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The Development of a Valid and Reliable Instrument to Assess Constructivist Practices in Primary Classrooms

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THE DEVELOPMENT OF A VALID AND RELIABLE INSTRUMENT TO ASSESS CONSTRUCTIVIST PRACTICES IN PRIMARY CLASSROOMS

by

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Abstract

This study investigates the development of an instrument to measure teachers' constructivist practices in their classrooms. The Department of Education Curriculum Framework for Western Australia is based on a constructivist learning environment, and this study has sought to develop an instrument for exploring individual Western Australian teachers' utilisation of a constructivist learning environment in their classrooms. While there are a number of studies relating to constructivist classroom practices, the literature review indicates that there is little research about actual practice in a Western Australian primary school context.

The instrument was developed from an extensive review of the literature. Key theorists and their primary concepts were identified and tabulated, and from 24 key concepts defined, survey questions were developed. Various validity checks were performed, and in order to further improve and assess reliability, data was gathered from 36 teachers over 8 schools.

Analysis of the pilot survey data suggests that the instrument developed is a valid and reliable tool for measuring teachers' constructivist practices in their classroom.

The thesis concludes with recommendations for further research and suggested uses for the instrument.

Declaration

I certify that this thesis does not, to the best of my knowledge and belief:

i) incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education;

ii) contain any material previously published or written by another person except where due reference is made in the text; or

iii) contain any defamatory material.

Signature [redacted]

Date 6th March 2002

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CHAPTER ONE

Introduction

Context

Educators have long been concerned with the efficacy of the learning process. For example, in 1989, a report commissioned by the Federal Government revealed that the teaching of science in primary schools was, according to the Australian Academy of Science, in a 'state of crisis' (Australian Academy of Science, 1994, p. v). In 1998 the Curriculum Council of Western Australia also expressed similar reservations about other learning areas in Western Australian schools.

These and subsequent reports on teaching ultimately led to recommendations for a different approach to teaching in Western Australian schools. This new approach was developed after wide consultation with theoreticians and practitioners, and was based on constructivist theories.

The Western Australian Curriculum Framework provides examples of how constructivist practices might be incorporated in classrooms. The Framework promotes many constructivist principles, and a fundamental vision is 'Student centred learning will become increasingly appropriate as an outcomes focus is adopted. Much of the Curriculum Framework has a student-centred flavour' (Education Department of Western Australia, 2001, p. 1). With such an official emphasis on constructivism, it would be advantageous to ascertain levels of attainment in Western Australian schools.

The aim of this study is to develop an instrument for exploring individual Western Australian teachers' perceptions of their constructivist learning environments.

Problem

Reports as discussed above and additional contemporary research to be discussed, contend that constructivist practices are crucial in the primary classroom. However, the linkage between teachers' acknowledgement of the importance of the theory and their practical implementation is not automatic. Essentially, while teachers may claim to understand basic constructivist principles, they may not. Additionally, they may not implement them in a meaningful way. In short, despite the existence of ample evidence that constructivist principles are desirable, we need to assess the current state of teachers' practices to guide further implementation. Of significance is an understanding of whether constructivist frameworks and the methodology currently available are in use, and teachers' perception of the value of constructivist practices.

Rationale and significance

In the 1980s The Department of Education, Western Australia (at the time the Ministry of Education), deemed that a change in classroom practices was required. Following this, in 1998, the Curriculum Council of Western Australia developed a set of Outcome Statements for all learning areas; the Curriculum Framework. The Curriculum Council envisages that the Curriculum Framework will be fully operational in all schools by 2004 (Curriculum Council, 1998a) and the framework is based on constructivist principles.

A careful reading of the literature indicates that many aspects are important when considering suitable learning environments for students. Firstly, the type of learning

theory utilised, secondly, how the selected learning theory can be applied, and finally, the context for efficient application. "Where teachers are at" or rather how they perceive they are incorporating various constructivist techniques in their classroom is of prime importance in the implementation of constructivist practices.

An instrument that would assist in developing an understanding of Western Australian primary school teachers' application of constructivist based learning techniques is important to assist in determining the extent to which the curriculum framework is being applied. This will assist in providing direction for areas such as additional teacher training and development, resource requirements, support, and research.

Research question

The following main research question is addressed in this study:
"Can a valid and reliable instrument be developed to measure teachers' perceptions of constructivist practices in their classroom?"

CHAPTER TWO

Literature Review

Introduction

This review involves an overview of constructivism and its main learning. It reviews the learning theory of behaviourism, the cognitive learning theory of information processing, developmental theories of cognitive development, and constructivism. It then continues by describing the various science learning models, because of their rich background of research in this area. The application of several successful learning models, for example apprenticeship style learning, are then examined. Finally, the key theorists' concepts are summarised, and from this, the key constructs underlying constructivism are generated.

During the twentieth century learning perspectives shifted from an emphasis on 'behavioural', to 'cognitive'. More recently there has been a further shift to 'constructivist' theories. Behavioural practices tend to focus on the end product of a learning experience while perhaps ignoring the educational value of the learning process itself, and are commonly typified by rote learning practices. Cognitive theory, however, suggests that learning results from the processing of information through internally held structures that differ between individuals. Effective learning then, according to this view, should be tailored to the individual. Constructivist approaches emphasise individuals' active construction of meaning. The suitability of constructivist techniques to computer-based delivery (Collins, 1991, p. 31) and the increasing prominence of computers in educational settings suggest that constructivist techniques will be increasingly relevant to teachers and students in the knowledge economy.

Learning theories- Behaviourism

Psychological research and philosophy have been influencing educational practice for over a century. During the first half of the twentieth century, learning philosophies were dominated by behaviourism. These didactic behaviourist learning theories have now mostly been superseded by more commonly used cognitive learning ideals that often purport to incorporate higher order thinking.

Chief proponents of behaviourism include Thorndike, Hull, Tolman, Skinner, and Watson. Skinner worked with the reactions of rats to develop a stimulus/ response model. The underlying notion of this theory set is the linking of an external stimulus with a resultant response or behaviour. This results in a purposeful response or behaviour due to operant conditioning where the organism operates on the environment. Operant conditioning is a type of learning in which the consequences of a behaviour alter the intensity of the behaviour. Positive reinforcement is a type of stimulus, and if this is applied after a behaviour is exhibited, the likelihood of the behaviour occurring again is intensified.

In the early 1950s, cognitivism gained popularity. It is argued that 'Its key notions are still alive and active in the minds of many educators' (von Glasersfeld, 1995b, p. 178). However, it is no longer in favour as it fails to explain how complex tasks are learnt, for example, the development of speech, or flying a plane. Further criticism has been expressed by von Glasersfeld (1995b, p. 178), who believes that 'From the constructivist point of view, the behaviorists' notions of stimulus and reinforcement are naïve and misleading'. Regardless of this, the author believes from personal experience

that some behaviorist principles are still in use, though not necessarily dominant in the current Western Australian teaching and learning environment.

Cognitivism

The basis of Cognitivist Theory is the belief that individuals learn by processing information according to internally held structures and pathways. These structures are developed by the individual from previous experiences and knowledge - 'internal frameworks that individuals employ for transforming, elaborating, storing, recovering and using information... [Cognitivist educational techniques primarily involve] assisting students to refine their information processing procedures and to evolve new and more effective structures for thinking about the environment' (Vander Zanden & Pace, 1984, p. 385).

The chief proponents of cognitivism include Piaget, Bruner and Ausubel. The common thread of their beliefs is that knowledge is acquired via an innate structure and that the structure is adapted in response to external influences. However, the surrounding detail of that central tenet varies between them, giving distinctly separate viewpoints.

Piaget was an interactionist, later being labelled a constructivist, believing that the interaction of internal and external elements comprises a person's cognitive development. Such interactions result in new internal structures and pathways being developed, as described above. He believed that children pass through four major stages, at different paces, and at times overlapping:

- Sensorimotor - from birth to two years - characterised by object permanence and reflex actions;
- Pre-operational - from two to seven years - characterised by the employment of symbols, classification and logical thoughts;
- Concrete - from seven to eleven years - characterised by complex mental operations, conservation and transformations; and
- Formal - from eleven years onwards - characterised by the ability to think in logical and abstract terms.

Additionally, Piaget believed that four basic factors affect a child's progress through the developmental stages: 'maturation, physical experience, social experience, and equilibration. Of these, the fourth is seen as most important', Piaget cited in Glaser (1978, pp. 169-170). Additional research has suggested that Piaget's stages are not uniform and students can achieve at a level beyond their supposed stage. This view is supported by Berk (1994), Driscoll (1994), and Slavin (1994).

Piaget proposed that knowledge is constructed progressively, thereby enabling students to proceed through different stages. In Piaget's terms,

> Knowledge results from continuous construction, since in each act of understanding, some degree of invention is involved; in development, the passage from one stage to the next is always characterised by the formation of new structures which did not exist before, either in the external world or in the subject's mind. (Piaget, 1970, p. 77)

Further, he saw intellectual development as the product of adaptation (a result of the processes 'assimilation' and 'accommodation'). Piaget uses the term 'scheme' to refer to the 'internal structures and pathways' described above, with 'assimilation' being the process of assessing information according to a currently held scheme, and 'accommodation' the process of modifying the scheme as a consequence of the assimilation of new information or experiences. 'Disequilibrium' occurs when new information or experiences can't be combined with the existing structures, and the innate desire for equilibrium encourages accommodation to produce a modified scheme.

Although initially a supporter of the Piagetian model, Bruner (1966, p. 49) found the model's categorisation of the developmental stages to be too restrictive. Similar comment has been noted by other researchers (Buck-Morss, 1975; Groen, 1978; O'Loughlin, 1992). Bruner also appears to be more concerned with the efficiency of the learning process by ascribing importance to normative learning and assessment conditions. A further difference is his belief that the main objective of the educational process is to engender an understanding of the structure of concepts, and how concepts interrelate.

In the Brunerian view, an individual's cognitive development is considered to progress through three stages:

- enactive (crawling, walking, imitating and general activity) - corresponding to the Piagetian sensorimotor stage;
- iconic (mental images closer to reality) - corresponding to the Piagetian pre-operational and concrete stages; and
- symbolic - corresponding to the Piagetian formal operational stage, and is the most popular way of learning.

The most obvious difference between Bruner and Piaget is Bruner's emphasis on expression in the early learning stages - the theory being that expression enhances understanding. Bruner is concerned with the process by which we organise and integrate information with previous understandings, which is termed cognitive development. To ensure understanding occurs he recommends standardised optimal learning conditions consisting of rules, objectives, and ways of measuring outcomes, mastery and deficiency. Four components of a theory of instruction are suggested:

- motivation;
- appropriately structured, organised and taught concepts;
- information sequenced in levels of logic and difficulty; and
- classification and pacing of rewards from extrinsic to intrinsic so that reward dependency decreased.

It could be suggested that Bruner and Piaget are also advocates of discovery learning (arguably Bruner more than Piaget). This involves 'the teaching of principles, rules, and problem solving through minimal teacher guidance, and maximal student exploration and trial-and-error learning' (Vander Zanden & Pace, 1984, p. 588). Bruner describes four advantages of discovery learning:

- memory retention is increased, as students synthesised information;
- intellectual power is augmented, encouraging problem solving;
- intrinsic rather than extrinsic motivation is cultivated; and
- it promotes the acquisition of skills that enable the individual to learn more.

Accordingly, he concludes that concepts and the process of discovery itself are central to the discovery learning approach.

Discovery learning has been related to inductive reasoning (deriving general rules from observations of the specific), and contrasts with expository learning that includes a deductive approach (deriving a conclusion from a set of general rules). Ausubel is a major supporter of expository learning that involves maximum instructor direction, little student exploration and little trial-and-error learning. In other words, it is the teaching of principles and rules, and problem-solving using the framework provided by those principles and rules.

Ausubel suggests that both discovery and expository (reception) learning can be either rote or meaningful (Vander Zanden & Pace, 1984) as below:

- rote discovery learning - when learners have arrived at the concept themselves (typically through trial and error), and commit it to memory without relating it to other knowledge;
- rote reception learning - the instructor presents a concept, and the learners merely memorise it;
- meaningful discovery learning - the learners formulate a concept for themselves and relate it to their existing ideas; and
- meaningful reception learning - the instructor presents a concept in its final form and learners relate it to their existing ideas.

Ausubel rejects the commonly held belief that *all* discovery learning is meaningful, and suggests that a place for rote learning exists, although conventional wisdom suggests that its use should be minimised (and meaningful learning maximised).

Simons (1993, p. 293) also supports the suggestion that learning should not be confined to discovery learning, the main reasons being that it can be time-consuming and inefficient. However, it 'can have an important place in a sequence of learning processes (especially in the beginning phases to motivate and in the final stages when application is the goal of learning)....' (Simons, 1993, p. 293).

The significance of working with students' prior understanding has been recognised by many educators. Ausubel (1968, p. vi) is well known for his assertion that 'If I had to reduce all of educational psychology to just one principle, I would say this: The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly'.

Cognitive learning theories

Information Processing

An understanding of cognitive learning theories is essential for a full understanding of constructivism, as many constructivist principles are related to cognitive learning theories. Accordingly, these principles will be reflected in questionnaire items. Information processing is central to cognitive learning theories. The information processing model assists in our understanding of constructivist approaches in relation to cognitive theories. This view is in part supported by Smith & Ragan (1999, p. 21): 'One of the most influential contributions from cognitive learning theory to instructional design practice is [the] information processing theory'. Furthermore, Smith & Ragan (1999, p. 20) state, 'Information-processing theories, in strong contrast to behavioural theories, describe learning as a series of transformations of information (i.e., processing) through a series of postulated structures within the brain'.

Memory

On the following page is a simplified memory flow chart based on a model devised by Atkinson and Shiffrin (1968). Information is depicted using three memory stores. These are; sensory, short-term and long-term (LTM). 'Inputs' go into the 'sensory register' and are selectively sent to 'short-term store', sometimes called 'selective perception'.

When in short-term store, also termed as working memory, information is either forgotten or passed on to long term store. The short-term memory can only hold seven plus or minus two units of information (Miller, 1956). Information is retained for a short period of time, (from ten to twenty seconds), though 'we can keep that information in working memory longer by rehearsing or repeating it' (Smith & Ragan, 1999, p. 21). There is a continuous flow of information between short-term and long-term store as illustrated by Figure 1 on the following page. The short-term/ working memory is our working store, accepting input from the sensory register and long-term store. Information is usually held in the short-term/ working store for up to 30 seconds, or for as long as it is rehearsed. Long-term store is more permanent.

