they ¹³take on the life of, **of the other Gods.**

4 Researcher: ¹⁴Okay.

5 K: ¹⁵Mhmm

6 Researcher: ¹⁶Umm. *[Pause]* Does it concern you that maybe your child is

7 ¹⁷learning something that goes against their upbringing?

8 K: ¹⁸**No**, *[inaudible]* I just say nothing, it doesn't. As I said there,

9 some ¹⁹way, or **somehow it's linked.**

10 Researcher: ²⁰Mmm.

11 K: ²²So it's just that my child, whatever she has learnt, **she has to**

12 **make ²³sense of it..**

13 Researcher: ²⁴Mmm.

14 K: ²⁵...and then just make her own decisions about it.

15 Researcher: ¹And at home, is there any, umm, is there any kind of fixed

16 Hindu, ²ah, teachings that you regularly give to your children?

17 How do you ³expect your children, in other words, to, you know,

18 to become ⁴knowledgeable about Hinduism?

19 K: ⁵*[inaudible]* It's just the different, umm, **religious days.**

20 Researcher: ⁶Ja.

21 K: ⁷We obviously, we are, ah, umm, commemorating something...

22 Researcher: ⁸Mmm.

23 K: ⁹...or some, some god...

24 Researcher: ¹⁰Ja.

25 K: ¹¹...and then **my children need to have knowledge of why we**

26 **¹²celebrating...**

27 Researcher: ¹³Mmm.

28 K: ¹⁴...that particular day and, ah, besides the, that we pray every

29 day ¹⁵for guidance and spiritual, you know strength.

30 Researcher: ¹⁶Ja, ja.

31 K: ¹⁷Ah, I think that is basically it. We don't go beyond that...

32 Researcher: ¹⁸Mmm

33 K: ¹⁹...as, as in services every *[Pause]* I am not very religious.

34 Researcher: ²⁰Ja, ja that's fine.

35 K: ²¹Okay, **but just knowledgeable** about why we celebrate...

36 Researcher: ²²Mmm.

37 K: ²³...Diwali or, or...

38 Researcher: ²⁴Ja.

39 K: ¹...um, ja Luxmi Day.

40 Researcher: ²So the significance...

41 K: ³The significance.

42 Researcher: ⁴...you do explain the significance?

43 K: ⁵Yes we do, we do explain it, yes.

1 Researcher: ⁶Okay, that's very good, and in, do you think that that is
2 sufficient for ⁷our children?
3 K: ⁸Mmm. [*pause*] Well, uh, if it comes to it I don't, well to some
4 people ⁹that is not obviously not sufficient...
5 Researcher: ¹⁰Mmm.
6 K: ¹¹...because they need to, ah, strengthen their spiritual beliefs
7 by ¹²attending services and **going to the temple.**
8 Researcher: ¹³Ja.
9 K: ¹⁴And then I, on the other hand, I am also a parent and
10 parental, ¹⁵umm, **discipline is also important...**
11 Researcher: ¹⁶Ja.
12 K: ¹⁷...for up, for bringing up your child.
13 Researcher: ¹⁸Ja.
14 K: ¹⁹So I think it, it goes hand in, **parental discipline and the Hindu**
15 **²⁰beliefs, put them together and bring up your child.**
16 Researcher: ²¹Okay. Okay, the reason I ask is because so far I've been
17 ²²interviewing quite a few lots of children, groups of children,
18 and ²³what is so, uh, surprising and actually quite disturbing, is
19 that many ²⁴of them have no knowledge of our scriptures. They
20 have no ²⁵knowledge of the significance of why we do things in
21 Hinduism and ²⁶for me that's a big problem.
22 K: ¹Okay.
23 Researcher: ²So that's why I'm asking.
24 K: ³Okay. [*Nervous Laughter*]
25 Researcher: ⁴You know it's not to pick on you or anything.
26 K: ⁵I guess because when I, when I changed...
27 Researcher: ⁶Mmm.
28 K: ⁹...to, **I ask a lot of questions.**
29 Researcher: ¹⁰Ja.
30 K: ¹¹Why do we do this? And why do we do that? Because I don't
31 want ¹²to do something that I did not understand.
32 Researcher: ¹³Mmm.
33 K: ¹⁴So I was learning at the same time, and then I have been
34 teaching ¹⁵my children as well that...
35 Researcher: ¹⁶Ja.
36 K: ¹⁷...because, ja, **we need to know why we doing a certain**
37 **prayer.**
38 Researcher: ¹⁸So when you say you converted to Hinduism when you got
39 ¹⁹married, was there any like, ah, ritual or prayer or something
40 that ²⁰you had to do to become a Hindu or...
41 K: ²¹No.
42

1 Researcher: ²²How did that happen?

2 K: ²³*[inaudible]* it was just all the mindset. I I just had to, umm,

3 umm, ²⁴change my whole mindset. My perception of being, that

4 just one ²⁵God and...

5 Researcher: ²⁶Mmm.

6 K: ¹...then that's it, as long as I believe in the central God, and

7 that's ²who I'm gonna pray to.

8 Researcher: ³Okay, so there is no formal ceremony...

9 K: ⁴No, no formal ceremony.

10 Researcher: ⁵...to convert to Hinduism?

11 K: ⁶It's just the marriages...

12 Researcher: ⁷Ja.

13 K: ⁸...see that's where the ceremonies are different.

14 Researcher: ⁹Oh, okay. So there's like, in Christianity, like if you convert from

15 ¹⁰Hinduism to Christianity, you undergo baptism.

16 K: ¹¹Yes.

17 Researcher: ¹²So in Hinduism there isn't something like that? That you have

18 to ¹³undergo?

19 K: ¹⁴Not that I know of.

20 Researcher: ¹⁵Okay *[nervous laughter from both parties]*. So, so do you think

21 ¹⁶there is anything in Hinduism, apart from what you've

22 mentioned ¹⁷already, is there anything else in Hinduism that

23 links to evolution?

24 K: ¹⁸I just had a conversation with someone, because I had, for the

25 time ¹⁹you told me that I am going to be interviewed...

26 Researcher: ²⁰*[Laughter]*

27 K: ²¹...and it's about evolution, then I started thinking about it...

28 Researcher: ²²Okay.

29 K: ²³...and uh and then I asked a learner.

30 Researcher: ²⁴Mmm.

31 K: ²⁵Very interestingly, and, ah, what he said to me, made sense

32 to me.

33 Researcher: ¹Mmm.

34 K: ²Umm, be it's a cycle.

35 Researcher: ³Ja.

36 K: ⁴Okay, when you start with Hinduism, and he spoke about a

37 cell...