Encoding is the process by which information is placed into the memory. To elaborate by using a filing system metaphor; encoding is the process by which information is filed according to the existing filing scheme (creating memory traces), in such a way that it may be retrieved. It is worth noting that in inefficient filing schemes, information may be filed in such a way that it can not be retrieved easily. Additionally, information may be received which can not be filed, so is placed in the rubbish bin. Otherwise it could be placed in an incorrect folder, so is still irretrievable. Vander Zanden and Pace (1984)

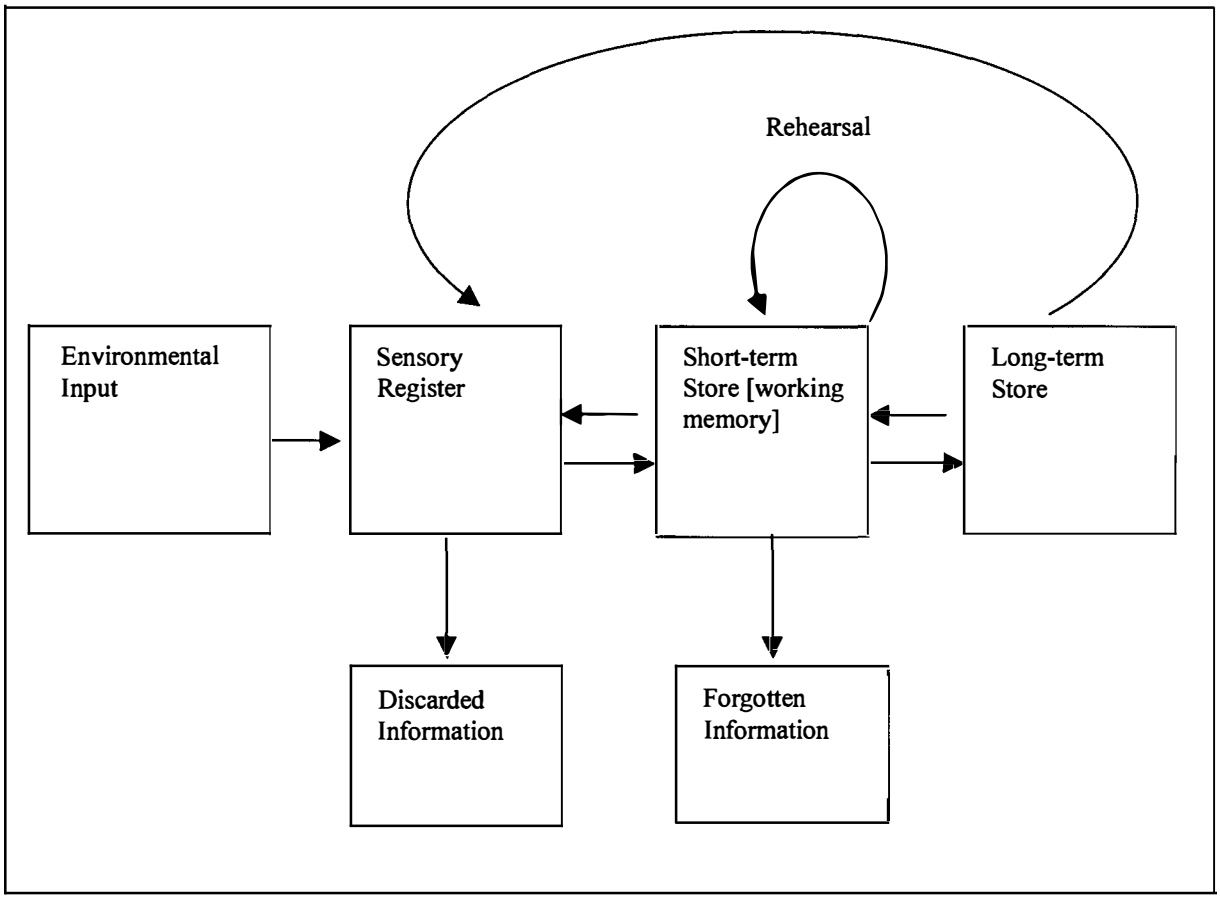

Figure 1. Simplified flow chart of the Atkinson-Shiffrin three-store information-processing model.

Note. From Educational psychology (p. 196), by J. Vander Zanden and A. Pace, 1984, New York: Random House.

suggest that the process of encoding is an active one, involving the 'active transformation and alteration of information' (p. 210). It follows that the more 'logical' the filing system, the lower the chance of mis-filing, and the more efficient the retrieval. This retrieval occurs when the information from the memory is reassembled when required.

Inert knowledge is considered to be knowledge that a student is unable to retrieve on command, the causes of which relate to inefficiency of filing. It has been proposed by

the Cognition and Technology Group at Vanderbilt [University] (1992, p. 67) that active involvement in learning can help to minimise 'inert knowledge'.

> Active learning (Cognition and Technology Group at Vanderbilt [University] 1992) can combat the occurrence of so-called inert knowledge. If learners actively build their own schematic links to the new learning, they have more ownership in those links and those links are less likely to degenerate over time. (Marra & Jonassen, 1993, p. 59)

Accordingly, to minimise inert knowledge active learning should be maximised. One of the principles of cognitivism, also a key constructivist concept, is that people assimilate new information from pre-existing ideas; similar to Ausubel's principle of tailoring instruction to students' prior understanding. This is also considered by Prawat (1989, p. 12); 'For meaningful learning to occur, the new knowledge has to connect or interact with the prior knowledge' and Smith & Ragan (1999, p. 21) 'A critical characteristic of information that is stored in long-term memory is that it must be meaningful'. It follows that information is more likely to be remembered if it is meaningful as it will be more easily accommodated into the student's memory. Elaboration is the process of learners relating information to their own cognitive structure. 'The more "elaboration" we make of the contents of LTM, the more likely it is that information will be remembered' (Smith & Ragan, 1999, p. 21). This can also be termed 'deep processing'. Smith & Ragan (1999, p. 21) discuss their interpretation of Craik & Lockhart's (1972) memory model 'Deep processing involves considering information at the meaningful or 'semantic' level, whereas shallow processing involves considering only the surface features or stimulus features of the information. They suggest that deep processing strengthens the memory trace in long-term memory'.

Clearly, the promotion of deep processing is important for future understandings to be built on, as information is more meaningful at this level. This will be one of the subjects of items in the survey.

From this information-processing model it could be suggested that the use of cognitive tools for students to construct meaning from the traces of information in their memories would benefit them in the rehearsal, storage and retrieval of such information, and so could contribute to more meaningful learning. These 'tools' could be in the form of advanced organisers, authentic learning tasks, and a learner determined environment rather than an instructor determined one. Another principle of cognitivism is that 'conflict' within a student's mind, also described as 'cognitive conflict' may also stimulate learning. However, in relation to the information-processing model, the student may fail to retrieve information that fails to consistently match with their previous understanding. It follows that we should be concerned with the relevance of accessing representations that are within student's memories.

Three types of long-term memory models have been documented; semantic, episodic and action representations. According to Simons (1993):

> [Cognitive] constructive learning involves learners building rich and complex memory representations showing a high degree of connectedness and having strong relations between semantic, episodic and action knowledge. Ideally, the connections both within these three kinds of representations and between them are rich and strong. Connections with the three types of knowledge representations in other areas are also believed to be important. (p. 291)

Simons (1993), believes that this is what constructive learning is aiming for.

Simons (1993) also provides the following definitions of the three types of memory models:

> Semantic representations refer to concepts and principles with their defining characteristics ([for example] "a bird is an animal with feathers"). Episodic representations are based on personal, situated and affective experiences with instances of the concepts and principles ("I love my bird"). Action representations refer to the things one can do with the semantic and episodic information: solving certain kinds of problems, using the knowledge ("birds can carry over messages"). (p. 291)

Accordingly, a set of learning experiences that incorporate the three memory models is suggested for use in most classrooms, and survey items will reflect this.

An alternative of the Atkinson-Shiffrin (1968) three-store information-processing model is the 'levels of processing' model, devised by Craik and Lockhart (1972). Instead of separate structured stages for sensory, working, and long-term memory, Craik and Lockhart believe that information is processed at various levels concurrently, according to its type. Craik and Lockhart (1972) believe in primary memory, which equates to Atkinson-Shiffrin's short-term memory, and secondary memory, which equates to the long-term store. It should be noted that neither the Atkinson-Shiffrin three-store information-processing model nor the Craik and Lockhart 'levels of processing' model offers a complete explanation about the operation of memory (Vander Zanden & Pace, 1984, p. 200).

An assumption made with both theories is that memory is strengthened as the depth of processing increases. For example, if the information is related to pre-existing knowledge, it will be processed at a deeper level. The amount of attention available for the stimuli and time to process it also affect the depth of processing. A strength of these models is that they explain why we find it easier to recall more meaningful information, and find it more difficult to recall information learned by rote.

Higher Order Thinking

Bloom's taxonomy is significant in any discussion concerning learning, regardless of theoretical basis. Bloom's (1956) model of mastery learning attempts to describe differences in students' learning by using a taxonomy of objectives that are designed to assist teachers in devising suitable learning experiences.

Of importance is his explanation concerning the merit of 'higher order thinking'. Bloom advocates that his taxonomy assists educators in communicating, by classifying and discussing educational goals with more accuracy. Bloom describes a hierarchical taxonomy of educational objectives, organised into six main classes; knowledge, comprehension, application, analysis, synthesis, and evaluation. These objectives lead to the overall aim of encouraging the development of higher order learning.

Bloom et al. (1956) promote the notion that, 'What is needed is some evidence that the students can do something with their knowledge, that they can apply the information to new situations and problems' (1956, p. 38). They label this as 'intellectual abilities and skills', variously termed 'critical thinking', reflective thinking', 'problem solving' and 'higher order thinking' by other theorists.

Bloom (1994) also emphasises that the taxonomy is not designed to impose a rigid set of teaching procedures, rather to allow the teacher to have:

> a wide range of choices in making instructional decisions related to objectives associated with each level of the Taxonomy. The Taxonomy does emphasise the need for teachers to help students apply their knowledge to problems arising in their own experiences and to be able to deal effectively with problems that are not familiar to them. (p. 7)

Of importance to this study in the application of the taxonomy is Bloom's belief that 'Past research has demonstrated that as higher mental processes are emphasised and taught, lower level skills can be learned concomitantly' (Bloom, 1994, p. 8). This suggests that an emphasis on 'higher order thinking' in learning programmes is beneficial; with incidental learning of lower order skills, such an approach could lead to efficiencies in instruction combined with the benefits of more meaningful accommodation.

Constructivism

Cognitive learning underpins most of the constructivist approaches, the current dominant learning theory. Cognitive learning theories concerning information processing emphasise the importance of deep and meaningful learning. Similarly, the relatively recent developmental and instructional cognitive learning theories incorporate more meaningful information processing and learning involving higher order thinking.

Constructivism also emphasises the construction of meaningful learning. Constructivism has had its implications for learning considered since at least the mid 1980s (Jonassen, 1994, p. 34). There is an abundance of literature on constructivism and various definitions are proposed, however, at times the literature appears divided and it is difficult to understand which type of constructivism is being described. This inconsistency can be attributed to a lack of general understanding by some, and to disagreements about the theory in other cases. Watts, Jofili & Bezerra (1997) believe that, 'As a broad principle, constructivism presupposes that knowledge is actively constructed by learners through interaction with physical phenomena and interpersonal exchanges' (p. 309). Piaget's view is similar, in proposing that the process of gaining knowledge is an active one; a 'system of transformations', applying real world experiences to internal frameworks, and the alteration of those frameworks to accommodate new experiences (Piaget, 1970, p. 15).

Another explanation is presented by Jonassen (1991):

> Constructivism ... claims that reality is more in the mind of the knower, that the knower constructs a reality or at least interprets it based upon his/ her experiences. Constructivism is concerned with how we construct knowledge from our experiences, mental structures and beliefs that are used to interpret objects and events. Our personal world is created by the mind, so in the constructivist's view, no one world is any more real than any other. There is no single reality or any objective entity. Constructivism holds that the mind is instrumental and essential in interpreting events, objects and perspectives on the real world, and that those interpretations comprise a knowledge base that is personal and individualistic. The mind filters input from the world in making those interpretations. An important conclusion from constructivist beliefs is that we all conceive of the external world somewhat differently, based upon our unique set of experiences with that world and our beliefs about those experiences. (p. 29)

Jonassen (1994) also goes on to discuss how a learning environment should be established.

> Constructivists emphasise the design of learning environments rather than instructional sequences ... [Constructivists] do not seek to predetermine a sequence of instruction or a prescribed set of activities and thought processes by the learner. Rather they seek to provide a supportive environment in which the learner can interpret at least a simulated reality in order to better understand that reality. (p. 35)

When establishing a learning environment, it is imperative that constructive learning is extensively planned and embedded in the whole learning environment design. In contemporary education, the expression 'authentic situations' appears to be fashionable, and is used to describe such an integrated contextual learning environment. This is further supported by Brown, Collins, & Duguid (1989, p. 34), Collins, Brown and Newman (1989, p. 459), and Simons (1993, p. 310) who suggest the following principle: 'Embed constructive learning environments in the total instructional system'.

Social Constructivism

'Contrary to Piaget, who perceived development as preceding learning, ... [is] Vygotsky, who perceived development as following learning' (Smith & Ragan, 1999, p. 24). Vygotsky is well known for his social constructivist theory of development being called a 'sociocultural theory'. Underlying this theory is the notion that, 'Learning is collaborative with meaning negotiated from multiple perspectives' (Smith & Ragan, 1999, p. 15). The collaborative construction of knowledge is further supported by Collins et al. (1989) and Young (1993). The social constructivist belief that learning is socially and culturally specific is related to the general constructivist principle of relating learning to real life rather than just the classroom context. Learning with others can also be of benefit through the learners helping each other to construct meaning. Additionally, as learning and development are social and collaborative, they can't be 'taught'. For social constructivists, talking is important in the construction of learning.

This view of learning is encouraged through cultural, language and social interactions, which are then restructured internally. With this model, the instructor has an active role as a facilitator, and students learn (construct their own understanding) through discovery in meaningful contexts. Sagredo (1991) in Cunningham (1991, p.16)

expresses the view that, 'Vygotsky's views are basic to the constructivist position. The role of the teacher, under such a view, changes from authority figure who presents knowledge to students, to one of senior partner, or master in a master/ apprentice relationship'.

Vygotsky's main focal points, according to a report by the College of Education University of Houston (2000) are:

- The making of meaning;
- A central role is played by the community;
- The way a student sees the world is impacted on by those around him/ her;
- Psychological tools for cognitive development;
    - The type and quality of tools used determine the student's pace and type of development
    - The tools may include; culture, language, and adults that are significant to the student
- Zone of proximal development;
    - This is where learning takes place with guidance or collaboration with a more experienced person
    - This is the zone that lies between what learners already know and what they don't know
    - This can be used to design appropriate tasks, thereby maximising opportunities for learning (scaffolding)
- Problem solving skills of tasks can be placed into three categories;
    - accomplished individually by the student
    - those that can not be accomplished, even with assistance
    - those that can be performed with assistance.

The 'Zone of proximal development' is further supported by Salviati (1991) in Cunningham (1991, p.16). Salviati maintains that Vygotsky (1978) 'proposed that each child has a Zone of Proximal development where, with the assistance of a more mature partner (a teacher or more advanced student), the child can accomplish more, [and] solve more advanced problems than he/ she could alone'. This assistance is called 'scaffolding'. Scaffolding is a type of temporary assistance provided for students (Verhagen, Collis, & Moonen, 1997, p. 1).

Simons (1993, p. 294) further promotes the idea that 'people can also discuss and interact with themselves and be social in this way... [and] social aspects of learning can also be built into teaching materials and computers'. Criticisms of this approach include that some groups don't function correctly, others prefer to learn without social assistance and some learning situations are not suitable for social learning. A further weakness is that it has encouraged a neglect of how the cognitive structures are supported by social structures, so fails to explain the internal processing that takes place.

Radical Constructivism

Radical constructivists believe the only external real world that exists is the one that our minds create, so don't recognise the existence of an independent reality. Radical constructivists' understanding of knowledge is that it should depict the real world, a 'real world that is thought of as existing, separate and independent of the knower; and this knowledge should be considered true only if it correctly reflects that independent world' (von Glasersfeld, 1995a, p. 6). In other words, an external real world may possibly be existent, but direct access to it is impossible.

The main principles of radical constructivism have been identified by von Glasersfeld:

- knowledge is not passively received either through the senses or by way of communication;
- knowledge is actively built up by the cognising subject;
- the function of cognition is adaptive, in the biological sense of the term, tending towards fit or viability; and cognition serves the subject's organisation of the experiential world, not the discovery of an objective ontological reality. (von Glasersfeld, 1995b, p. 51)

Critical constructivism

Critical constructivism refers to constructivism contained within a social and cultural environment. It is realist in nature as it doesn't refute the existence of a real world. It stresses students using deeper thinking, reflection and more critical analysis skills. Kincheloe (1993, p. 36) provides the following explanation of critical constructivism: 'Critical constructivists perceive a socially constructed world and ask what are the forces that shape our construction. Our constructions of reality are not freely made but are shaped by power interests in the larger society'.

Constructivism and Science learning

It is important to review these constructivists as they possess a rich research background of more than 25 years and provide a good source of practical learning models. An agreement is yet to be reached by science instructors regarding the strategies best suited to educating students. This is in part due to changing scientific understandings as well as students changing their own conceptions, so it is important that students be prepared

for this rate of change. Piaget (1970, p. 2) also acknowledges these modifications: 'Scientific thought then, is not momentary; it is not a static instance it is a process. More specifically, it is a process of continual construction and reorganisation. This is true in almost every branch of scientific investigation'.

Piaget goes on to support students' changing conceptions, in saying:

> I think that human knowledge is essentially active. To know is to assimilate reality into systems of transformations. To know is to transform reality in order to understand how a certain state is brought about... Knowledge then is a system of transformations that become progressively adequate. (Piaget, 1970, p. 15)

Science Learning: Generative Model

Several theorists have examined the value of supporting students in employing generative activities as opposed to passive activities (Cognition and Technology Group at & Vanderbilt, 1992, p. 66; Cosgrove & Osborne, 1985; Freyberg & Osborne, 1985; Wittrock, 1974).

Cosgrove and Osborne (1985, p. 108) devised a practical constructivist learning model and labelled it a generative learning model of teaching. The model has three separate teaching phases: focus, challenge, and application. A preliminary phase that involves teacher preparation precedes these. The preliminary phase establishes an understanding of students' and teachers' pre-existing ideas. The overall aim of the focus phase is to 'provide a context for later work' (Cosgrove & Osborne, 1985, p. 108). The overall aim of the challenge phase is for students to ask questions as they attempt to accommodate

new concepts. During the application phase, new ideas are to be further made clear and reflection encouraged.

Freyberg and Osborne (1985, p. 83) describe Wittrock's research about information processing in which he also discusses a generative learning model. The main features include:

- the student's working memory store, long term memory store and processing interact with sensory input by selecting and attending to some inputs and ignoring others;
- isolated input has no inherent meaning, but links are generated between input and parts of the memory store if deemed significant by the student. Links that are not planned by the instructor are also made at times;
- information retrieved from the memory store is used to actively construct meaning from sensory input;
- the student might test these constructed meanings against memory and sensed experience;
- the student might absorb constructions into their memory. New ideas may be accommodated in conjunction with already stored ideas, otherwise reorganisation of ideas and reinterpretations of experiences may be required to successfully subsume a new understanding; and
- the student will place some significance on the new understanding/ construction even though it may be subconscious.

It has also been proposed that when students generate their own understandings, they have engaged in better learning. Due to elaboration leading to a greater depth of processing, Craik and Lockhart (1972) believe that such students perform better. Smith

and Ragan (1999, p. 124) cite various studies that have 'found that learners perform better on comprehension and recall tests if they have generated associations for themselves rather than having the associations supplied'.

Additionally, Smith and Ragan (1999, p. 125) express the view that more mental effort than normal is required in generative techniques. This would lead to more in-depth processing, producing improved learning. They caution that the working memory is restricted, so cognitive overload and frustration may occur, and in turn, students would be incapable of learning.

The generative learning model features low levels of scaffolding as it is designed to encourage students to generate their own understandings. According to Wittrock (1974, p. 94) 'instruction which causes the learner to generate distinctive associations between stimuli and memory facilitates long-term recall and understanding'. Additionally, generative processes 'involve learning material being structured thereby enabling students to create their own personal meanings. They can do this by devising their own goals, emphasising the content most relevant to them, self-monitoring and also transferring understandings to other environments...' (Smith & Ragan, 1999, p. 124). One of the features of this approach appears to be that students are very self-directed and can to a degree, follow their own interests resulting in more motivated learning.

The Cognition and Technology Group at Vanderbilt [University] (1992, p. 67) have also promoted generative learning. They believe active learning that incorporates problem solving and reflection is desirable.

Science Learning: Primary Investigation

'Primary Investigations' is a science programme developed by the Australian Academy of Science (1994), in response to a need to improve science learning by Australian students. The Piagetian belief in stages of development has also been incorporated into the programme. The use of concrete materials, and the progression of instruction from engagement through to evaluation, a more formal stage, reflects a Piagetian developmental basis within each topic. The programme embodies constructivist learning principles, in that a variety of activities are used in which 'students are allowed to work out explanations for themselves over time...' Australian Academy of Science (1994, p. xxi). This technique encourages the building of understanding incrementally, linking new information to students' prior knowledge. Of significance is that this programme has been implemented in most Western Australian schools so teachers are likely to be familiar with it. Additionally, it may assist teachers in implementing a constructivist environment.

Co-operative learning is also a major feature of the programme, consistent with Vygotsky's belief in 'various modes of social interaction'. Glasson & Lalik (1993, p. 203), also refer to it as the collaborative construction of knowledge. Relevance to students' home, community, and school learning environments is also deemed important, by providing activities and basic equipment that are strongly linked with these environments. This assists students in understanding that science is an integral part of everyday life.

The constructivist model used in this programme has five phases; engage, explore, explain, elaborate and evaluate, giving the instructor a template for the complete learning cycle. Each unit has a beginning lesson, designed to engage and create initial

interest (consistent with Bruner's objective of 'motivation'), in which students are encouraged to express their prior knowledge. This is to assist with making connections between prior understanding and new concepts, in accordance with Ausubel's emphasis of ascertaining prior understanding. Exploration is encouraged with the provision of 'hands-on' activities, allowing students to explore and verbalise concepts or skills with each other. This is consistent with Bruner's focus on discovery learning, Piaget's belief in interaction and Freyberg's notion of exploration.

Explanation is intentionally sequenced after the students have experienced and explored the concepts and skills. This is the point when explanations and terms that describe what they have experienced are provided, allowing the student to compare their understanding with the 'master' (instructor). Elaboration offers opportunities for students to discuss and compare ideas with one another and to apply their understandings to new situations, thereby developing a deeper understanding. Evaluation allows students to further develop their understandings and evaluate them.

Elaboration and evaluation are critical stages as students are adapting their original ideas to accommodate new ones. It is at the 'evaluation' stage that disequilibrium may become apparent; when students don't modify their scheme, and so may display difficulty in understanding ideas. If students do show an understanding and ideas have been accommodated, it can be suggested that equilibrium has been reached and produced a modified scheme.

Science Learning: Driver

Rosalind Driver was a researcher in the 1980s and 1990s who investigated the way that students learn science in both structured and unstructured learning environments.

Driver et al. (1994) propose that there are various personal and social constructivist ideas regarding how the construction of knowledge evolves.

As Piaget does, Driver, (1989, p. 482) also believes in a series of transformations in the construction of knowledge, and in fact sees learning as an adaptive process.

Driver (1989) believes that this view extends Piagetian ideas, yet in two ways varies. Firstly, 'Instead of focusing on the development of general logical capabilities, the new perspective emphasises the development of domain specific knowledge structures' (Driver, 1989, p. 482). Secondly, instead of emphasising knowledge being personally constructed via one's interaction with the physical environment, the new perspective recognises more of the social processes needed for knowledge construction. Driver (1989) discusses that over the years, the debate regarding the logic of Piaget's stage theory is now appearing again; now focusing on general metacognitive strategies being developed [understanding of one's own knowledge, skills and abilities].

Driver, Asko, Leach, Mortimer and Scott (1994) further describe the idea that knowledge isn't passed from one learner to another. Rather, that it is built up by the learner based on previous experiences and through social interactions. Driver, Asko, Leach, Mortimer and Scott (1994) also contend that the personal construction of meaning is an important concept, and when incorporated in a classroom setting will enable students to reconstruct their own theories by challenging their previous beliefs using well devised practical activities. They compare this with the Lemke (1990), and Edwards and Mercer (1987) belief of scientific learning being a knowledge construction process best achieved through immersion in scientific culture (enculturation); a process with a significant social component. Similar comparison is made with Rogoff (1984),

who sees scientific learning as involving 'apprenticeships into scientific practices', implying the interaction with a 'master' and others; the master guiding the personal construction process. Finally, Piaget (1970) postulates that 'equilibration' involves modifying old schemes, thereby allowing more elaborate new schemes to be formed.

Driver and Oldham (1986), also propose several strategies for educating science students. They have suggested a constructivist teaching procedure that has five phases: orientation, (thereby focusing children's interest on a specific scientific matter); elicitation (assisting children in being aware of their prior knowledge and helping teachers gain access to the variety of children's ideas); restructuring ideas (helping children become aware of an other points of view, critically investigate them, and to test, modify, extend or replace their previous concepts); application of new ideas (reinforcing the newly-constructed ideas); and, review (reflection about the extent to which their ideas have altered). It is to be noted that this is similar to the Primary Investigations science programme format that is in five phases or stages of engage, explore, explain, elaborate and evaluate.

Driver et al. (1994) also examined difficulties with the relationships between scientific knowledge, the learning of science and pedagogy. Driver et al. (1994) believe that the nature of knowledge to be taught is important in science education and view it as symbolic and socially negotiated. Symbolic representation is readily applied in science for organising concepts and it is unlikely that students will discover these representations. It is therefore the role of the science instructor to assist students in making sense of science concepts. An approach that is considered important is to provide students with activities that generate cognitive conflict, thereby leading students to alter or develop knowledge schemata that assimilates and accommodates any new

activities or experiences. This is further supported by Prawat (1989, p. 12) who believes that one of the aims of science education is to assist students to 'develop new frameworks for understanding phenomena, and these frameworks frequently conflict with those that the child has developed spontaneously'. Accordingly, science should be in a socially interactive and supportive environment, with challenging experiences that lead to a change in students' knowledge schema. Social interaction is an advantageous element of group activities as students can be stimulated by each other's ideas and reflect on these and the experiences provided.

Driver et al. (1994) contend that there is an omission in this perspective of knowledge construction. 'What is not considered in a substantial way is the learners' interactions with *symbolic* realities, the cultural tools of science' (Driver et al., 1994, p. 7). They go on to discuss the idea of; when viewing learning as including new knowledge schema that replaces the old, the possibility of students having 'plural conceptual schemes' is not taken into consideration.

The assimilation or transformation of information and subsequent development of explanations through active construction is a concept supported by a number of researchers. Using the subject area of science as an example, Freyberg and Osborne (1985) believe that science education should encourage all children to:

- continue to investigate things and explore how and why things behave as they do; and
- continue to develop explanations that are sensible and useful to them.

(Freyberg & Osborne, 1985, p. 90)

This second point is partly supported by Osborne and Gilbert (1980, p. 376) 'science learning involves modifying a student's cognitive structure in such a way that the student can explain things both better and more scientifically'. In summary, students' development of their own understandings is central to meaningful learning, and the prime requirement of constructivist instructional design is to provide the mechanisms to enable and encourage this process.

Many researchers, including those already mentioned, discuss the value of providing students with frameworks or strategies to allow them to develop meaningful understandings within a constructivist environment. Application of the strategies is now generally considered to be important.

Application of constructivism

The use of a learning model or framework has been promoted by McKenzie (1999). He believes that 'exploration by students progresses most effectively when those students have been well equipped, well prepared and well guided along the path' (McKenzie, 1999, p. 2). A key element of many approaches is scaffolding. There is an abundance of literature concerning models of scaffolding, utilising traditional and electronic media. Many researchers have proposed the use of scaffolding to support learning, and several of the more recent articles are worthy of further discussion. As scaffolding is also a key element of constructivist approaches, its features are reflected in the survey.

Scaffolding

Scaffolding is a type of temporary support provided for students. When students can perform autonomously without support, scaffolding is removed. Scaffolding has been studied by many researchers, particularly in the model of cognitive apprenticeship developed by Collins-Brown-Newman (1989). In this model scaffolding is referred to as a means of coaching students until they can perform tasks independently.

The notion of scaffolding can be traced to Vygotsky's concept of 'the zone of proximal development', as part of social constructivism. There are, in his view, two features of a child's developmental level: the actual developmental level and the potential developmental level. According to Winnips (2000c, p. 11) new knowledge should be pitched outside the actual level of development, within the level of potential development. The point at which new knowledge should be pitched should be far enough outside the actual level of development to be challenging, yet not too far outside the level otherwise failure will occur. It is suggested that scaffolding is a suitable way to teach in a student's zone of proximal development.

Collins et al. (1989, p. 482) refer to studies where scaffolding is provided, either as suggestions or help such as in Palincsar and Brown's (1984) Reciprocal Teaching, or as physical support as with cue cards in Scardamalia, Bereiter and Steinbach's (1984) 'procedural facilitation of writing'. This reciprocal teaching method focuses on modelling and coaching students leading to reflection, and then uses scaffolding and fading so that students master skills modelled by the instructor.

Guzdial (1996), Rogoff (1990), Winnips (2000a), Wood, Bruner & Ross (1976), and Young (1993, p. 46) also refer to scaffolding in the context of interaction between

students and the instructor. Winnips (2000a, p. 1) defines scaffolding 'as a communication process where presentation and demonstration by the instructor are contextualised for the learner; performance of the student is coached; and articulation is elicited on the part of the learner'. Importantly it is to be noted that scaffolding involves more than coaching, it is also a type of temporary assistance provided for students, either as ideas or as material support.

Although scaffolding is a very effective method according to the Curriculum Council (1998b), its application has been limited in classrooms, partly due to the fact that it can be very time-consuming for teachers (Zhao, 1997). Recognition that this problem needs to be addressed is occurring as learning environments are also changing.

Collins et al. (1989, p. 456) discuss the 'interplay' of observation, scaffolding and 'increasingly independent practice' and how they are needed for students to reach the level of 'advanced expertise'. Observation assists students in developing a conceptual model of a task before attempting it. This conceptual model is important because it equips students with an advanced organiser, gives them a structure for making sense of feedback, hints and corrections from the master, and provides a type of internalised direction. An advanced organiser gives students a structure within which to place their understandings. The conceptual model can be repeatedly updated through more observation and feedback, thereby encouraging independence in reflection. Reflection is important for allowing students to compare their own performance to that of an expert, and modifying their performances until they become more proficient. Reflection is further supported by Cognition and Technology Group at Vanderbilt [University] (1992), Collins et al. (1989, p. 456) and Driver et al. (1994) who believe

that 'The teacher's role is to provide the physical experiences and to encourage reflection' (p. 7).

Collins et al. (1989, p. 456) also support the regeneration of 'apprenticeship-style learning' in education and discuss apprenticeship as being the way that we most naturally learn. An analogy they put forward is that of the apprentice tailor. The apprentice observes the tailor, (also referred to as 'master') modelling the target process. Then the apprentice, with assistance, also known as coaching, is given guidance. This coaching is the provision of one type of scaffolding; that is, support via reminders and assistance. Once the apprentice has grasped the skill, the 'master' decreases or 'fades' his involvement, giving restricted hints and feedback to the apprentice, who continues practising until the whole skill or process is refined.
It can be seen that the main methods that Collins et al. (1989) discuss are 'modelling', 'coaching', and 'fading'.

Coaching in the cognitive apprenticeship environment is further supported by Collins et al. (1989):

> coaching consists of observing students while they carry out a task and offering hints, scaffolding, feedback, modelling, reminders, and new tasks aimed at bringing their performance closer to expert performance. Coaching may serve to direct students' attention to a previously unnoticed aspect of the task or simply to remind the students of some aspect of the task that is known but has been temporarily overlooked. (p. 481)

In addition to modelling and coaching, Collins (1991) apprenticeship style learning model includes the use of coaching that leads to reflection, reminders and assistance, and also giving hints and feedback. The use of modelling in scaffolding, and 'fading' to encourage the learner to become self-reliant is further supported by Guzdial (1996), Winnips, (2000b, p. 1), and Zhao (1997). Fading this support is promoted by Boekaerts (1995, p. 199), and McLoughlin, Oliver, and Winnips (2000, p. 4). McLoughlin et al. (2000) identify fading as the process of gradual reduction of support until the scaffolding is no longer needed and the right level of scaffolding is critical. Guzdial (1996) believes that the learner should not be stifled by too much support nor fail due to too little scaffolding.

Modelling in the cognitive apprenticeship environment is also endorsed by Collins et al. (1989) 'Modelling involves an expert's carrying out a task so that students can observe and build a conceptual model of the processes that are required to accomplish the task' (p. 481).

Constructivism and the Teacher

As the front line in the implementation of any instructional method, an understanding of teachers' perspectives, explanations and attitudes about constructivism is of importance. The understanding of teachers' beliefs has been promoted by Beck and Lumpe (1996, p. 3) and Pajares (1992, p. 326). Additionally, Bell (1998) expresses the view, 'Because teachers bear the ultimate responsibility for teaching, their centrality in the social construction of knowledge about teaching must be recognised' (p. 691).