38 Researcher: ⁵Ja?

39 K: ⁶...and it's very interesting, because with Darwin's theory, it

40 talks, ⁷when you die it's your cell, uh, that changes.

41 Researcher: ⁸Mmm.

42 K: ⁹Now remember **evolution is about development**...

43 Researcher: ¹⁰Mmm.

1 K: ¹¹...changes. It changes into something, something small,
2 maybe like ¹²an insect...

3 Researcher: ¹³Mmm.

4 K: ¹⁴...and I, **in Hinduism, remember it's reincarnation.**

5 Researcher: ¹⁵Ja.

6 K: ¹⁶And then, and then that changes into something bigger, and
7 as it ¹⁷go, I am talking about now once its dies, it's something
8 bigger.

9 Researcher: ¹⁸Ja.

10 K: ¹⁹You reincarnate and become something bigger, and then
11 that's ²⁰what I was talking about, when maybe it comes to a
12 stage where ²¹**you're an ape...**

13 Researcher: ²²Mmm.

14 K: ²³...and that's where science takes over, and then ape, and you
15 ²⁴changed to that, and then you **eventually become man**, and
16 it's the ²⁵cycle, **and the man dies again and it's a cell.**

17 Researcher: ¹Oooh, okay.

18 K: ²I don't know that, that seems to make sense to me.

19 Researcher: ³Mmm.

20 K: ⁴I don't know how, but it does.

21 Researcher: ⁵But now you have this picture in your mind about an ape
22 becoming ⁶a man, right?

23 K: ⁷From a science perspective.

24 Researcher: ⁸Yes, no I understand that...

25 K: ⁹Yes, yes.

26 Researcher: ¹⁰...because a lot of people have that, ah, belief about evolution
27 or ¹¹view of evolution. That we started off as apes and we've
28 now ¹²become men. So do you have an explanation for how
29 come there ¹³are apes present with man at the moment? We
30 are co-existing with ¹⁴apes.

31 K: ¹⁵Okay, umm, when I, after you told me then I started thinking
32 about ¹⁶it and then we don't really change...

33 Researcher: ¹⁷Mmm.

34 K: ¹⁸...unless, ah, I, I **climatic changes.**

35 Researcher: ¹⁹Yes.

36 K: ²⁰So, if, if nothing's affecting the apes they will remain as apes,
37 but ²¹we will change, develop, if there's, uh, cli-climatic
38 conditions. ²²That's how I see that.

39 Researcher: ²³Okay, that's very clever.

40 ²⁴*[Laughter]*

41 K: ²⁵Yeah, **if the climatic changes, I have to change.**

42 Researcher: ¹Okay, that's good.

43 K: ²Otherwise we won't change.

1 Researcher: ³Okay, so basically to sum up, because we have come to the
2 end of ⁴the interview now, is you, you've said at the beginning
3 that there's ⁵no conflict that you see between your religion...

4 K: ⁶We are linked.

5 Researcher: ⁷...and evolution, you say they are links?

6 K: ⁸Okay, in this interview I have lots of mixed feelings...

7 Researcher: ⁹Ja.

8 K: ¹⁰...lots of confusion.

9 Researcher: ¹¹Mmm.

10 K: ¹²So you'll find myself contradicting, uh, being contradicting at
11 some ¹³points, but as I said, because of confusion, mixed. So I
12 hope you ¹⁴can actually decipher [laughter] what I...

13 Researcher: ¹⁵Ja, that, ah, that's for me to do.

14 K: ¹⁶[inaudible]

15 Researcher: ¹⁷The main thing I wanted to clarify was what do Hindu parents
16 feel ¹⁸about their children doing evolution at school, and what
17 you've ¹⁹basically said is that you don't have any negative
18 feelings.

19 K: ²⁰I don't have any negative feelings, ja.

20 Researcher: ²¹Okay.

21 K: ²²[inaudible] the evidence is there...

22 Researcher: ²³Ja.

23 K: ²⁴...then that's what you've gotta base your theories on.

24 Researcher: ¹Okay, that's fabulous. I think it was a great perspective
25 because you ²come from a Christian background...

26 K: ³Yes...

27 Researcher: ⁴...and since you have...

28 K: ⁵...but somehow when I, I think about it now, I am much more
29 ⁶mature...

30 Researcher: ⁷Mmm.

31 K: ⁸...and, and I, I changed or converted at a very young age.

32 Researcher: ⁹Ja.

33 K: ¹⁰Umm, I actually, you know a Christian perspective, I don't
34 believe ¹¹in Adam and Eve.

35 Researcher: ¹²Mmm.

36 K: ¹³Soo [Laughter]

37 Researcher: ¹⁴So how do you believe? What did you believe when you were
38 ¹⁵Christian [Inaudible]?

39 K: ¹⁶When, when I Christian, you know, it's like I used to go to
40 church...

41 Researcher: ¹⁷Ja.

42 K: ¹⁸...and, and, and when you are taught something...

43 Researcher: ¹⁹Mmm.

1 K: ²⁰...so, ja, the bible...

2 Researcher: ²¹What did [*Inaudible*]...

3 K: ²²...but how did Adam and Eve get on to earth?

4 Researcher: ²³Ja.

5 K: ²⁴That's another question...

6 Researcher: ¹Ja.

7 K: ²...altogether.

8 Researcher: ³So, but because that's what the bible says...

9 K: ⁴Yes.

10 Researcher: ⁵...that **god created them**.

11 K: ⁶Exactly.

12 Researcher: ⁷So is that what, what you believed when you used to go to church?

13

14 K: ⁸Yes, exactly, but now I see **my perspective has, has changed...**

15 Researcher: ⁹Ja.

16 K: ¹⁰...but **I know the cell and, and, and how it changes**.

17 Researcher: ¹¹I think that's very interesting, that you've allowed yourself to

18 ¹²change.

19 K: ¹³Yes

20 Researcher: ¹⁴I think that's wonderful...

21 K: ¹⁵Mmm.

22 Researcher: ¹⁶...because many people, especially they been taught a certain

23 ¹⁷thing at church, they don't change.

24 K: ¹⁸That's true and, and I, I think it's, it's, it's all about being

25 ¹⁹literate and, and going higher in, in studying...

26 Researcher: ²⁰Mmm.

27 K: ²¹...and you are, your mind is more opened...

28 Researcher: ²²Ja.

29 K: ²³...to other philosophies and theories whereas if you're not, um,

30 ²⁴exposed to that, uh, way...

31 Researcher: ¹Mmm.

32 K: ²...then you just going to one, one, have one frame of mind, one

33 ³track.

34 Researcher: ⁴Mmm.

35 K: ⁵Ja, it's what you're taught, and that's what you are going to

36 ⁶believe in...

37 Researcher: ⁷Mmm.

38 K: ⁸...but I'm, I obviously am teaching my children, you know, the

39 ⁹**evidence is there, you base your theories on that**.

40 Researcher: ¹⁰Mmm, so if they're basing their theories on, on the evidence

41 that's ¹¹present, right? How would, do think there's a place

42 there for them ¹²to also have their Hindu faith?

43 K: ¹³**Yes, definitely**. As I, uh, I mentioned, uh, the **fossils**...

- 1 Researcher: ¹⁴Mmm.
2 K: ¹⁵...uh, that, that was recently found, and if you're going right
3 back to ¹⁶Hinduism and the cell.
4 Researcher: ¹⁷Ja.
5 K: ¹⁸So I think if, if the child, learner, can try to link that...
6 Researcher: ¹⁹Mmm.
7 K: ²⁰...they can make sense of evolution.
8 Researcher: ²¹Mmm, and then there will be no conflict?
9 K: ²²There will be no conflict.
10 Researcher: ²³Okay, thank you K for your time...
11



INDIVIDUAL PARENT 2 – 24 MAY – TRANSCRIPT 11

TRANSCRIBED BY L. Glaus

- 1
2
3
4
5 Researcher Does your religion play a role in your life? In other words are you a
6 practising Hindu?
7
8 M To a certain extent, yes I am.
9
10 Researcher Please explain.
11
12 M I follow all the religious things that I have to do which to a certain extent
13 I do believe. I try to practice it, as far as possible, in my home with my
14 children. There are certain norms and values that we are brought up to
15 believe in and I instill those things in my kids, hoping that they will carry
16 on. Also from the children's side they also want to know why we do
17 certain things. As far as possible I try to explain to them from what I
18 know and what I've been brought up with but at the same time, I am
19 unable to give them a full explanation because many times, in my
20 upbringing my parents were not able to explain certain things as why do
21 we do it and the reasons behind and things like that.
22
23 Researcher You mentioned that there were certain beliefs and values that you were
24 taught being a Hindu so can you say what some of those beliefs and
25 values are?
26
27 M Some of the values that I like to instill in my children is love, harmony,
28 peace. Giving doesn't only believe in receiving, also at home. Looking
29 up to the needy people, helping them and things like that.
30
31 Researcher And you try to teach your children that?
32
33 M I try to teach them that love is very important and that's what keeps us
34 going. Not to be envious and treat people with kindness and if someone
35 is horrible to you, you don't do the same. How to behave and about
36 violence.
37
38 Researcher So how strong would you say your Hindu beliefs are?
39
40 M I think it used to be very strong after I married because I married into a
41 very religious family where they also practiced the same Hindu beliefs as
42 I did while growing up. I tried to follow all of the rituals and things that
43 one performs and I am still doing it up until today. But if I look at

1 myself today, I am moving more **towards the spiritual** line rather than
2 being religious. I think that means a lot and I like to bring my children
3 up.
4
5 Researcher That's very interesting when you say spiritual line. Can you explain
6 further?
7
8 M Spiritual line linking myself with God. Being closer to God and
9 understanding why certain things happen in life. I also believe in the
10 **Law of Karma, cause and effect**, and what you do, will be done upon
11 you. I try to bring my children up along those lines as well.
12
13 Researcher So when you talk about the law of Karma – what do you know about the
14 law of Karma?
15
16 M To me, its cause and effect, what you do or what you sow you shall reap.
17 Or you get it back to you or you get it back a hundred times to you.
18
19 Researcher So you believe very strongly in that.
20
21 M I believe very strongly in the law of Karma. Lots of things throughout
22 this life have brought me closer to understanding the law of Karma and
23 an understanding of how it works. That you naturally carry your own
24 personal Karma, financial Karma, all sorts of things to it.
25
26 Researcher Okay that's great. So do you have any knowledge of the Hindu
27 scriptures?
28
29 M To be honest with you, not much.
30
31 Researcher Do you know anything, even if its hearsay. Even if you didn't read it
32 yourself. You've seen it on TV or you were told about it, anything like
33 that?
34
35 M Well according to **certain rituals** that we perform, prayers and things like
36 that but here in South Africa it does get a bit confusing as well when you
37 look at the meaning of how things originated and why we perform
38 certain things. It's a bit fabricated here and when you talk to people
39 from other countries, they give you a different view. I don't know how
40 much truth there is **in praying** and things like that because we have one
41 called a porridge prayer and a fasting prayer in September. The prayer in
42 September that we do, we are under the impression that we have to pray
43 to this God and **fast** in a certain way and abstain. When you speak to

1 people from other countries, they have another story. They would tell
2 you it was harvest time and they only had veggies and things like that.
3 The same goes with the porridge prayer as well. We believe that we
4 have to pray to our mother and during this time there is a lot of
5 significance to contagious diseases like measles and mumps and things
6 like that. Lots of our kids have measles during that time and we
7 basically cook the porridge and sometimes some people sacrifice and
8 where we are vegetarians we offer that to the God. But in India, I
9 believe it was harvest time and they got a lot of rain and they celebrated
10 in this way so it's very contradicting.
11
12 Researcher So do you think if you had any Scriptural knowledge that would change?
13
14 M Yes, I think so because we get it from different people and our parents as
15 well cannot give us a proper answer as to why we are performing some
16 of these things. Why do we abstain from this thing or why do we have to
17 do this thing in this manner or whatever. There is a lot of rituals and
18 very confusing.
19
20 Researcher I know what you mean but why I'm asking about your scriptural
21 knowledge is because my next question is how in Hinduism are you
22 taught or what impression do you have of how life originated on earth,
23 according to the Hindu perspective?
24
25 M I think when I was brought up, I read a lot of stories related to
26 Christianity like Adam and Eve and how they originated and things.
27 When it comes to Hinduism, I really don't get a feel there; no one
28 explains how things originated. I just know this big bang theory, and
29 everything started growing and things but not something specific relating
30 to life on earth, relating to Hinduism.
31
32 Researcher So you mention the big bang theory and everything originating from that.
33 Don't you think that is a bit more scientific than religious?
34
35 M Yes definitely but there isn't a real Hindu thing. I mean we have a lot of
36 deities and things that we pray to and things we worship and give thanks
37 to in our life be it for food, water, wealth, health and things like that. But
38 really the concept in Hinduism of how life came about – I don't really
39 have any understanding of that.
40
41 Researcher Now your son studies Life Sciences at school. Did that make you feel
42 that he was being led astray in any way because maybe in Hinduism
43 there was something that preached otherwise?