Even though teachers may not formally use the term 'constructivism', it has been found that they may still be incorporating some of its principles. Numerous examples have been identified, firstly by Crawford and Witte (1999):

> In our years of teaching, supervising, and developing curriculums, we have observed outstanding teachers create these classroom environments. Even though many did not know the word, their classrooms were, and are, models of constructivism. (p. 34)

This study will examine this dimension, that teachers may already be incorporating constructivist techniques in their classroom.

However, while the implementation of any new concept will be embraced by an innovative segment of the teacher population, barriers exist to mainstream adoption. Such barriers for teachers, perceived for some and real for others, have been identified previously (Bell, 1998). In the author's experience, these major issues include:

- willingness to change;
- fear of losing control in the classroom;
- extent of teacher intervention;
- accountability;
- knowledge of the subject;
- time constraints;
- meeting of assessment requirements;
- epistemological belief;
- professional development limitations; and
- implementation reservations.

These are all recognised by the researcher, but of key interest to the study is the teacher's epistemology.

In addition, Lortie (1975, pp. 208-210) has found that when teachers are faced with doubtful situations, unclear practical knowledge positions, and time constraints, they often teach as they were taught, basing it on their experiences or apprenticeships as students. The outcome is often a reliance on traditional instructive approaches.

On the following page is a conceptual framework that illustrates how teachers' understandings influence the roles they adopt. This framework incorporates the main factors to be studied and the relationships between them. In this study it is not the teachers' knowledge base but their knowledge in action, which is to be studied in order to validate how well these principles are put into action/ or have been accommodated if not assimilated by teachers. Figure 2 represents the conceptual framework underlying the study.

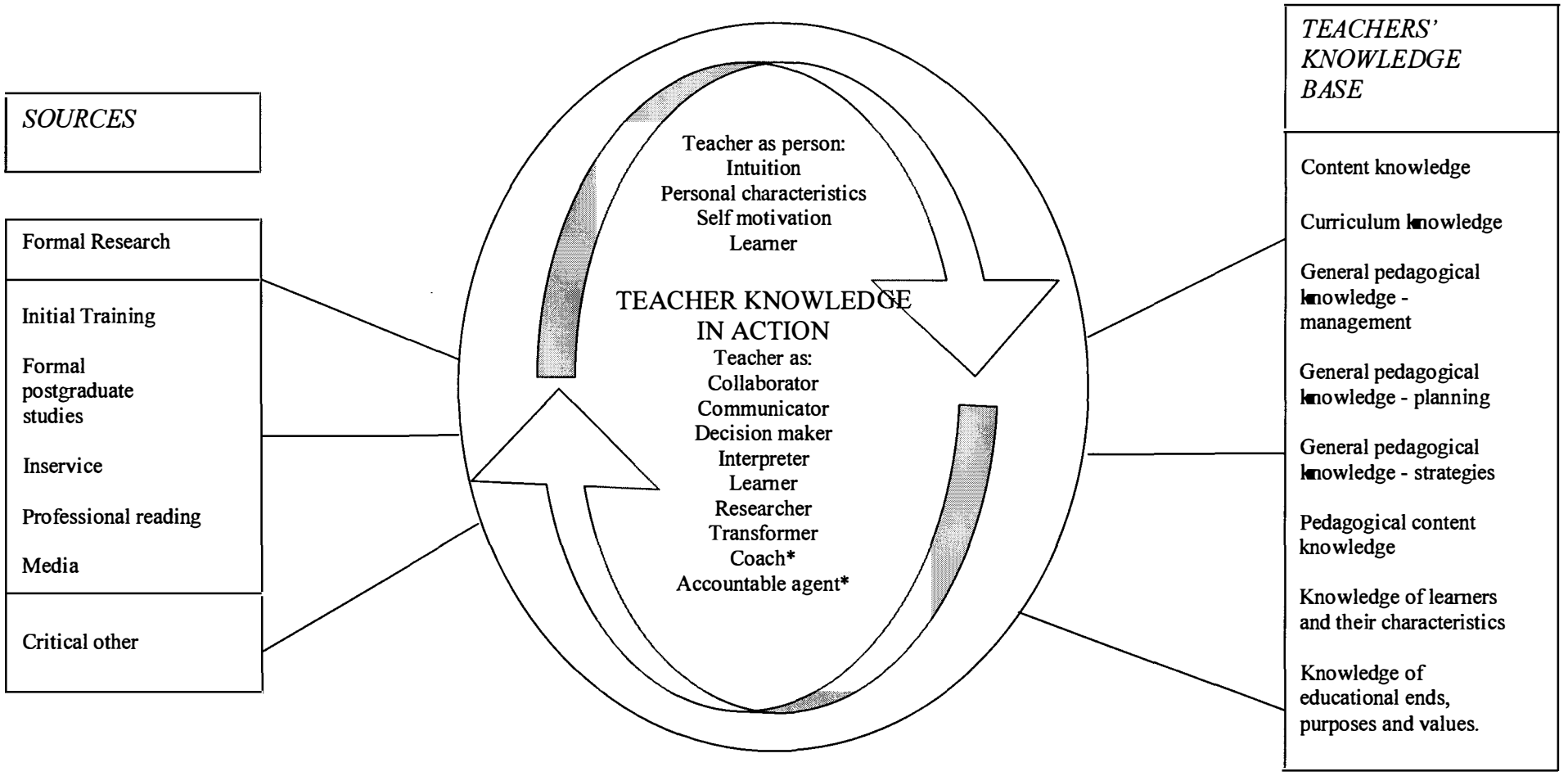

Figure 2. Teacher knowledge in action and the sources influencing their actions.

Note. Asterisk indicates additions made by the researcher. From The Impact of educational research, Research evaluation programme (p. 494), by Higher Education Division, Department of Education, Training and Youth Affairs, 2001, Canberra, ACT: DETYA.

This study will contribute to an understanding of the issues represented in the conceptual framework, by developing a tool to measure the application of constructivist practices in primary classrooms.

Chapter Summary

Educators have long been concerned with improving the efficiency of the learning process. The means to achieve such an improvement lie in engaging students in meaningful learning. "Efficient" learning could be described as that which results in information that is more easily recalled and applied to new contexts. In other words, information which is well-understood, and stored in memory with a well-defined pathway to facilitate retrieval. It is the process of understanding which creates the memory trace, and "understanding" can be taken to mean the relating of new information to the conceptual framework of information which is already known and the modification of this framework if necessary. However, each individual's framework is different, and each learner must create their own understanding or meaning from the processing of new information. "Meaningful" learning, then, is that in which each learner's creation or modification of these robust understandings and memory pathways is maximised. Deep processing is important for future understanding to be built on, as information is more meaningful at this level.

Constructivism can be viewed from many angles, and some of its principles may also be shared with other theories. For example, 'transmission based approach' (Popper, 1972), 'student centred learning' (Hobbs & Moore, 1992) and

'discovery learning' (Cunningham, 1991) could be seen to have, at a minimum, similar characteristics to constructivism. This overlap between theories is acknowledged, and based on the literature review, the main principles of constructivism are summarised in Table 1. It is these elements that were used to construct the survey instrument. Also included are sample questions derived from each of the elements, which could be used to assess the techniques that teachers believe they are practising in their classrooms. In this way, final survey questions can be strongly related to the literature. Indeed there is a direct link.

Table 1

Summary table showing key elements of constructivism and theorist

No.	Constructivism Element	Supporting theorists, researchers and authors	Subject of possible questionnaire item (not always phrased in the positive)
1.	Interaction of internal and external elements.	(Piaget, 1970)	Students received external stimulation.
2.	Four major stages, at different paces, and at times overlapping. Practical (hands on, concrete) activities that require different materials.	(Piaget, 1970) (Driver et al., 1994; Piaget, 1970; Primary Investigations, 1994)	Students all worked at the same difficulty level. Students used concrete materials.
3.	Intellectual development is the product of adaptation (a result of the processes 'assimilation' and 'accommodation'). Students assimilate information by assessing information according to a currently held scheme.	(Driver, 1989; Piaget, 1970; Primary Investigations, 1994) (Piaget, 1970)	See assimilation and accommodation below. Activities related to students' current understandings.
	Students accommodate new concepts by modifying their scheme/s. Equilibration is an important stage it involves modifying old schemes, thereby allowing more elaborate new schemes to be formed.	(Cosgrove and Osborne, 1985; Freyberg & Osborne, 1985) (Driver et al., 1994; Osborne and Gilbert 1980; Piaget, 1970)	I assessed the activity afterwards. Students demonstrated an understanding of the new concepts covered. Students were encouraged to ask questions. Students showed an understanding of new concepts covered.
	Encourage the generation of cognitive conflict thereby leading students to alter or develop knowledge schemata that assimilates and accommodates any new activities or experiences.	(Driver et al., 1994; Prawat, 1989)	Activities were designed to challenge students' existing understandings. Students developed their own explanations of the concepts covered.
4.	Learning requires the learner's active involvement in constructing knowledge. Learners build up 'mental representations' that are used to examine new situations and to make a suitable response. This active involvement in constructing	(Cognition and Technology Group at Vanderbilt [University], 1992; Driver, 1989;	Students were able to take an active role in their learning.

	develop knowledge schemata that assimilates and accommodates any new activities or experiences.		understandings. Students developed their own explanations of the concepts covered.
4.	Learning requires the learner's active involvement in constructing knowledge. Learners build up 'mental representations' that are used to examine new situations and to make a suitable response. This active involvement in constructing knowledge has also been termed 'self-generated knowledge' or 'self-generated information'.	(Cognition and Technology Group at Vanderbilt [University], 1992; Driver, 1989; Marra and Jonassen, 1993)	Students were able to take an active role in their learning. Students were able to work independently at times.
5.	Knowledge is constructed progressively.	(Piaget, 1970)	New information integrated with previous understandings.
6.	Brunerian view, an individual's cognitive development is considered to progress through three stages: enactive, iconic, and symbolic.	(Bruner, 1966)	Students were active, used concrete materials and either wrote or drew their understandings.
7.	Four components of a theory of instruction: motivation; structured, organised and taught concepts; information sequenced in levels of logic and difficulty; and classification and pacing of rewards from extrinsic to intrinsic so that reward dependency decreases.	(Bruner, 1966)	Intrinsic motivation appeared to exist. Extrinsic motivation was integrated. Concepts were structured and well organised. Information was sequenced in levels of logic and difficulty.
8.	Discovery learning (activities are ill-defined).	(Ausubel, 1968; Bruner; 1966; Freyberg & Osborne, 1985; Primary Investigations, 1994; Simons, 1993)	Students were able to make choices about their learning. Exploration was encouraged.
9.	Work with students' prior understanding.	(Ausubel, 1968; Prawat, 1989; Primary Investigations, 1994)	I based my lessons on students' prior understanding.
10.	Information stored in long-term memory must be meaningful, also termed deep processing.	(Craik and Lockhart, 1972; Primary Investigations; Smith and Ragan, 1999)	Students were able to discuss and compare ideas with one another and to apply their understandings to new situations.

table continues

No.	Constructivism Element	Supporting theorists, researchers and authors	Subject of possible questionnaire item (not always phrased in the positive)
11.	Evidence that the students can do something with their knowledge, that they can apply the information to new situations and problems i.e. higher order thinking being developed, also labelled as 'critical thinking','reflective thinking', 'problem solving' by other theorists.	(Bloom, et al.,1956; Cognition and Technology Group at Vanderbilt [University], 1992; Primary Investigations, 1994)	Students were able to reflect on the validity of their own, the teacher's or other student's ideas. Students were able to compare their own performance to the teacher or other students. Students were able to apply what they had learnt to another problem they were given.
12.	Learning is actively constructed by learners through interaction: • with physical phenomena;	(Collins et al., 1989; Jonassen, 1991; Piaget, 1970; Primary Investigations, 1994; Watts, et al., 1997)	Interaction with physical experiences occurred.
	• through interpersonal exchanges.	(Collins et al., 1989; Driver, 1989; Driver et al., 1994; Glasson & Lalik, 1993; Jonassen, 1991; Piaget, 1970; Primary Investigations, 1994; Smith and Ragan, 1999; Vygotsky, 1978 (in Cunningham 1991); Watts et al., 1997; Young, 1993)	I encouraged students to talk. Students worked in pairs. Students worked in groups Students were able to discuss and compare their ideas with each other.
13.	Zone of proximal development is where learning takes place with guidance or collaboration with a more experienced person. It is the zone that lies between what learners already know and what they don't know.	(Salviati (in Cunningham, 1991); Vygotsky, 1978 (in Smith & Ragan 1999); Winnips, 2000)	When attempting to solve new problems students were directly assisted by a teacher, parent or more advanced student.
14.	Scaffolding: • as a means of coaching students until they can perform tasks independently;	(Collins et al., 1989; Guzdial, 1996; Palincsar and Brown, 1984; Rogoff, 1990; Scardamalia et al., 1984; Winnips, 2000; Wood et al., 1976)	I coached students until they could perform tasks independently.
	• is a means of temporary assistance, [as ideas or as material support];	(Collins et al., 1989; Verhagen et al., 1997)	I provided suggestions or help promptly.

	• as a means of coaching students until they can perform tasks independently;	(Collins et al., 1989; Guzdial, 1996; Palincsar and Brown, 1984; Rogoff, 1990; Scardamalia et al., 1984; Winnips, 2000; Wood et al., 1976)	I coached students until they could perform tasks independently.
	• is a means of temporary assistance, [as ideas or as material support];	(Collins et al., 1989; Verhagen et al., 1997)	I provided suggestions or help promptly. I provided sufficient materials.
	• in a form where teacher is available for a considerable period of time;	(Bruner, 1978; Young, 1993)	I was available to assist the students.
	• presentation and demonstration are contextualised for the learner; and	(Winnips, 2000)	Expectations were made clear. Appropriate examples and standards were modelled to the students.
	• articulation is elicited on the part of the learner.	(Winnips, 2000)	I was able to make individual students to talk about their learning experiences.
15.	Teacher has an active role as a facilitator or master in a master/ apprentice relationship. The emphasis is on learning, not teaching- Apprenticeship style learning:	(Sagredo (in Cunningham), 1991) (Collins et al., 1989; Rogoff and Lave, 1984)	Students had the opportunity to interact with you. I talked more than the students did. *Broken up into the sections directly below.*
	• modelling;	(Collins et al., 1989)	I continually demonstrated and explained target skills.
	• coaching;	(Collins et al., 1989)	I provided hints and assistance to students until they could perform tasks on their own.
	• fading; and	(Boekaerts, 1995; Collins et al.,1989; Guzdial, 1996; McLoughlin et al, 2000; Winnips, 2000)	Assistance was gradually withdrawn.

table continues

No.	Constructivism Element	Supporting theorists, researchers and authors	Subject of possible questionnaire item (not always phrased in the positive)
	• know the student's existing skill level.	(Collins et al., 1989)	I ensured that students had explained their prior knowledge.
16.	Constructivists emphasise the design of learning environments rather than instructional sequences. They do not seek to pre-determine a sequence of instruction or a prescribed set of activities and thought processes by the learner.	(Jonassen, 1994)	The students designed the learning activities. The students managed the learning activities.
17.	Constructive learning is extensively planned and embedded in the whole learning environment design, also termed 'authentic situations'.	(Brown et al., 1989; Collins et al., 1989; Simons, 1993)	Students had the opportunity to solve authentic, real-world problems.
18.	Vygotsky perceived development as following learning. Contrary to Piaget who perceived development as preceding learning.	(Vygotsky, 1978, (in Smith & Ragan, 1999))	Students were taught concepts only when you felt they were developmentally ready.
19.	Reflection is to be encouraged.	(Cognition and Technology Group at Vanderbilt [University], 1992; Collins et al., 1989; Cosgrove and Osborne, 1985; Driver et. al, 1994; Driver and Oldham, 1986; Kincheloe, 1993; Rogoff and Lave, 1984; Sagredo (in Cunningham, 1991))	See question 11.
20.	Levels of logic and difficulty.	(Cosgrove and Osborne, 1985; Driver and Oldham, 1986)	Information was sequenced in levels of logic. Information was sequenced in levels of difficulty.
21.	5 phases- Primary Investigations.	(Driver and Oldham, 1986; Primary Investigations, 1994)	Topics were well organised.
	• first phase or an early phase is called either:		Did you engage and create initial interest at the beginning?
	o orientation;	(Driver and Oldham, 1986)	Students expressed their prior knowledge. Students were able to instigate their own ideas.
	o engagement; or	(Primary Investigations, 1994)	See number 7 (motivation) part of the question.
	o motivation.	(Bruner,1966; Simons, 1993)	
	• second phase is to explain (allowing the student to compare their understanding with the 'master' (instructor);	(Primary Investigations, 1994)	Explanations and terms that described what they had experienced were provided.