1 M I don't think I was confronted with anything otherwise. I think I kind of
2 accepted what he was learning at that stage and it did make more sense
3 to me when I looked at it and studied it and I'm also doing some work
4 around that with my learners and they are very fascinated. They always
5 say that God has made us and that's always an answer coming from the
6 kids who are Christian orientated. They seem to have a better
7 understanding of that. I really didn't mind what he was learning in fact I
8 was very curious about it.
9

10 Researcher So you didn't feel there was any conflict between Hinduism and
11 evolution according to what your son was learning at school?
12

13 M No not really.
14

15 Researcher So do you have any idea what the topic of evolution is all about at
16 school?
17

18 M Yes it's about how man has evolved on earth and the different stages
19 from how we started and moved up the ladder to what we call ourselves
20 now, homo sapiens. People who have the ability to think and I think I'm
21 able to converse that and show the kids graphics and pictures and things
22 and make them understand how man originated from the ape and moving
23 up.
24

25 Researcher According to Hinduism, do you know how old the earth is? The
26 Christian people always talk about the earth being about 6000 years old.
27 In Hinduism is there any idea of how old the earth is?
28

29 M I'm not sure about the earth but I know that Hinduism is the oldest
30 religion on earth. About 300 000.
31

32 Researcher Is that something that you are just estimating?
33

34 M Yes.
35

36 Researcher So do you feel that there is something missing in your life because you
37 don't have all the scriptural knowledge that could maybe help you to
38 understand all these questions I've been asking you?
39

40 M Definitely yes, because as I get to read more and more and empower
41 myself, I'm moving more towards spirituality and be closer to my
42 religion as such. I feel that if my religion has that kind of knowledge to
43 offer and have it simplified in the language of English it would make

1 more sense because I think I will be more empowered to convey this
2 kind of knowledge to my kids which I feel it's important that they need
3 to know. I feel as I go on reading and doing a bit of soul searching and
4 things. I feel myself closer holding onto Christianity books so I have a
5 greater understanding on that part than I do on my own religion.
6
7 Researcher So do you think that there's a deficiency of knowledge in the Hindu
8 religion available to us or do you think you just don't know how to
9 access the knowledge?
10
11 M I can access the knowledge on Internet and things but it gets a bit
12 complicated so if it was simplified in books and things it would be much
13 easier. For instance if I pick up the Bhagvad Gita the language is beyond
14 comprehension at times. So if it's simple and we have reasons for
15 reading it, it will make it much easier and simpler.
16
17 END
18
19



INDIVIDUAL INTERVIEW PARENT 3 – 28 MAY 2011 – TRANSCRIPT 12*TRANSCRIBED BY L. Glaus*

- 1
2
3
4 Researcher Are you a practising Hindu?
5
6 V Yes I am
7
8 Researcher How would you describe yourself?
9
10 V Firstly, I'm a born Hindu. I firmly believe in my religion as a Hindu but
11 more important **Hinduism has strengthened my spirituality**. I have been
12 very involved in my **prayers** and that is something that has carried me
13 through my recent tragedies. I have my **lamp** at home which I pray to
14 daily.
15
16 Researcher And in terms of Hindu scriptures, do you know any of them?
17
18 V Yes I used to, I was very very involved . I am not sure if you are aware
19 of the Sathya Sai teachings. From a Hindu scripture point of view, In
20 1981 I graduated as a teacher in Bal Vikas I taught religiously for 20
21 years until I moved up to Gauteng. I did a lot of Sai **spiritual education**
22 and in terms of personal reading, I have focused a lot on Hindu books.
23 At the moment because I am trying to seek answers. One of the things is
24 Sivananda on **reincarnation**.
25
26 Researcher Okay, that's very interesting. In terms of all the Hindu scriptures and all
27 the readings and teachings that you have been involved in so far, what
28 have you heard or read that Hindu's say evolution is all about?
29
30 V In terms of Hinduism, I've not read much on evolution but if it's related
31 to **reincarnation then that's the emphasis for me**. Hinduism has put a lot
32 of emphasis on reincarnation. Yes there was a beginning and **Hinduism**
33 **being the oldest religion more than 5000 years old**. Obviously we
34 believe that we came from somewhere and when we evolved, and I'm
35 not sure that Hinduism focuses on this but there are a lot of theories on
36 us evolving from when the earth changed and evolving from
37 Neanderthals. Those kinds of things – I'm not very familiar on that, I
38 will be honest but my focus is rather on reincarnation and rebirth and
39 **reaching nirvana** eventually.
40
41 Researcher So what is your take on reincarnation?
42

1 V I firmly believe in it. It's also very much ingrained in my scriptures,
2 engrained in Hinduism. Eventually we do reach liberation. In order to
3 do that one needs to go through a series of births and deaths, but it just
4 doesn't happen like that. Each life has to have a strengthening and
5 moving towards Godhood. So in Hinduism we believe in the stages of
6 life. I did Hindu studies at university as a course and I think that this was
7 also covered but we are talking about 25 years ago. There we learnt the
8 stages on Hinduism where you go into your developmental, you reach
9 21, your reach your adulthood, your married life. You then give up your
10 material life and go into your Sannyasihood then if a person has not
11 achieved that in one life span then obviously your rebirth will allow you
12 to continue with that depending on other circumstances. What you are
13 reborn into, what form, which family you are born into and all those
14 things but Hinduism ultimately believes in reaching Godhood and that's
15 where all the saints have reached and one day we will all be there.
16

17 Researcher Very fascinating. According to Hinduism and all you knowledge do you
18 have any idea how old the earth is?
19

20 V I've heard that its billions of years old. That's not Hinduism, just
21 National Geographic and that sort of thing but I really can't tell you.
22

23 Researcher How do you react when you hear that sort of age of the earth? Do you
24 believe it?
25

26 V Are we talking about the earth structure itself?
27

28 Researcher Yes
29

30 V There is certain information that is best understood by science and if
31 science gives us this information, one is not going to question that and
32 one needs to be proud that the planet earth has developed human life and
33 human life can thrive here. Compared to other planets where nothing
34 lives. Now they're talking methane gas in the one planet which obviously
35 we can derive some things from. They talk about water on the moon. Its
36 scientific history but one is not going to go and test it. You take their
37 word for it.
38

39 Researcher You mentioned that humans thrive here on earth and we should be proud
40 of that so what is your take from a Hindu perspective about how humans
41 got to be on earth?
42

1 V This is a tough question and I would like to open the National
2 Geographic book for this.
3
4 *[laughter]*
5
6 Researcher No but this is Hindu perspective.
7 V There are so many theories about it I can't tell you what Hindu scripture
8 itself says because my focus has not been on evolution but rather on the
9 afterlife. I needed answers on that one. My personal belief is that
10 initially all of us were born Hindu. 5000 years ago we were all born
11 Hindu and we did not have the separation of the continents as it is right
12 now and there are many theories and one of those is that there were huge
13 masses of land that everyone lived on and they separated when various
14 things happened. I'm not sure what Hinduism says about where life
15 began. There's the Christian philosophy about Adam and Eve and that's
16 very plausible.
17
18 Researcher In terms of creation?
19
20 V Yes in terms of creation but I have not researched that.
21
22 Researcher You are aware that the topic of evolution is being taught at schools?
23
24 V Yes I am but I have not read it.
25
26 Researcher So you don't have any idea of what the topic entails?
27
28 V I would assume that it would be taught from a scientific perspective
29 meaning that this is where life began and this is the different stages of
30 development of the human being. Where one has gone through the
31 stages to the Neanderthal and the figures are in my mind, the baboon
32 face, and the man that was walking on fours and then eventually an
33 upright two legged citizen. Yes, I would assume that that is the scientific
34 accepted study that would be taught at school.
35
36 Researcher Do you feel that there is any conflict between your religion and evolution
37 that's being taught at school?
38
39 V Because I am not sure what Hinduism exactly says, I would not object to
40 what is taught in school.
41
42 Researcher So there's no conflict from your side?
43

1 V No.
2
3 Researcher Okay, that's very good.
4
5 Researcher Does it bother you that your child is learning something at school that
6 goes against their upbringing? Was your child brought up to believe in
7 Hinduism, Hindu Scriptures and so on?
8
9 V My child has been brought up in the Sai way and that's the difference.
10 The Sathya Sai believes in all religions so Hinduism being one of the
11 five major religions and both my children graduated from the Sathya Sai
12 religion school after nine years. We believe firmly in the equality of all
13 religions and in the equality of everything so I would have had no
14 objection so if the Christian religion believes that Adam and Eve came,
15 there is nothing wrong with you learning this because eventually you will
16 make up your own mind as to what happened.
17
18 Researcher So you have brought up your children in a Hindu home as well even
19 though the background was Sai principles.
20
21 V Yes we still are practising Hindu's.
22
23 END
24
25



INDIVIDUAL HINDU PRIEST INTERVIEW – 30 May 2011 – TRANSCRIPT 13*TRANSCRIBED BY L. Glaus*

- 1
2
3
4 Researcher Guru we were talking about your scriptural knowledge.
5
6 GD Scriptural knowledge comes from a basic form of worship based on
7 mother worship but I've done a lot of extensive research into **Vedic**
8 **scriptures** which is quite informative. It gives us a lot of aspects of what
9 our religion actually revolves around. It is a scriptural background that I
10 come from.
11
12 Researcher Guru how do you rate your scriptural knowledge from 1 to 5 with 5
13 being very good.
14
15 GD I'd say about 4, you know I would not say I have knowledge of the entire
16 scripture but **in my readings and understanding of scripture**, I try to do it
17 in mylife. I also do readings on a lot of swamis that have passed on
18 where I read their literature and their books as to how they understood
19 Hinduism.
20
21 Researcher With your scriptural knowledge, do any our scriptures describe how life
22 began on earth?
23
24 GD Everything revolves around, um what we Hindu's believe, that there was
25 a **huge ball of fire which exploded. There were millions of particles**
26 **which came about which formed the planets etc.**
27
28 Researcher Do we actually believe that?
29
30 GD Well, you know, the version of God from the Hindu perspective is that
31 God is Omnipotent, Omnipresent, Omniscient, formless, nameless,
32 speech-less but you will get in certain parts of worship in Hinduism
33 where they will worship the Mother which is a female aspect. It is a
34 chosen form, not saying that that is the only form of God. Then you get
35 people that actually do the male form of worship but in part of which
36 they choose so the aspect about God being Omnipotent, Omnipresent and
37 Omniscient is what Hinduism is actually all about because God is not
38 made like a female. God is this great ball of energy, and it says very
39 clearly in the scripture that we as the **Atma** has to one day submerge
40 with the **Paramatman** which is God Almighty so that great ball is actually
41 what we are all here to aspire to.
42
43 Researcher Is there any scripture that actually says what you have been describing?

1 GD If you look at the **Bhagvad Gita** it states very clearly that the almighty
2 aspect of God is the super consciousness of God. He is this great
3 Paramatman which they refer to as Krishna and **Krishna is referred to in**
4 **the the Bhagvad Gita as the Supreme**. And it was called a super
5 consciousness and yet again you will find that the human creation that
6 lives on this earth itself has been born from the various levels that has
7 come down through this media of Krishna consciousness, having attained
8 human birth, it is said it is the highest level of consciousness that a soul
9 can achieve and through that medium the soul which is referred to as the
10 Atman is able to eventually merge with the Paramatman at a point in
11 time but in scripture it is stated yet again that the **cycles of birth** has to go
12 through such a different process where it is stated that finally the soul is
13 purified and it reaches a **stage where is called Nirvana where is which it**
14 **becomes one with the Paramatman but that has to be a process**. Now you
15 will find in Hinduism it is taught very clearly that **the soul never dies**. It
16 is **reborn and that is based on your Karma**, how that is reborn. You could
17 have a human birth, you could have an animal birth or whatever but the
18 that soul takes that birth until it is purified where it reaches **108 cycles of**
19 **birth, then only can it merge with the Paramatman** and that process is
20 called *Navava*. It's the most purified form that the soul actually goes to.
21 A lot of people would ask the question," Is the soul tangible?" Can you
22 feel the soul? The soul cannot be felt because if you go back to how life
23 started, very simply we have what is called life – in vernacular, it's called
24 *weer* then you get the spirit, called *arul*, then *Atman* which is the soul.
25 So that is basically how it happens. The *weer* which is the life and spirit
26 is what decides on this earth and the Atma is one that goes through the
27 process. So there's really three aspects. Life Spirits is very important
28 and then the soul. In every life and spirit, there is a soul so that is how it
29 works. So the life is on this earth and the spirit and soul is what leaves
30 this body. Then you will find from a Hindu perspective we go through a
31 process of mourning which is only a year. Now that spirit and soul,
32 there's a definition of what we Hindu's try to bring about the importance
33 of the soul. You will find that where it is not the time for the soul to pass
34 on the spirit lingers on and that is where you get all aspects of spirit,
35 people being affected by spirits, ghosts or have this strange experience
36 with something that was living dead etc but the soul is the most purified
37 aspect so when the soul detaches itself from the spirit that's what actually
38 contributes its journey to be either reborn or one with the Paramatman.
39
40 Researcher So that was a very interesting explanation and I wish I could ask you
41 more questions about that but just to move on to the topics that I am
42 trying to look at. I'm just looking at what our scriptures say about why