	○ orientation; ○ engagement; or ○ motivation.	(Driver and Oldham, 1986) (Primary Investigations, 1994) (Bruner,1966; Simons, 1993)	Students expressed their prior knowledge. Students were able to instigate their own ideas. See number 7 (motivation) part of the question.
	• second phase is to explain (allowing the student to compare their understanding with the 'master' (instructor);	(Primary Investigations, 1994)	Explanations and terms that described what they had experienced were provided.
	• third phase is to explore;	(Primary Investigations, 1994)	See number 8 (discovery learning) question.
	• fourth phase is to elaborate; and	(Primary Investigations, 1994)	See number 10 (deep processing) question.
	• final phase is to evaluate.	(Primary Investigations, 1994)	See number 22 (evaluate own understandings) question.
22.	Students are able to evaluate their understandings.	(Bloom et al., 1956; Driver and Oldham, 1986; Primary Investigations, 1994)	Students were able to evaluate their own learning.
23.	Metacognitive strategies being developed (understanding of one's own knowledge, skills and abilities).	(Driver, 1989)	I modelled an understanding of my own knowledge, skills and abilities.
24.	Students reconstruct their own theories.	(Driver et al., 1994; Piaget, 1970)	Students demonstrated an understanding of the new concepts.

Note. Vertical lines have been used for clarity, although they are rarely used in APA documents.

The 'Primary Investigations' reference is to the 'Australian Academy of Science Primary investigations' book.

CHAPTER THREE

Design of the Instrument

Introduction

This chapter includes an overview of two different research approaches, interpretivistic and positivistic, and justifies the major reliance on a positivistic approach. The process of the survey construction is described, the selection of a sample is examined. Finally, data collection, analysis and other procedures that were followed are discussed.

Design

Many descriptions of qualitative and quantitative methods exist, and one by Goetz and LeCompte (1984) is provided due to its concise nature. 'By quantitative research, people mean that a study is deductive, verificative, enumerative, and objective; qualitative research is understood to denote inductive, generative, constructive, and subjective processes' (p. 6). This subjectivity has also been discussed by Angus (1998, p. 73) who believes that one researcher could interpret events differently to another, so identifies it as having elements that can be consistent with interpretive approaches. Quantitative research can be interpretive, as a researcher needs to select variables and has the ability to make subjective decisions (Angus, 1998, p. 74). To this extent, this study is somewhat interpretivistic. Quantitative results are generally quicker and easier to code than qualitative results, so can give either a brief but broad or a more in-depth overview depending on the analysis required. One of the main techniques in quantitative research is the use of the survey method. The instrument developed in this study seeks predominantly quantitative data.

Survey Instrument

What is a survey

Surveying is a commonly used descriptive approach in educational research. It is usually carried out in the form of a questionnaire using a set of fixed questions. Its aim is to 'obtain information which can be analysed and patterns extracted and comparisons made' (Bell, 1999, p. 13). These can be administered by mail for self-completion by the participant, personally administered, or administered by an interviewer as a questionnaire, schedule or checklist. It has been noted by Blaxter, Hughes & Tight (1996, p. 150) and Kumar (1996, p. 113) that questionnaires are a common way of collecting information.

Why a survey

There are numerous advantages of surveying, some of which have been identified by Burns (2000, p. 581) and further supported by other researchers:

- surveying can be a reasonably consistent, quick, efficient and inexpensive (Bell, 1999, p. 14; Burns, 2000, p. 581; Isaac & Michael, 1981, p. 138; Kumar, 1996, p. 114) way of obtaining a variety of information, including viewpoints and intentions;
- it allows the researcher to make comparisons and generalisations;
- if the survey is in the form of a written questionnaire and self-administered, mistakes from interviewers' recording are omitted, participants' can respond at their own pace, and anonymity is preserved;
- due to this anonymity (Burns, 2000, p. 581; Isaac & Michael, 1981, p. 138; Kumar, 1996, p. 114), confidentiality can be assured, encouraging participants to give more truthful responses (Burns, 2000, p. 581; Kumar, 1996, p. 114);

- any difficulties in arranging meeting times are also alleviated (Burns, 2000, p. 581) as they can be self-administered (Isaac & Michael, 1981, p. 138), so are comparatively convenient (Kumar, 1996, p. 114);
- if a written questionnaire is mailed out, it is possible to include a large wide-ranging number of subjects (Burns, 2000, p. 581; Isaac & Michael, 1981, p. 138) as well as ones in remote and diverse locations, a real advantage in remote regions of Western Australia; and
- an interviewer's presence, appearance or behaviour would not influence the participant.

The researcher believes that the relatively time efficient and inexpensive method of surveying is advantageous as participants can respond reasonably easily at their own convenience and results can be received and analysed almost immediately. The analysis can also be relatively straightforward

Limitations of the survey technique

The shortcomings of questionnaires, mainly relevant to mail questionnaires include:

- low response rates can occur (Isaac & Michael, 1981, p. 138; Kumar, 1996, p. 114) and will reduce the sample size, although this is not seen as a problem when a questionnaire is self-administered (Kumar, 1996, p. 114);
- approaches such as follow up letters and attention to design may help to reach a ninety to one hundred percent response rate (Burns, 2000, p. 581);
- surveys can make the participant consider themselves unique or unnatural, and so produce responses that are false or skewed (Isaac & Michael, 1981, p. 137);

- sampling problems can occur if all questionnaires are not returned, as there is a possibility of biased as non-respondents may have varied in their responses (Burns, 2000, p. 581);
- there is no guarantee that the questions were understood (Isaac & Michael, 1981, p. 138);
- complicated instruments, or vagueness can result in poor responses (Burns, 2000, p. 581) ;
- when probing is needed, the method is inappropriate (Burns, 2000, p. 581);
- responses must be accepted as they are given, as there is no opportunity for follow up of unclear, unfinished, or inaccurate information (Burns, 2000, p. 581);
- spontaneous responses are not permitted as a questionnaire gives time for participants to reflect before answering (Kumar, 1996, p. 114);
- inflexibility may restrict participants from giving open expression of opinions, open-ended instruments as an alternative may produce data that is difficult to merge for methodical analysis (Burns, 2000, p. 581) ;
- participant's motive for answering the questionnaire is unidentified (Burns, 2000, p. 581);
- self-selecting bias can occur as not everyone who receives a questionnaire will complete it, those who do have different motives and attitudes to those that don't, also if response rates are low it indicates that the findings may not be representative of the total population (Kumar, 1996, p. 114);
- it has a limited application as it is designed for a population that are literate (Kumar, 1996, p. 114);
- surveys arouse 'response sets' such as acquiescence or a tendency to agree with affirmative statements or questions (Isaac & Michael, 1981, p. 137);

- surveys are susceptible to over-rater or under-rater tendencies, where some respondents give consistently high or low ratings (Isaac & Michael, 1981, p. 137);
- a respondent can read all questions before answering, which may influence the answering of other questions (Kumar, 1996, p. 114); and
- conferring with others before responding is possible (Kumar, 1996 p. 115).

With the surveying technique in this study there was a disadvantage of not knowing who the respondents were as it was required to be anonymous.

Constructing the survey

Types of questions, open, closed.

In a survey, three core types of items can be asked; closed items, open-ended items, and scale items. The type of questions and wording of them is important as they can affect the type and the value of responses received. According to Kumar (1996, p. 118) closed-ended questions are generally appropriate for obtaining factual information and open-ended ones for opinions, attitudes and perceptions.

Closed items usually permit the participant a choice of two or more pre-determined options. According to Burns (2000, p. 571) the choices or alternatives offered must be exhaustive. They also believe that closed items' advantages include; achievement of improved consistency of measurement, leading to better reliability, respondents answers fit the categories provided, and ease of coding. Disadvantages that they identify include; superficiality, possibility of annoying participants that don't find any of the choices suitable, or forcing unsuitable answers.

In open-ended questions, possible answers are not provided and can provide unanticipated answers. In interviews they enable the interviewer to probe, clarify understandings or misunderstandings. Limitations include the difficulty of establishing reliability in coding and analysis of answers. Kumar (1996, p. 118) has also identified a number of advantages and disadvantages of open-ended questions:

- In a questionnaire they can provide in-depth information as long as respondents feel comfortable about expressing their opinions. Conversely, analysis of open-ended questions is more difficult as the researcher usually needs to classify the data by analysing the content;
- In a questionnaire, open-ended questions provide respondents with the opportunity to freely express themselves, producing more varied information. Accordingly, participants aren't 'conditioned' by selecting responses from a list. The disadvantage of this free choice in a questionnaire is that some participants may be unable to articulate their understandings, so information may be missing; and
- The likelihood of researcher bias is minimised with open-ended questions as participants are able to freely express themselves rather than having a pattern of possible answers given to them.

Several types of structured survey questions have been suggested by Youngman (1986). The following are included:

- list, in which a set of items is provided and one or more can be selected;
- categorise, where the participant chooses one only from a set of categories, for example age 20-29, 30-39;
- ranking whereby the respondent ranks items in order;
- scale, for example ratio, ordinal, or Likert, though scaling requires careful use;
- quantity in which a number must be selected; and

- grid or a table is provided for two or more questions to be recorded at the same time.

According to Burns (2000, p. 574) a 'well-planned and carefully constructed questionnaire will increase the response rate and will also greatly facilitate the summarisation and analysis of the collected data'. Four parts to a questionnaire are suggested by Burns (2000, p. 574); introduction, warm-up questions, the main part of the research and demographic questions. These demographic questions can also be included first or in a covering letter.

Open-ended and scale questions were incorporated in this survey. The questionnaire was also broken into the four parts, as above with open questions as well as closed questions that have exhaustive choices in the form of a scale. To assist in overcoming the limitations of closed questions, items in the questionnaire were devised carefully, and as previously indicated, also combined with open-ended items.

Considerations when formulating questions.

When designing both mail and interview questionnaires the following are important as maintained by Burns (2000, pp. 574-575):

- items should be grouped into logical sections, for example based on the same topic or those that use the same response types together;
- smooth transitions between segments, thereby avoiding a quiz style;
- important items are not to be placed at the end;
- items are to be numbered so that confusion is avoided;
- pages to be marked or numbered in case they become unattached; and
- study title to be in bold type on the questionnaire's first page.

In this study, the survey's title was clearly indicated on the front cover. Important items were placed at the beginning and items were grouped in themes based on those constructivist areas deemed to be pertinent. Short answer questions were placed at the end of the survey. This was intended to assist with smooth transitions. Items and pages were numbered to minimise any confusion and assist participants in avoiding accidentally overlooking items. The survey attempted to be as short and clear as possible with items as comprehensive, succinct and as straightforward as possible.

The survey was not based on any previous surveys and was discussed with the researcher's supervisor and several other teachers so that any unclear, unnecessary items or overlooked areas were rectified. Field-testing occurred in the form of a pilot-test to assist in rectifying any other problems, for example, loaded questions, and this will be further discussed later. Machine scored answer sheets were not employed due to the logistics and cost involved. However to assist with ease of analysis, structured questions using a scale were predominant, and open-ended questions prudently used.

The surveys were anonymous. Details of participants' age, gender and number of years as a teacher and year level taught were sought.

A carefully worded letter that was polite and succinct was included, as was disclosure information including an introduction to the researcher and Edith Cowan University and an indication that permission has been received for the study (see Appendix four). A brief statement regarding the study's purpose and relevance, how the information was to be used, and any other disclosure details were also included. Assurance of anonymity and a statement regarding the fact that participation was voluntary was also incorporated.

Response rate

One of the key problems of mailed questionnaires is a low response rate (Kumar, 1996, p. 113). The response rate to mail questionnaires is in part affected by the questionnaire's appearance (Burns, 2000, p. 575 and p. 580). Accordingly, it is believed that careful consideration should be paid to:

- the sample's interest in the topic (Kumar, 1996, p. 114);
- the length and layout of the questionnaire (Kumar, 1996, p. 114);
- personally prepared letters with an official letterhead (Burns, 2000, p. 575 and p. 580);
- the quality of the letter that explains the study's purpose and relevance (Kumar, 1996, p. 114) ;
- inclusion of short and understandable instructions or examples, printed in bold type or italics (Burns, 2000, p. 575 and p. 580);
- methodology that is used to deliver the questionnaire (Kumar, 1996, p. 114);
- a pre-paid, self-addressed envelope with the questionnaire may increase the rate of response (Kumar, 1996, p. 113);
- an attractive and a complete questionnaire (Burns, 2000, p. 575 and p. 580);
- if questions appear on both sides of a page, position on the foot of the front page the word 'over' (Burns, 2000, p. 575 and p. 580);
- avoid creating parts of the questionnaire only applicable to a group of the participants, otherwise others may not complete the questions as they may believe that it is not suitable for them (Burns, 2000, p. 575 and p. 580); and

- if sections of long checklists are included, miss a line after every third item thereby assisting the participants in correct positioning of answers (Burns, 2000, p. 575 and p. 580).

Burns (2000, p. 575 and p. 580) recommends avoiding using the words 'questionnaire' or 'checklist' as it may bias the survey, and that the name and address of the person to whom it should be returned should also be placed on the survey in case it is separated from any other documentation, such as the envelope. The layout should be easy to read (Kumar, 1996, p. 110), and sufficient white space left thereby enabling participants to place answers in the correct place (Burns, 2000, p. 575 and p. 580). The above recommendations were incorporated into the questionnaire design. Questions were arranged so that answer placement was close to the question, thereby minimising mistakes.

Isaac and Michael (1981, p. 142) also recommend a follow-up letter a few days after the deadline. It should have a tone that assumes the respondent had intended to send back the questionnaire, but may have over-looked it. It should reiterate the study's importance and the individual participant's valuable contribution. Bell (1999, p. 130) recommends assisting follow up also by maintaining a record of the dates questionnaires were distributed and returned. Follow-up letters should be prepared ahead of time in case the responses are not received by the due date. She believes that with projects that have restricted time, about a week after the due date is advisable. If anonymity has been promised, then it will not be known who has replied, and letters may need to be sent to all participants.

Kumar (1996, p. 113) believes that personally administered questionnaires have a much higher response rate than mail ones and the researcher has an opportunity to explain the study's purpose and answer any questions. It is a quick way of gathering data and saves on postage costs

To improve response rates in this study, a number of these recommendations were implemented. The survey was in the format previously described, and made to look as attractive as possible. It also showed the name and address of the person to whom it should be returned in an attempt to personalise the study and encourage involvement. The survey also had a letter attached that explained the study, and used the Edith Cowan letterhead to give some official status to the study. Clear layout and instructions and manageable length were also designed to assist in making it easy to respond.

Non-return is problematic, with Isaac and Michael (1981, p. 142) believing that non-return rates of up to 20% are acceptable. On the other hand, Kumar (1996, p. 114) differs in believing that a researcher should consider themselves lucky to obtain a 50% response rate, and occasionally it may be as low as 20%. As indicated earlier the sample comprised of 37 teachers from eight schools, of which 36 responses were used in the analysis.

Pilot study

Two pilot studies were planned in this study to assist in detecting any survey deficiencies. The second pilot study was planned in order to validate any changes made after the first pilot. As the internal consistency from the first pilot was rated high (see Chapter four) a second pilot was deemed unnecessary. Bell (1999, p. 128), Burns

(2000, p. 579) and Isaac and Michael (1981, p. 143) recommend that pre-testing should be carried out on a sample of people as alike as possible to those who will be surveyed.

Bell (1999, p. 14) notes that 'Question wording is not as easy as it seems, and careful piloting is necessary to ensure that all questions mean the same to all respondents'. Bell (1999, p. 128) also believes in asking:

- amount of time it took to complete;
- clarity of instructions;
- were any of the questions unclear or confusing and if so, which and why;
- was there any objection to answering any of the questions;
- do they believe that any key topic been omitted;
- layout appeal and clarity; and
- any other remarks.

Fetherston (2001) believes that it is preferable to have 30 or more respondents in pilot surveys in order to calculate useable reliability indices, though a smaller sample can offer good feedback about the wording of questions. He also recommends sitting with the pilot group as they complete the questionnaire while noting verbal and written feedback that will be used for improving the questionnaire.

The researcher's supervisor was asked to conduct an initial content validity check; validity will be discussed in more detail later. Pre-testing was carried out with three teachers, and pilot-testing with a group of teachers in similar conditions to those expected when the survey would be used in practice. The pilot study used 36 respondents and was conducted to enable any survey shortcomings to be identified and rectified. Pilot participants were asked if they believed relevant items had been omitted

or required re-wording. Room was made available for pilot participants to provide feedback regarding suggested positive aspects, changes, additions, opposition, and clarity of items or general ideas, for example, presentation. This is also supported by Bell (1999, pp. 127-128) who considers that 'All data-gathering instruments should be piloted to test how long it takes recipients to complete them, to check that all questions and instructions are clear and to enable you to remove any items which do not yield useable data'.

Validity and reliability

Two concepts are important in questionnaire design; validity and reliability. Some of the different types of validity and reliability are illustrated in Figure 3.

Validity.

Validity is (generally) the certainty that you are measuring the construct that you purport to, and no other.

Internal validity is related to issues like absence of selection bias, test effects, and levels of questionnaire validity, mortality and attrition rates. Burns (2000, p. 357) elaborates, by noting that internal validity is concerned with asking 'Do the experimental treatments, in fact, make a difference in the specific experiments under scrutiny, or can the differences be ascribed to other factors?' Conversely, external validity raises the question 'Given these demonstrable effects, to what populations or settings can they be generalised?' (Burns, 2000, p. 357).

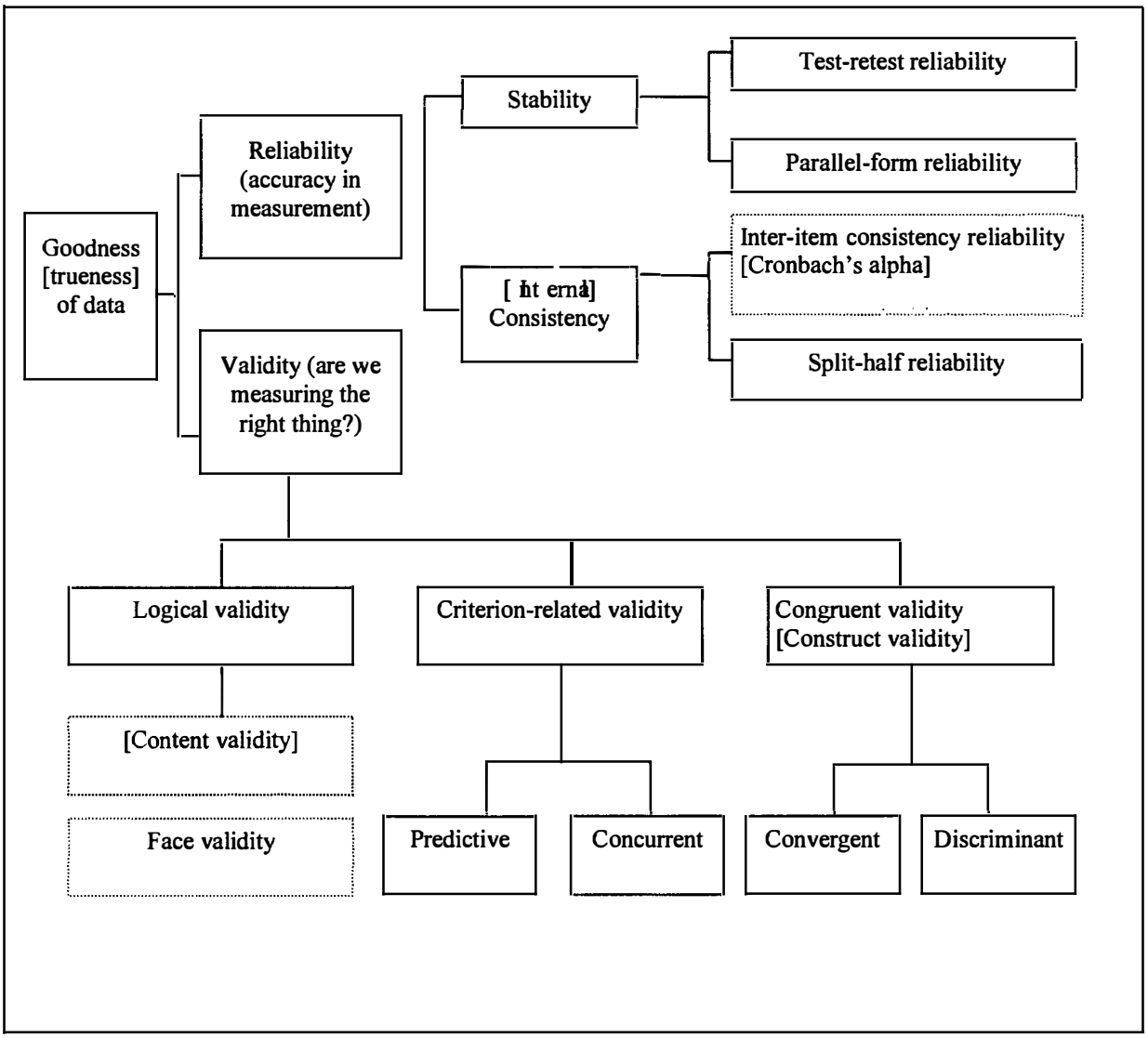

Figure 3. Overview of reliability and validity.

Note. Dotted line indicates techniques used in this research. From Research methods for business: A skill building approach (p. 170), by U. Sekaran, 1984, New York: John Wiley and Sons Inc.

'Threats to external validity are likely to limit the degree to which generalisations can be made from the particular experimental conditions to other populations or settings'

(Burns, 2000, p. 358). Such threats generally involve factors of experimental design, such as:

- Incomplete description of independent variables. A failure to clearly describe independent variables is problematic, as future replications of the experimental conditions would be practically unachievable otherwise (Burns, 2000, p. 359).
- A lack of 'representativeness of available and target population. While those participating in the experiment may be representative of an available population, they may not be representative of the population to which the experimenter seeks to generalise his or her findings' (Burns, 2000, p. 359).
- 'Inadequate operationalising of dependent variables. Dependent variables that the experimenter operationalises must have validity in the non-experimental setting to which the researcher wishes to generalise his or her findings' (Burns, 2000, p. 359).

Content validity

Content validity is not a statistical measure, it is concerned with how representative, comprehensive and accurate the instrument is. Content validity is achieved through thorough review of the material. According to Gay (1979, p. 159) 'Content validity is the degree to which a test measures an intended content area'. To establish this validity, items are commonly constructed from written specifications, and then it is often shown to expert/s who validate the content for the particular group that it is designed for. 'There is no formula for computing it and there is no way to express it quantitatively. ... The [experts'] judgement is based on whether all sub-areas have been included, and in the right proportions' (Gay, 1979, p. 160). The questionnaire underwent assessment for content validity with two academics, and results are to be discussed in Chapter four.

Content validity needs both item validity and sampling validity. Gay (1979) defines item validity as being 'concerned with whether the test items represent measurement in the intended content area' (p. 159). She elaborates by defining sampling validity as being 'concerned with how well the test samples the total content area...' (Gay, 1979, p. 159). It is imperative that the appropriate content area is adequately sampled; every characteristic could not possibly be covered because the required test would be too long. In this study, the more accurately the questionnaire is designed, that is, the more accurately the constructivist concepts have been defined, the better the content validity is likely to be.

Burns (2000, p. 357) suggests that face validity is important in attitude measurement. Face validity is a minimum guide of content validity and refers to the degree to which a test appears to measure what the researcher claims it measures. In other words, if on the face of it, it looks like it is measuring what it claims to. Gay (1979, p. 159) cautions against using only face validity, and believes that it is occasionally used as a preliminary screening procedure when selecting tests. The questionnaire underwent face validation with two academics and three teachers prior to further refinement.

Construct validity

> Construct validity is the degree to which the test scores can be accounted for by certain explanatory constructs in a psychological theory. If an instrument has construct validity, people's scores will vary as the theory underlying the construct would predict. (Mehrens & Lehmann, 1973, p. 126)

Constructs can explain characteristics of human behaviour. Fetherston (2001) believes that when discussed in relation to questionnaires, constructs 'refer to questions that are grouped together and relate to a common theme (construct)'. Further, 'Construct validity is important because analysis of questionnaires can be performed on single questions or groups of questions (constructs) and the analysis is different in each case' (Fetherston, 2001).

Similarly, Angus explains how construct validity measures sets of questions, 'Construct validity is the extent to which a test or research instrument measures an intended hypothetical construct' (1998, p. 58). Construct validity can be measured through convergent and discriminant validity.

'We must validate our test through a variety of kinds of indirect evidence. For example, the items must be internally consistent, i.e. show good agreement, one with another (i.e. a high alpha coefficient) for if not, they are measuring different qualities' (Burns, 2000, p. 355). Cronbach's coefficient alpha was calculated for the questionnaire using pilot survey results to give a measure of internal consistency.

Discriminant validity

'Discriminant validity is established when, based on theory, two variables are predicted to be uncorrelated, and the scores obtained by measuring them are indeed empirically found to be so' (Sekaran, 1984, p. 173). In other words, the measure has a low correlation with a variable that is supposed to be unrelated.

The questionnaire was piloted, and from this correlation coefficients were generated. If the tool were to be further developed these figures and the literature review findings

could be used to provide a method for measuring validity. According to Fetherston (2001), this method can demonstrate that the questions used in each construct are well correlated to the intended construct. Discriminant validity was not used in this study.

Convergent validity

Convergent validity is found when the scores obtained by two different instruments or methods measuring the same concept correlate highly. As no other instrument is available with which to compare results, convergent validity is not appropriate in this study.

Criterion, concurrent, and predictive related validity

'Criterion-related validity pertains to the empirical technique of studying the relationship between the test scores and some independent external measures (criteria)' (Mehrens & Lehmann, 1973, p. 125).

Two types of criterion-related validity have been identified; concurrent and predictive. Both undergo the same procedures, except concurrent validity is measured when criterion data is collected at the same time as the test. When criterion data is gathered at a later time, predictive validity is measured. The purpose of testing is another difference, (Mehrens & Lehmann, 1973) elaborate:

> In predictive validity we are actually concerned with the usefulness of the test score in *predicting* some future performance. In concurrent validity we are asking whether the test score can be substituted for some less efficient way of gathering data...[concurrent validity is] assessment of current status. (p. 125)

Concurrent validity

'Concurrent validity is determined by establishing relationship or discrimination. The relationship method involves determining the relationship between scores on the test and scores on some other established test or criterion (e.g. grade point average)' (Gay, 1979, p. 161). A validity coefficient is then calculated, this shows the concurrent validity of the new test. The test has good concurrent validity if the coefficient is high. As no other standardised test for measuring teachers' constructivist beliefs is known of, concurrent validity was not used in this study.

Predictive validity

'Predictive validity is the degree to which a test or research instrument can predict the performance of the subject in the future' (Angus, 1998, p. 59).

The test used to predict success is often termed the predictor, the behaviour that is to be predicted is often termed the criterion. Burns (2000) describes that 'It is usually possible to express predictive validity in terms of the correlation coefficient between the predicted status and the criterion. Such a coefficient is called a validity coefficient'. Moreover, Gay (1979, pp. 162-163) recognises that the criterion must be a valid measure of the behaviour to be predicted; additionally, one should not try to predict a criterion for which the base rate is exceptionally high or low.

Once the criterion has been identified and defined, the procedure for determining predictive validity is as follows:

1. Administer the test (the predictor variable).
2. Wait until the behaviour to be predicted (the criterion variable) occurs.

3. Obtain measures of the criterion.
4. Correlate the two sets of scores.

The resulting number, or validity coefficient, indicates the predictive validity of the test; if the validity coefficient is high, the test has good predictive validity. (Gay, 1979, p. 163)

It is advisable to re-confirm the predictive validity of a test in order to check it is valid for more than one sample of people; this is termed cross-validation. Gay (1979, p. 163) recognises that cross-validation 'involves administering the predictor tests to a different sample from the same population and developing a new equation'.

An expectancy table is a means of determining the relationship between a predictor and a criterion. According to Gay (1979, pp. 165-166), an expectancy table is a two-way table; down the left side are the categories or predictor scores, and along the top are the categories or criterion scores. Additionally, table entries represent the amount or percentage of people at each intersection. An expectancy table was not used in this study, but could be a useful supporting technique in future research.

Reliability.

Reliability is the extent to which the measurement instrument used gives similar results from repeated uses. In other words, the instrument's consistency of measurement. Burns (2000, p. 345) identifies three sets of attributes that can affect the reliability of any test:

- issues regarding the characteristics of the test items and also the test itself;
- the characteristics of the subjects that are being tested; and
- issues regarding administration of the test.

Various techniques are available to indicate reliability, including test-retest reliability. This measures reliability over time usually when the questionnaire is administered on two different occasions, with a correlation calculated between the two questionnaires. Generally, a two to three month period between each test is recommended. The higher the coefficient, the better the score. Similarly Fetherston (2001) believes that 'acceptable test-retest reliability would be demonstrated by a Pearson coefficient of above .80'.

A second method is alternate forms reliability, also known as parallel-form reliability or equivalent form reliability. Equivalent forms of the same items are administered and then reliability is established by correlating the results of participants on one set of items with the results of equivalent ones.

Thirdly, the split-half reliability method generally entails dividing a test's items into two groups and then calculating an appropriate coefficient.

Cronbach's coefficient alpha is a popular form of internal consistency reliability based on all the possible split-half combinations. Reliabilities less than 0.6 are considered to be poor, the 0.7 to 0.8 range to be acceptable, and over 0.8 to be good; according to Sekaran (1984, p. 287). This is the method that was used to determine the reliability of the instrument.

Specific Procedure

A questionnaire was devised and assessed primarily for face and content validity using a process of review by several academics and teachers.

Initially devising the survey

To generate the scale questions the researcher firstly conducted an extensive literature review (see Chapter two). Having identified the major theorists in the field (Table one), material that was uncovered in the literature search was analysed, and from this major and supporting concepts were distilled. This resulted in 24 major concepts and within these a number of supporting concepts were documented. These concepts were defined and re-grouped into related subdivisions (see Table one).

As the items were written, the researcher reflected on her previous practice in the classroom, to assist in writing clear items for the target audience of primary school teachers. This first draft of items (see Table one, final column) were then discussed with the researcher's supervisor. Researcher and supervisor then collaboratively wrote a first draft set of 86 items. Some concepts overlapped and certain items were repeated. These items were discarded in later versions.

In short, each survey item relates specifically to a specified component of constructivism. This relationship has been recorded using the first (numeric) column of Table one to relate to a survey statement. For example; statement one 'I actively provoked initial interest at the beginning of lessons' is from number 21b and 21c of the table. A second example is survey statement 13: 'Students were given many opportunities to discuss their ideas with others'. This is from 14 of the table and is within the second part, 'To further assist in this 'sense making', students need to be

provided with opportunities to make decisions about their own learning. The exploration of a) materials, b) ideas and c) social interaction assists'. This process of cross-referencing theoretical concepts with questionnaire items increases the validity of the items.

Further development of the survey

After content validation with two academics whose research interests included constructivism, the questionnaire was reduced down to 73 scale questions in version two. The subsequent version three involved the researcher grouping the items into eight major concepts (grouped as per the items in Appendix seven). This allowed easier discrimination of similar items, and further refinement resulting in an increase in the number of scale questions to 75 items. Though some items were deleted, there were several double-barrelled questions that had to be split into two separate questions. For example in version five of the survey, item 21 was worded 'I encouraged students to talk about the concepts or what they were doing'. In subsequent versions this item was broken up into two items, item 17 'I encouraged students to talk about the concepts' and item 18 'I encouraged students to talk about what they were doing'.