1 man came to be on earth. Is it what you were explaining just now that
2 we are the ultimate manifestation of that?
3
4 GD The human creation is the highest of birth that is brought unto man. In
5 **scriptures** it is stated very clearly that we are born here purely not to
6 enhance the physical appearance of these human body but to enhance
7 what is within so there is a consciousness and a **super-consciousness**
8 which is what we need to reflect because the human being is what is seen
9 but what is within is what we should be searching for so when we say
10 very clearly that we are searching for God it is said in Hinduism that God
11 resides within everybody. That is the consciousness that we need to
12 dwell into and how do we do that very simply is through our actions.
13 We have various forms of being able to live on this earth, one is the
14 material world. Now the material world is purely everything that is seen
15 on this earth that is due to man's technology and man's scientific
16 research etc. All that is only material. That is achievable to man through
17 his sheer hard work. No God intervention whatsoever because
18 everybody has the ability to achieve materialism but that is not our
19 ultimate goal. That is what is called the mental consciousness and
20 spiritual consciousness which is what is inside. In Hinduism it is taught
21 very clearly that it does not stop us, you know in the **Bhagavad Gita or**
22 **any scripture** you see. It does not stop us from being material but it says
23 very clearly that you cannot be materially possessed. **When you are**
24 **materially possessed then you are only in the physical world**, not with
25 any other world which is what our consciousness is all about meaning to
26 yearn so you find that through the actions, which is what we should be
27 doing, pure actions. Some of these actions, our duty, our service to
28 mankind, physical cleanliness, spiritual cleanliness, mental cleanliness.
29 You get the various yogic aspects that we should be performing
30 physically, mentally, spiritually. Then you get the aspect of spiritualism
31 which is, you know if you take cleanliness and associate it with
32 spiritualism then there is **a more higher science to that type of cleanliness**
33 because it is not just the physical, it is the mind that comes into it
34 because you can be whoever you are but when you are in the presence of
35 God, your mind is the first aspect that needs to be clean. Your mind and
36 your thoughts.
37 That is an innovation that mankind has to actually achieve. So the
38 actions that we perform on this earth pretty much determine how we
39 evolve in the sense of our **atman reaching the Paramatma because every**
40 **action has a reaction**. So it is very clear that in our actions on this earth
41 that while we are on this earth it is not purely to live, although we are
42 here to live a life but we are here to yearn for a higher level and that level
43 is to reach the super consciousness that is within us. **In every human**

1 creation there is the super consciousness within us that is the soul. That
2 is what we need to purify and bring that above all other activities in this
3 material world and be able to supercede everything else so that we can
4 reach the Paramatma.

5

6 Researcher Is there anything in the Hindu scriptures about how old the earth is?

7

8 GD This year is called Karvarasham It is basically 5012 years old. Now
9 every year is given a name. This year it's referred to as the year we need
10 to worship. In the cycle of Kallyuga it is said that this is the 4th yuga.
11 Now we had yuga's prior to this which relate to millions of years but
12 there is no documentation that says that but the Vedas is an authenticated
13 scripture that goes back to the very first yuga which is called Dwapara
14 yuga. Then you get Sathyam yuga, then you get Tretha yuga, then you
15 get Kali yuga which is now. Now Kali yuga, at the current count is
16 around 400 000 some odd years old but if you look at the other previous
17 yuga's they range from 500 000 to 600 000, 700 000 years old. Now that
18 is from a Hindu prospective about how Yuga's actually came. The first
19 one, Dwapara yuga is where a man was created, sorry, when the world
20 was created and the higher super forces of God almighty presided on this
21 earth. Krishna came during that time to bring to mankind various aspects
22 through the medium of the Baghavad Gita . One of the great aspects he
23 taught was the aspect of duty, what is duty. You have got to supercede,
24 even if it came to your family, you supercede that. In the Satya yuga man
25 came onto this earth and started this process of where you could
26 communicate the higher super aspects of God. You could relate to
27 mankind. You'll see in many of the scriptures that man could
28 communicate with God. It was that God was present then. Then in the
29 Tretha yuga is when all the anarchy started. Anarchy started through
30 temptation, desire all these aspects, the world became a confused state
31 and God removed himself from that. And that is why in the Kali yuga,
32 its stated for God to come back to be in and with man it has to be a
33 situation where desire, temptation, the materialism of this world, all the
34 lower consciousness has to be removed from man. That is why it is said
35 – don't look at the outside, look at the inside which is very important.

36

37 Researcher With these four ages that you've mentioned now, is this a cyclic thing or
38 is it, or what happens when Kalli yuga is over?

39

40 GD The scriptures states very clearly that when it comes to an end, those
41 that have trodden onto the very feet of God will be saved and there will
42 be a new world that will be revealed but there is not a time frame that is
43 given but you are finding that in this time and age that is given that

1 people who cling on God will be given a higher status or higher elevation
2 of birth but that is yet to come so what is happening the kalliyugu is
3 being purified of all the negative elements and these elements are being
4 taken away and the more purer in thought we are the closer we get to
5 what they mean and being in the world that we look for. Yes, it is a
6 cycle.

7

8 Researcher So do our actions also determine that?

9

10 GD Absolutely, every action that we perform in this material world, in this
11 Yuga has to be pure Sathwic, it has to be selfless, it has to have a
12 spiritual link, it has to have a super conscious state of mind. You can't
13 take say something like me now, wanting to serve the community with
14 an ulterior motive like I want to do something for you but I want
15 something in return. It does not work like that.

16

17 Researcher Do you know that the topic of evolution is being taught in schools. How
18 do you as a Hindu priest feel about that. Do you feel that it's going
19 against what Hinduism teaches?

20

21 GD It becomes a difficult one because when you look at the curriculum in the
22 schools it seems to be on a Christian based or Christian perspective.
23 Hinduism says very clearly that there is life after death. Man came from
24 the super conscious state and as the years went on man became involved
25 in all aspects of desire, temptation etc which infiltrated his mind to such
26 a level that he is now living in this kalli yuga trying to reach a state of
27 perfection. It is impossible and very difficult but yet he must not lose
28 sight of this reason, not lose focus of the reason he was put on this earth.
29 Although I find it difficult to accept what is being taught about evolution
30 but I don't have that kind of power to stop it. We hope by mediums of
31 satsangs and temple worship we hope through a Hindu perspective that
32 we will be able to spread the message of where we started and where life
33 started.

34

35 Researcher So you actually think there is a conflict?

36

37 GD There is a conflict, yes, we do believe that because God created human
38 which was the highest consciousness and that is why you will find in
39 scripture and in more recent scripture, in the Ramayan, Lord Vishnu was
40 the preserving force on this earth came in human form as Raam and
41 you'll notice that the Baghavad Gita yet again is another epic of how God
42 came as Krishna in a human form and evolved as a human being from
43 baby to an adult and even practiced the normal activities of a human.

1 And God had to come in that form to show, like in the Ramayan, Lord
2 Raam shows what is the meaning of dharma. What is duty and in the
3 beginning of the Baghavad Gita, Krishna shows a very unique
4 understanding of the conflicts in life, the battles that we have. The battle
5 of Kurukshetra is one that actually brought families that were opposing
6 each other eventually to conflict. But eventually there was some kind of
7 alliance and Krishna was the mediator in that sense. It gives you an
8 understanding, when non Hindu's look at it, they perceive God to be this
9 monster, this ferocious aspect but the evolution of God in the more
10 recent times as Raam, as Krishna, came in human form. And that was to
11 depict, or to live amongst mankind in order to bring an understanding
12 amongst them.

13
14 Researcher Do you feel that there's any place in Hinduism for rituals that we
15 observe?

16
17 GD **There is a place for rituals** but we also need to live in a time of reality.
18 And reality meaning, very simply, that what has been performed
19 hundreds and thousands of years ago **cannot be used in the context of**
20 **what we are living in now**. And the reason why I say that, is very simply,
21 is that when we speak about God, God is a loving being. The loving
22 aspect, is a caring aspect, a nurturing aspect but when we look at all these
23 aspects of **rituals, fear is instilled in people**. It becomes frightening
24 because people ask themselves "If I don't do this, God is going to be
25 angry with me". So is God as people perceive him to be. Is God so
26 angry at us? So bad to us. No, it's not that. God is love. Its stated in our
27 Thevaram Love is God, God is love. If we can keep that at all times and
28 remember that and not instill fear, then we are actually moving in a
29 realistic path. As much as rituals are part of Hinduism, it is not the end
30 all of it. It is one tier.

31
32 Researcher Do you feel that there's any science in Hinduism?

33
34 GD Absolutely. The science in Hinduism is depicted in the Vedas where
35 Lord Skanda, Skanda is Lord Muruga.. He was referred to as the
36 **Scientist of Hinduism** because when we look at the science of
37 *Saravanabhava* .which is the six senses, it gives you a very important
38 understanding of human life. Sa which is sight, Ra which is hearing, Va
39 which is touch, Na is taste, the sixth one is understanding. So these are
40 the six senses of a human life and when we look at all these aspects and
41 understand the science of it and if you use all these senses in a balanced
42 level. What we see is what is interpreted in this entire body. What you
43 see, you speak, you hear, you know it goes out. You speak, people hear.

1 So the sensory organs play a very important part of one's life in a human.
2 In Hinduism that is where it is said that the science of all aspects is
3 because like it is revealed in the Vedas, Skanda was the great warrior that
4 came on this earth to destroy the negativity that man on this earth was
5 constantly enjoying. So the medium of sight, the medium of taste, the
6 medium of hearing so all these things were in a chaotic situation and
7 there was no understanding. And unless these things are all in balance,
8 there is no understanding. If you look at it in a deeper aspect there is so
9 much that you could extract from just that. The Vel that Lord Skanda
10 brings about reflects the super-consciousness of what happens in the
11 human mind. Very simply, you look at the pear shape of the vel, pointed
12 aspect is what is called our Brahma which is the part of the brain which
13 is referred to as the computer of the entire body.

14
15 Researcher You call this the Brahma and Lord Brahma is the creator?

16
17 GD Now everything that comes to this body of ours, whether it is pain,
18 sickness or some kind of transmission, it has to go through that main
19 centre because that is where everything is received and from there
20 everything is processed. And everything before that is very important
21 because when you look at all the sensory aspects, its below that so if all
22 these things can be balance, imagine what a super human understanding
23 you would be and it says in scripture it says that if we are able to reach
24 that, then we reach what we call *Satchidanandum*, total bliss. So yes,
25 there is a tremendous amount of science in religion. The saddest part,
26 which I as a spiritual leader find very difficult to handle, is that people
27 place too much emphasis on rituals. They don't look at the science
28 behind the ritual and the meaning. There is a meaning, a deep deep
29 meaning. There is not the pure act of doing that. You have to extract
30 from that physical aspect, the knowledge, and use it in your spiritual
31 capacity. Use the morals and morals you learn from there to elevate your
32 consciousness. That is what is most important. Don't look at that as
33 they only "if I don't do that this is what's going to happen" Typical
34 example is people buy new vehicles, a common thing in Gauteng here is
35 that everybody who buys a new vehicle believes that if they don't pray,
36 they will meet with an accident. Accidents are natural, it happens. It is
37 part of life. People are driving with no license, there is going to be an
38 accident. It's not an act of God. So people may say that I am doing this
39 ritual so now I will be prevented from having an accident.

40
41 Researcher But don't you think that that actually helps their mind set because now
42 that they've convinced themselves that they are safe- they probably will
43 be?

1 GD If there mindset was such that they would say I have bought a car and I
2 am thankful to the super-consciousness for giving me that ability and
3 intellect to buy and purchase a car. When the mind set is elevated and
4 reached that you will find the mind is clear at all times and is not able to
5 be distracted and you won't find accidents happening. So the
6 consciousness must be higher than just that. Yes it is important but it is
7 not the end and be all.
8

9 Researcher So I think that doing the prayer should actually be clearing your mind.
10

11 GD Yes it should be clearing your mind but making sure that that should not
12 be the end of it because every day you are going to get into that car recite
13 Om Namoh Shivaya Namah is the remover of obstacles. As long as you
14 remember his name and you do it selflessly and you do it in a purified
15 mind, with no ulterior motives, you will be protected.
16

17 Researcher Okay, now I'm going to ask you the reverse of the question I asked you
18 just now. Do you think there should be a place in science for religious
19 knowledge particularly Hinduism?
20