There also appeared to be areas of overlap within the topics that were devised, a question that was placed within the survey's 'social interaction' topic section (items 15-21, Appendix seven), could also have been placed in the 'scaffolding' topic (items 27-33, Appendix seven), as well as in the 'articulation', section (item 14, Table one). 'Questioning' was another topic that overlapped. The item in question is item 16 (Appendix seven) 'Students were able to compare their ideas with those of the teacher or parents or others'. Furthermore, this topic grouping allowed the repetition of similar items to be identified, so some sets of two or three items were combined to make one

item. For example the items 'I encouraged students to explore', 'Students were able to apply what they had learnt to another problem they were given', and 'Students investigated their understandings' were combined to make the one item of 'Students investigated their understandings'.

A person with a background unrelated to education was also asked to read through version three and comment. Though some lack of comprehension could be attributed to his non-education background, several grammatical changes were made, for example instead of the wording 'prior understanding', rewording resulted in 'existing understanding'. This version was then saved as version four.

Content validity was specifically addressed through deriving survey items from the content analysis of the literature review (item selection is detailed later). The survey items were ordered under their sub-groups, to enable the participants to see a logical pattern and so that the areas being covered were clear, although this grouping was not used in the final survey. Most pilot survey statements were written in a positive sense, except two items; item 56 'Most of my lessons followed a pre-determined sequence of instruction' and item 57 'Most of my lessons followed a prescribed set of activities'. The researcher's supervisor then cross-checked the survey for content validity, and this version was saved as version five. A few formatting issues arose, so another version was created.

Version six, an explanatory letter (Appendix one) and feedback sheet (Appendix two) were hand delivered to six validators. There was one exception, as the validator (a teacher) resided in the country, in this case initial contact and explanation was made by phone, and the survey and letter mailed. In all instances, the researcher explained the

aim of the research, reiterated on the covering letter, and provided opportunity for any queries. A period of up to ten days was provided for feedback; most validators abided by the time line, and all validators replied.

The content validity was first assessed by two academics. They assessed the literature review, and then assessed the summary table that reviewed the literature (Table one). Following this they reviewed the draft survey (version six). For each item that had been devised, the survey had a cross reference to the summary table to enable the validators to more readily assess the appropriateness of each item. The two academics were able to assess the sub-areas and check that they were in the right proportions. Due to the overlap of concepts from the literature review, some sub-concepts were repeated in the questionnaire. Even though concepts were re-worded, the validators detected these overlaps and made comment. The researcher made appropriate changes to such an extent that a seventh version of the survey was devised and this was the one eventually piloted.

Data from the validation process was transcribed and summarised by the researcher electronically on the survey. Each reviewer's comments were identified. Different font colours were used to allow for easier identification of different reviewers' comments.

Other validators were provided with a paper copy of the survey and provided their feedback either electronically, or directly onto the survey. Some validators encouraged the researcher to contact them if further feedback was required. All of the validators had e-mail access, and immediacy of feedback and response was made easier with the use of e-mail. For example one of the teachers commented on the appropriateness of the validator's letter in that it could appear 'daunting' for a teacher. After receiving this feedback, the researcher e-mailed the teacher with a modified copy of the letter

designed for teachers and asked for comment. Feedback was received within a few days.

Distribution and collection of pilot questionnaires

Initial contact to the school was through the registrar. Based on the researcher's previous teaching experience it was believed that afternoons would be best for initial contact. After contacting several schools mid afternoon, in the belief that any post lunchtime incidents would have been resolved, the researcher found that contact was not as easy as first thought. The first school approached had by coincidence a registrar that the researcher had met previously, so her endorsement to the principal resulted in a positive welcome. The principal explained the local school events and that timing was inconvenient as teachers and students were preparing for an important visitor. The researcher approached 12 different schools in a similar way and found resistance high. Lessons learned were to telephone in the morning (avoiding break times) as principals were often unobtainable in the afternoon. Prior to telephoning, faxing the letter as per Appendix three and also attaching the first two pages of the survey was helpful. Names of principals, schools and fax numbers were obtained from the Department of Education's web site. This personally addressed fax provided an image of research so that the researcher could at least get past the 'gate keeper' secretary and discuss the survey with the principal. The principals approached were in the main friendly and understanding but all felt either that their staff had done many surveys recently (at times with very low response rates), or that the timing was particularly inconvenient.

As the researcher needed to gain access to participants without delay she approached several former colleagues and asked them to personally approach other colleagues. The former colleagues were given as many surveys as they felt comfortable with, ranging

from two to ten surveys. As a result, the survey was conducted on eight groups (from eight schools). The main purpose of the pilot was to obtain data for calculating reliability indices. If any major modifications were to be made, a second pilot was to be conducted on a separate group to confirm the instrument's reliability. As the initial reliability was considered sufficient, this second pilot was not required. All schools were in the same school district, but the sampling was based on a convenience approach.

39 surveys were given out and 37 returned, based on these returns it can be deduced a response rate of 94% was obtained, justifying the personal approach. Gestures of appreciation were conveyed to all participants.

Questionnaire scores were analysed using SPSS (SPSS, 1997) and Cronbach's alpha as a measure to indicate the internal consistency of the questionnaire. The scores obtained for testing the reliability in the pilot study have been disclosed. All items were very reliable, however some more than others. These were deleted or amended. The final version of the survey is version eight and is attached as Appendix seven.

Questionnaire specifics

Open-ended and closed questions used were drawn from elements discussed in the literature review. The initial version of the piloted questionnaire consisted of approximately 69 items, utilising a one to five Likert scale. In addition several open-ended questions were also employed.

Scale.

Bell (1999, pp. 185-186) believes that the Likert Scale is probably the most straight-forward attitude scale. In this scale a statement or statements are given, and each participant responds on a five-point scale using descriptors, 1 'never', 'occasionally', 'sometimes', 'quite often' to 5 'all the time'. An example of one of the statements used is 'I based my lessons on students' prior understanding.' See Appendix six (version seven of the survey) for all other statements that were used.

Open-ended questions.

The questionnaire also included several open-ended questions as they assisted in providing direction for further areas of investigation. This technique is also supported by Bell (1999). An example of one of the questions asked is 'Can you write for me what you understand to be the meaning of constructivist learning?' Further questions that were asked include:

- Are there any other comments that you would like to make?; and
- What do you think are the questions that are most relevant to your classroom teaching situation?

Analysis of items

Likert scale questions were analysed quantitatively using SPSS (SPSS, 1997). Responses from open-ended questions were also analysed quantitatively by grouping answers into conceptual categories. Summaries of these categories are reported in the next chapter.

Chapter Summary

The processes of constructing the pilot survey instrument, sample selection and conducting the pilot survey have been described. Each survey item devised relates specifically to a component of constructivism, based on an extensive literature review.

Content validity of the survey instrument was assessed by two academics, and face validity by another two academics and three teachers. Cronbach's alpha was used to indicate the internal consistency of the questionnaire based on pilot results. As reliability in the pilot study was found to be high, the survey only required minor modifications and was not re-tested. Unreliable items were deleted or amended.

Data for the pilot was collected using the survey instrument. The survey comprised of 69 questions utilising a one to five Likert scale, and several closed and open ended-questions. Eight schools were selected on a convenience basis, one teacher from each school administered the surveys. A response rate of 94% was obtained, and surveys were analysed from 36 teachers. The results were analysed using SPSS (SPSS, 1997), Excel (Microsoft, 2000) and Word (Microsoft, 2000), and summaries of the qualitative and quantitative data were produced. Results are presented in the next chapter.

CHAPTER FOUR

Results of the pilot study

Introduction

This chapter presents the results of the pilot study. Areas described include detailed results and analysis of:

- pre-test face and content validation findings; and
- pilot reliability at eight schools.

The survey 'Teaching and learning practices in primary classrooms' was developed after undergoing face and content validation by teachers and academics. The survey was then piloted and reliability indices obtained. Additionally, several open-ended questions were answered.

Face and content validation results

As previously discussed, face validity was first assessed by the first and second academics and all three teachers. Content validity was assessed by the third and fourth academics.

The content validators read the researcher's literature review and cross-checked this reading with the table based on the review (Table one). Each item in the survey corresponded with one or more of the 24 key elements of constructivism as well as supporting theorist/s and possible items. From Table one, each individual point was written underneath each survey item so that the direct link could be viewed and if required, further cross-checked.

Academic one and academic four gave feedback regarding the rating scale. The original rating scale was a five point Likert scale with the options selected from; strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree. Academic four suggested that most teachers would respond strongly agree to most items so it would be likely to get little discrimination. To give the survey more discrimination he recommended that it would be better to use a frequency scale i.e. how often they use the practice - every lesson/ most lessons/ some lessons/ few lessons/ never. The first academic also suggested a change in the form of; 1= in none or very few lessons, 2= in some lessons, 3= in all lessons. Accordingly, the researcher changed the rating scale to: never, occasionally, sometimes, quite often, all the time.

Other educationalists assessed the face validity (three teachers and two additional academics) by analysing the content with their own personal reference and understanding of constructivist teaching practices. A number of comments were received, and those of relevance to the instrument construction are discussed below.

The first teacher commented:

> The survey covers so many teaching strategies. Would it be fairer to ask teachers to reflect over the past week's teaching period? Today was my DOTT day and I would have to answer "No" to most of these questions, which doesn't reflect accurately what I use regularly in class.

With this comment believed to be significant, the time period teachers were asked to consider was changed from; 'In most of the lessons that I conducted yesterday' to 'In most of the lessons that I conducted in the last fortnight'.

Two of the validators questioned the clarity of item three which originally was 'I knew what were students' existing ideas' and was changed to 'I knew what students' existing ideas were'.

Three of the validators commented that item five required re-wording. It was originally worded 'Students' responses gave me a good understanding of their mental representations of the main concepts of my lesson'. This was changed to 'Students' responses gave me a good understanding of their ideas about the main concepts'. Three validators questioned how to interpret item 13. The original wording was 'Students drew their understandings'. This was elaborated on and re-worded as: 'Students drew pictures of their understandings'.

Two of the original items were similar 'Students investigated their own understandings' and 'I encouraged students to explore their own ideas'. These were consolidated into the one item of 'I encouraged students to explore their own ideas'.

The meaning of the original item 'Students usually checked your work' was questioned by three of the validators, so was changed to 'Students usually checked my examples'. The item 'Students were able to offer suggestions for improvement of your work' was changed to 'Students were able to offer suggestions for improvement of my explanations', therefore keeping the terminology similar to the previous item.

The second academic assessed the face validity, and commented as below.

> I consider the instrument demonstrates your clear understandings of the theoretical underpinnings of constructivism, and has strong face validity. The questions provide an opportunity to gauge participants' sense of engagement with and empowerment of their students in the learning environment. Although I was initially concerned at the length of the survey, I was impressed with the cyclic nature of the construction of the instrument, which reflects an increasing conceptual exploration of the respondent's beliefs and reported practices related to constructivism. Each cycle of questions presented the conceptual exploration from a new perspective, which should counter the potential for any sense of repetition. I [am] particularly impressed with the sets of questions related to student and parent involvement in the teaching/learning environment.

Reliability

Background information

Validation of the instrument at eight schools involved the completion of the survey instrument by 36 respondents.

Details of respondents' age, gender and number of years as a teacher, and year level taught were also sought. These items were used in the analysis of the data.

Room was made available on the response sheet for the respondents to provide feedback regarding recommendations for improvement like changes, additions, clarity

of items or general ideas, and presentation. As can be seen in the final version of the survey (version eight), these items were not included as they were only applicable to the pilot survey.

Reliability Calculation

The reliability of the survey was assessed by calculating Cronbach's coefficient alpha for the questionnaire, producing an overall coefficient of 0.93. Table two was generated using SPSS (SPSS, 1997) and provides a summary of the alpha coefficients for the exclusion of each of the pilot study items. The very high alpha coefficient for the questionnaire indicates that the questionnaire was internally consistent, so can be considered to be internally reliable.

To increase the reliability of the questionnaire, a number of changes are recommended for consideration. These changes are detailed in Table three, and should these changes be implemented, it is recommended that the questionnaire be re-piloted to confirm the instrument's reliability.

Question Number	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
Q25	251.3056	478.2754	.5643	.9281
Q26	251.4722	484.4849	.3636	.9298
Q27	250.8611	486.5802	.4971	.9287
Q28	252.1667	496.4286	.1447	.9313
Q29	250.9722	494.8278	.2983	.9298
Q30	250.8889	492.8444	.4301	.9293
Q31	250.7500	490.3643	.4869	.9290
Q32	250.7222	487.8635	.6053	.9285
Q33	250.3333	485.4857	.5908	.9283
Q34	250.5000	502.1429	.0304	.9315
Q35	250.5556	495.0540	.3111	.9298
Q36	252.4167	478.8786	.4985	.9286
Q37	251.6389	495.1516	.2369	.9302
Q38	251.1944	482.9611	.5967	.9281
Q39	250.7500	495.5071	.2539	.9301
Q40	251.1111	491.5873	.3638	.9295
Q41	251.1389	485.8373	.4889	.9287
Q42	251.4444	486.5968	.4850	.9288
Q43	251.1667	488.2000	.4659	.9289
Q44	251.2778	491.2921	.2916	.9301
Q45	250.6944	486.4468	.4483	.9290
Q46	251.3889	481.2730	.4846	.9287
Q47	250.9722	482.7135	.6076	.9281
Q48	250.2778	488.6063	.4811	.9289
Q49	251.3056	486.9611	.4568	.9289

table continues

Table 2

Reliability analysis showing internal consistency using Cronbach's alpha

Question Number	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
Q1	250.5556	494.7683	.3918	.9295
Q2	251.5000	495.8000	.2507	.9301
Q3	251.2222	496.1778	.2053	.9304
Q4	250.6944	491.6468	.4794	.9291
Q5	250.5278	494.7135	.3802	.9295
Q6	250.4444	495.4540	.2535	.9301
Q7	250.5278	492.4278	.3704	.9295
Q8	250.5000	493.6286	.3230	.9297
Q9	250.6389	488.0659	.5787	.9285
Q10	250.8611	490.7516	.4485	.9291
Q11	250.6944	496.5611	.1841	.9306
Q12	251.3889	493.3873	.2949	.9299
Q13	251.5556	492.9397	.2603	.9302
Q14	251.0278	495.5706	.3100	.9298
Q15	250.7500	489.3929	.4276	.9291
Q16	251.3611	490.7516	.3929	.9293
Q17	250.5556	484.5397	.6556	.9280
Q18	250.8056	473.0183	.6888	.9271
Q19	250.9444	498.6254	.1697	.9305
Q20	250.9444	492.1683	.3718	.9295
Q21	250.9722	491.5706	.3427	.9296
Q22	251.1667	488.5429	.3756	.9295
Q23	250.9167	490.0786	.4507	.9291
Q24	250.5278	493.6849	.4247	.9293

Question Number	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
Q50	251.4722	492.7706	.2365	.9305
Q51	250.6389	491.6659	.4091	.9293
Q52	250.8333	481.3429	.5189	.9285
Q53	250.9722	482.3706	.5885	.9281
Q54	252.1667	486.6000	.4266	.9291
Q55	251.4444	491.5111	.3402	.9296
Q56	251.1111	485.6444	.4212	.9292
Q57	251.1389	495.0373	.2072	.9306
Q58	251.0556	499.0825	.1550	.9305
Q59	251.3889	481.6730	.4905	.9287
Q60	251.1111	489.6444	.4516	.9290
Q61	251.6389	487.6659	.4366	.9291
Q62	251.1944	493.2468	.3081	.9298
Q63	250.0556	494.6254	.3765	.9295
Q64	250.4167	494.4214	.2399	.9303
Q65	251.4167	485.1643	.3747	.9296
Q66	250.5556	489.4540	.4253	.9292
Q67	252.1667	486.0286	.4246	.9291
Q68	251.1944	482.3325	.5181	.9285
Q69	250.7500	489.8500	.4134	.9292

Of the changes recommended, it was deemed desirable to remove item 19 'Students worked in pairs'. As teachers may reasonably consider 'pairs' to be within 'groups', so provided their answer within the context of item 20 'Students were given opportunities to work in groups'. With the deletion of item 19, the final survey would comprise of 68 instead of 69 scale items, and a resultant alpha coefficient of 0.93 could still be expected (Table two). Other changes recommended are to clarify or improve the interpretation of the item concerned, given feedback from the participants in the pilot survey.