21 GD Do you think it would be possible?
22

23 Researcher Let's imagine it would. UNIVERSITY
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25 GD If it could be – why not. It would make such a better understanding of
26 everything. When you look at the **creations of God** and how from a
27 Hindu perspective, we look at preserving the earth. We look at how
28 important the water is, the various aspects, animal life, all that. In
29 everything it is said that there is a spark of God because from the great
30 **ball, all these great aspects were created and who created it. God**
31 **Almighty**. If it can be understood, in the human creation where people
32 are understanding it through medium of education it becomes much more
33 better.
34

35 Researcher So basically you are saying that when that big ball of energy exploded all
36 of the life forms were created. Did that happen at the same time?
37

38 GD Over a period of time. The **scriptures** states very clearly that it came
39 down until this earth was created and man was given an opportunity to
40 live on this earth . That is when human creation was able to happen even
41 in the aspect of human creation there being continuity. Hinduism has a
42 manner in which that is done but now you look in this kali yuga, the
43 desire and the temptation man has gone to extremes, beyond extremes

1 where life is not respected eg ladies given birth there is so many
2 mediums of this happening. It is crazy but it's gone to the extremes.
3 There is a manner in which that is perceived, correct according to
4 Hinduism meaning that if you follow a process, you are born, you grow
5 up, you learn the facets of life. Like Raam in the Ramayan, he grow up,
6 he learnt the various aspects that his father taught him, he came to a stage
7 in life where he found somebody. He found Sitha, and this is all an
8 enactment of God's great plan, and that is what he brought onto this earth
9 and in the same way we need to go through those processes before we
10 need to commit to say we need to procreate. We are given that authority
11 or that spiritual authority to procreate. Now if we can bring all this into
12 the medium of education is involved and we can utilize it in some
13 scientific manner it becomes a more virtuous life if at all possible.

14
15 Researcher With this creation that you have just been talking about, do you think
16 there is a place for all the fossils and all of those bits of evidence that the
17 scientists have found?

18
19 GD In Hinduism, it is said that the first Dwapara yuga was over 500 000
20 years old and you know, there was creation from that time and these
21 aspects could have taken different forms and gone through the various
22 aspects. Even when they speak about evolution with man coming from
23 that initial form and coming down and being more redefined but the
24 Hindu perspective doesn't actually hold that in saying that that is how
25 our life started. We don't completely come to that understanding of
26 that's how life started. We have a different approach but you will find
27 that somewhere in the centre there is some kind of connection which is
28 how human life started. We don't say that man evolved from this and
29 that. We say that Hinduism evolved from a certain period of time
30 because Hinduism is a religion. It's basically man made. It's not what
31 God made in the same way like Christianity or Islam but the values that
32 we are taught based on the part that has been chosen for us as the Hindu
33 way is absolutely scientific. So we have to understand that concept in
34 relation to life.

35
36 Researcher So basically you do say that there is a place for the fossils and the other
37 pre historic life form that have been found in the Hindu perspective.

38
39 GD Yes in the Hindu perspective, there really is.

40
41 Researcher That's really interesting so you are not renouncing it at all.

42

1 GD No. I don't believe that it should be renounced at all because if you look
2 at the Mahabharatha, it is an actual event that occurred. Thousands of
3 years ago the Ramayan. You take South Africa itself; we have two
4 extreme aspects of history that affect us Indians and specifically us
5 Hindus. If you look at two important shrines on the north coast and
6 south coast of KZN. One the Mt Edgecombe Mariaman temple and one
7 the Isipingo Mariaman temple where you find so much history. Those
8 places are 150 years old but there is so much history and so many things
9 that have been unraveled from those places. People that lived there, little
10 scriptural books that were found. People that passed on, their remains
11 were found in close proximity to there. There were certain aspects that
12 related back to Hindu mythology. They found footprints of a monkey
13 foot or the ape feet which was related to the Lord Hanuman. So from a
14 Hindu perspective, I personally don't rule out the idea of fossils because
15 it has happened. The journey from the first yuga has come down to us
16 and for all this to be unraveled definitely proves that Hinduism dates
17 back to thousands and thousands of years.
18

19 Researchers You know the story of the 10 avatars? The first avatar being the fish and
20 so on. Where do you think that fits in?
21

22 GD When we speak about Hinduism it is based on a large aspect of what is
23 called the Trinity. Which is the Creator, the preserver and the disposer.
24 I say disposer, I don't refer to it as destroyer. The creator is Brahma
25 and is revered, Vishnu is the sustainer and Lord Rudra/Shiva is the
26 disposer. You take these aspects of these Avatars, Avatars are
27 manifestations. You will find that one is a fish, one is a hare, one is a
28 tortoise you go through all these aspects but when you come the later
29 ones, like Vishnu who took the form of Raam. Vishnu took the form of
30 Krishna and these are the important ones that we need to understand.
31 When you look at why they took the forms of these things like if you
32 look at why Vishnu had to come. He had to come to clean or purify the
33 ocean that he took the form of a fish. He had to come as a fish because
34 of all the turmoil that was happening. He had to prove a point or depict a
35 lesson that had to be taught where he came in the form of a tortoise. So
36 each form that Vishnu took was for specific purposes. There are various
37 things that you can look at. The Deer itself, when Lutchmana was
38 injured, that Deer was a distraction but that Deer was the Ravana in
39 disguise. He had to actually destroy so Raam took that form.
40

41 Researcher Do you think that there is a significance for these forms of the Avatars
42 early on they were fish, and hare and all that and later on they were man.
43

1 GD As I said, if you look at the continuance of life, life started at that point in
2 time but as we say, the souls were being purified it became a higher level
3 of consciousness. But in no way does Hinduism say that is evolution.
4

5 Researcher We don't say it but do you think that there is an underlying meaning
6 there?
7

8 GD I wouldn't say it because of my belief. I believe in the soul being
9 purified, I believe in a super-consciousness. It would be wrong for me as
10 a spiritual leader to say evolution is the Hindu way because we believe in
11 reincarnation.
12

13 Researcher But don't you think that reincarnation is a type of evolution?
14

15 GD Probably is.
16

17 Researcher Because it's our soul evolving to become more purified?
18

19 GD It probably is but it is difficult for us to completely agree with that
20 because when we look at how Hinduism relates to the world or how
21 everything being started off, there is quite a distinction that we have
22 made amongst other religious beliefs. If there was documentation
23 relating to millions of years ago it would have been proven that
24 Hinduism existed and that it is revered and the oldest religion in the
25 world. It says 5012- documented proof.
26

27 Researcher Anything else you would like to add?
28

29 GD I don't think I need to add anything but hopefully the emphasis on us
30 understanding life, the spirit and the soul and knowing how man is put
31 on this earth for a better purpose. And that purpose not purely to
32 entertain the material world.
33

34 Researcher Thank you very much Guruji.
35

36 END