Original statement (Survey V07)	Proposed statement if a final survey was to be re-piloted (Survey V08)	Reason
Q58 Students worked on real-world problems.	Students worked on realistic problems.	The term 'real-world' may be ambiguous so the term 'realistic' has been substituted.
Q64 Students often asked me when they didn't understand.	Students usually asked me when they didn't understand.	The term 'often' may not specify the frequency sufficiently, so the word 'usually' has been substituted.
Q15 Students were given many opportunities to discuss their ideas with others. Q40 I gave students many opportunities to apply ideas in different situations. Q48 Students worked at many different levels. Q53 Students were provided with many different strategies in the lesson to advance their learning.	Students were given opportunities to discuss their ideas with others. I gave students opportunities to apply ideas in different situations. Students worked at different levels. Students were provided with different strategies in the lesson to advance their learning.	Survey respondents can interpret 'many' in different ways.

Note. Vertical lines have been used for clarity, although they are rarely used in APA documents.

Table 3

Further improvements

Original statement (Survey V07)	Proposed statement if a final survey was to be re-piloted. (Survey V08)	Reason
Q 3 I knew what students' existing ideas were.	I knew what students' existing ideas were about the concepts being treated.	It may be unclear in teachers' minds as to what type of 'existing ideas' were being referred to.
Q 11 I was able to promptly provide sufficient materials to most students.	I was able to provide sufficient materials to most students.	The interpretation of the term 'promptly' may vary.
Q28 A parent was able to assist individuals to understand new ideas.	A parent was able to assist individuals to understand new ideas in class.	This item may be unclear as the context for the parent help is not indicated, for example this may have occurred at home, so the statement is re-worded to indicate the classroom setting is relevant.
Q34 I modelled expected standards to students.	I demonstrated expected academic standards to students.	The term 'modelled' may not be an everyday part of all teachers' language, so the term 'demonstrated' has been substituted, additionally the type of standard may need to be clarified, so the term 'academic' is included.
Q50 Students were able to make choices in regard to the sequence of the activities they did.	Students were able to make choices about the sequence of the activities they did.	The section 'in regard to' has been re-worded to say 'about'.
Q57 Most of my lessons followed a prescribed set of activities.	Most of my lessons followed a set of activities prescribed by the teacher.	Teachers may be unsure about who was supposed to have prescribed the set of activities.

Open ended questions

As the survey is at pilot stage, these answers are of general interest so do not have an impact on the reliability and validity of the tool, rather assist in providing future directions for further development of the tool.

Teachers' understanding of constructivist learning

The results of the participants' reply to Question A 'Can you write for me what you understand to be the meaning of constructivist learning?' are detailed in Table four.

These results are of interest firstly to see if teachers' answers are related to findings from the literature review and secondly in response to a comment made by the second academic validator. 'I will be interested to see whether the participants' descriptions of constructivism complements the construction which will be apparent from your instrument'.

It is noted that teachers' responses may be influenced by the survey items themselves, as is apparent from one teacher's comment, 'I did not answer the initial question of "teaching in constructivist way" as I'm not sure of the meaning. I'm guessing from the questions that it involves building on students' prior learning and giving students more input in deciding what and how they learn'.

Comment	Responses
Eclectic approach.	1
Catering for many different learning styles.	1
Not learning isolated pieces of information.	1
Children can relate their learning to real life situations.	1
To gain or further develop these understandings, learning in general.	1
Problem solving skills.	1
Teachers are merely the facilitators.	1
Children are part of whole process.	1
Build on skills through research and interaction with others	1
To learn by fitting different parts of learning and skills together.	1
Taking students' advice in teaching.	1
To enable children to help decide upon their learning and then manage it.	1
Topics student and teacher initiated collaboratively.	1
Given a choice as to the presentation of their learning.	1
Students discover ways to learn.	1
Students are able to discuss ideas and understandings in a constructive manner.	1
Students are in control of how/what they are learning.	1
Planning done from students' ideas and topics of interest. Finding out students' prior knowledge first is essential, then build on this knowledge.	1
The use of many strategies to develop understanding eg. rote. Children are exposed to a variety of strategies to cater for learning needs.	1
Where children construct their own knowledge about the world by real-life experiences. This is how they make sense of the world.	1
Skills and understandings can be carried over into other subject areas where they have a practical application. Subject integrations across the curriculum utilises the principles of constructivist learning.	1
They are involved or at least aware of the criteria for three levelled performance and what they need to get to each level. The criteria changes to a more difficult one once it is attained.	1
Students learning how to learn and taking charge of their own learning e.g., evaluation of learning etc.	1
However this is not possible in all situations, as children don't always know "what they need to know"!!!	1
Use the students' ideas to promote learning as this will motivate and extend their knowledge.	1

Table 4

Teachers' understanding of constructivist learning

Participants collated responses to the question:

Can you write for me what you understand to be the meaning of constructivist learning?

Comment	Responses
Have never heard of the term 'constructivism' before.	4
No comment indicated.	3
Students building on existing understandings.	15
A student-centred learning environment.	8
Students actively learning.	6
When the learning is meaningful to the student.	4
Children learn collaboratively.	3
Children learning by doing and sharing.	2
Students working at own level.	2
Variety of open-ended tasks.	2
Teaching in a setting where students are encouraged to initiate learning.	2
Learning that has a purpose.	2
It is where you ask the students for their input into the activities.	2
Activities and lessons suited to real life.	2
Type of learning that is developmental to individual's level of abilities.	2
Students to take responsibility for their learning.	2
Students progressing at own pace.	2
Students encouraged to question and investigate.	2
Students learning how to learn.	1
Children learn by doing and redoing.	1
Children learn by doing.	1
Students learn through talking.	1
Experiential learning.	1
Base learning on children's interests and build on that.	1

Four of the participants had never heard of the term 'constructivism' before. It is noted that even though teachers may not use the term, they may still be incorporating some of its principles. Fifteen teachers believed constructivist learning to be 'students building on understandings'. The significance of working with students' prior understanding has been recognised by Ausubel (1968, p. vi) as well as many other educators, detailed in Chapter two.

Of additional interest when answering Question A was 8 teachers out of 36 referring to a 'student-centred learning environment'. As discussed in Chapter two, student-centred learning has been recognised as important in learning environments (Hobbs & Moore, 1992). Student-centred learning is also identified by the Curriculum Framework through its promotion of many constructivist principles, a fundamental vision being 'Student centred learning will become increasingly appropriate as an outcomes focus is adopted. Much of the Curriculum Framework has a student-centred flavour' (Education Department of Western Australia, 2001, p. 1). There is an indication that the value of student-centred learning is recognised by the pilot group.

A point of interest when answering Question A is 6 out of 36 teachers' reference to 'Students actively learning'. This active involvement is central to theory previously cited (see Chapter two). This active involvement in constructing meaning (Vander Zanden and Pace (1984, p. 210), Cognition and Technology Group at Vanderbilt [University] (1992, p. 67), Marra & Jonassen, (1993, p. 59), Watts, Jofili & Bezerra (1997, p. 309), Piaget, (1970, p. 15), von Glasersfeld, (1995b, p. 51), Freyberg and Osborne (1985, p. 83, p. 90)), is one of the concepts identified in Chapter two: Students need to be *active participants*. The ideas that they develop must be integrated into existing structures and mental models. The teachers' reference to active involvement is

positive, however a more representative sample would be needed before any conclusions could be made regarding any significance.

A final point of interest when answering Question A is four teachers referring to the concept of constructivism as learning that is meaningful to the student. This meaningful involvement (Bloom et al., (1956, p. 144), College of Education University of Houston (2000), Driver, Asko, Leach, Mortimer and Scott (1994), Freyberg and Osborne (1985, p. 83), Prawat (1989, p. 12), Smith & Ragan (1999, pp. 15, 21, 124), Vander Zanden & Pace, (1984)) is central to theory cited in Chapter two. Meaningful involvement and learning is important for students to develop understandings, it is positive to see that some teachers are recognising its importance.

Survey question A 'Can you write for me what you understand to be the meaning of constructivist learning?' is deemed suitable for use in the final survey. Pilot survey results suggest that rich data may be gained, consequently teachers' understandings may be evaluated more comprehensively.

Other comments.

The results of the participants' replies to Question B 'Are there any other comments that you would like to make?' were varied and examples are provided below.

- 'Time restraints often mean that children can not always discuss all their ideas and understandings, even in a group' Participant 1.
- 'Many teachers have a pre-described sequence of activities and ideas for lessons as it is essential that teachers are highly organised. However in this organisation teachers must be flexible and go to some degree to the childrens' interests. However there are some understandings and concepts which must be covered

within particular year levels e.g. phonics, basic numeracy concepts' Participant 6.

- 'Yes some of these statements require more clarification and there are always exceptions and so it is difficult to select 'all the time'. I would have liked a 'most of the time' option as well as the 'quite often'' Participant 10.
- 'I don't like children to 'disagree' with one another but I do like them to present alternative views' Participant 11.
- 'Constructivism is a great theory but in reality I don't think it would work all the time. Lots of factors i.e. the students, the school, the subject etc' Participant 21.
- 'I would like to teach in a less formal way and have more student input, but large numbers with such diverse levels and personalities restricts me to a more formal approach to a) keep my sanity b) I feel like I can keep a closer 'eye' on progress of all-in a more formalised setting. I'd like to see smaller class sizes and better resources' Participant 31.
- 'Curriculum framework and outcomes taking up much of teachers planning time/ instructional style' Participant 36.

The second open-ended question 'Are there any other comments that you would like to make?' is deemed of relevance for the final questionnaire as anecdotes such as those above provide an insight into the rationale behind teachers' current classroom practices. Time was discussed by two of the participants, and as reported in the literature review Lortie (1975, pp. 208-210) has discussed that time constraints can impact on teachers by their reverting to previous experiences or techniques. Participant 6 indicates a concern for covering the curriculum, and participant 31 is concerned about progress being monitored. These concerns of 'covering the curriculum' and 'meeting assessment requirements' are also identified by (Bell, 1998, p. 687) as 'barriers' for teachers when adopting new techniques.

Non-scale items

Time taken.

In response to Question C 'Approximately how much time did this survey take to complete?', most participants took 15 minutes or less to complete the survey. A third of the participants (12) took from 20 to 30 minutes and two participants took 40 minutes (see Appendix 8, item 70). It is noted that as this is a pilot survey, the final five survey items and at least one scale item would be omitted, resulting in a shorter completion time.

Clarity of instructions.

In response to question D 'Were the instructions for this survey clear enough?, most respondents believed that they were, and two did not respond. See Appendix 8, item 71, a response of '1' denotes 'yes'.

Clarity of wording.

Responses were received to question E 'Were there any questions in which you felt the wording or the meaning was unclear?' (See Appendix 8, item 22, a response of 2, denotes 'no'). It was believed by 26 participants that the wording or meaning was clear, 5 did not respond. Five participants believed that the wording or meaning were not clear, of these one did not give an example, and the remaining four provided the following answers:

A. Many? How many is many? (Participant 1)
B. Q25- Students didn't always need to check. (Participant 5)
C. Q68- Challenge the answer (given teacher)? Or taken risks and be challenged by volunteering an answer? (Participant 8)

D. Q69 - Not sure of context, did you mean during discussion students were encouraged to disagree with other student's opinions, support this with facts. (Participant 6)

Comment A has been noted, the statements in the survey (Appendix six version seven) that include the word 'many' include; statements 15, 40, 48, and 53. These items all produced acceptable alpha coefficients of; 0.93 (Table 2), suggesting no great improvement in overall reliability could be gained by their removal. Survey respondents can interpret 'many' in different ways, though the high alpha coefficients suggest that most have interpreted it similarly. However, the word 'many' could be removed from the four items, giving an improvement in reliability. Comment B relating to item 25 'Students usually checked my examples' was not changed, as it is pertinent from a constructivist perspective that examples are checked.

Comment C is a relevant comment, as teachers may be unaware that the statement Q68 'Students were able to challenge an answer' is aimed at all participants in a socially constructed learning environment. The item could be divided into two specific items:

- Students were able to challenge an answer provided by a teacher or parent; and
- Students were able to challenge an answer provided by a peer.

Comment D questions the context for item 69 'I encouraged students to tell me when they disagreed with what others were saying'. The respondent was unsure of the context, and questioned if the survey meant when during discussion were students encouraged to disagree with other student's opinions, and if they were to support this with facts. The researcher believes that this item does not need clarification, as challenging other students' opinions is implicit in the question.

Most relevant items.

In response to question F 'What do you think are the questions that are most relevant to your classroom teaching situation ?' The items that teachers thought were most appropriate, were :

- Q47 Students were able to evaluate their own learning;
- Q48 Students worked at many different levels;
- Q58 Students worked on real-world problems;
- Q61 Students often suggested new activities;
- Q63 Students were encouraged to ask questions; and
- Q64 Students often asked me when they didn't understand.

Additionally, teachers made the following comments to support their responses:

- 'Student lead (sic) planning was something I have found hard to do but am working at and therefore very interested in' Participant 5;
- 'Allowing more time for discussion and reflection. No matter how hard I try- there is never enough' Participant 11;
- 'Hands on experiences' Participant 12;
- 'The questions about students ' setting learning tasks, doing more reflection' Participant 13;
- 'How do we find the time to do everything expected e.g. reflection, evaluation through marking and assessment without a personal aide or secretary or without much smaller classes?' Participant 15;
- 'All were relevant- I was pleased to see that I gave students opportunities to do most things' Participant 18;
- 'Group work' Participant 21;

- 'Most of the questions made me think about my methods of teaching' Participant 22;
- 'Given a different time frame, some answers would differ. Depending upon the topics being covered, lesson styles and strategies vary from very structured to very open' Participant 24;
- 'The questions that allude to this teacher as a facilitator and students having a major input into the learning process' Participant 27;
- 'They all provoked me to think about my current practice. Thanks for the opportunity' Participant 29;
- 'Do you use a mixture / a range of very student centred and more traditional strategies?' Participant 30; and
- 'All of them because they make you think about what you do on a daily basis'. Participant 35.

Initial background questions

The initial background information that would be used when the survey is used for data collection was completed by all but six respondents; two did not indicate their age and six did not provide a response for constructivist tendencies (Appendix eight). It is suggested that when evaluating this survey after data collection, a category of "no age" provided may be necessary. Similarly a category for "neither constructivist or non-constructivist tendencies provided" may also be necessary.

Chapter Summary

Face validation of the pre-test was carried out by two academics and three teachers, producing a number of results, including the finalisation of 69 items. Content

validation of the survey instrument was assessed by a further two academics with a research interest in constructivism.

Validation of the survey instrument by pilot testing with 36 teachers across 8 schools also produced a number of results including an overall Cronbach's coefficient alpha for 69 items of 0.93.

CHAPTER FIVE

Overall summary, discussion and conclusions

Introduction

This chapter presents a summary of the study, overall conclusions, and provides suggested direction for further research.

Summary

After a content check, the final content of the survey was agreed upon by content validators. Face validation of the survey instrument was by two academics and three teachers. These validation exercises resulted in:

- modification of the scale;
- ambiguous items re-worded;
- similar items consolidated;
- the time period over which teachers were asked to consider their classroom practice changed to two weeks; and
- the finalisation of 69 items.

Validation of the pilot-test by 36 teachers resulted in:

- calculation of Cronbach's coefficient alpha producing a reliability coefficient of 0.93;
- removal of one item, 19, not affecting Cronbach's coefficient alpha coefficient of 0.93;
- identification of items that could be further refined if the opportunity to conduct a second pilot arose;

- general comments relating to teachers' understanding of constructivist learning of value to the Department of Education authorities with an interest in the implementation of the Curriculum Framework;
- identification of items that participants deemed most relevant to assist with further development of assessments in this area;
- the revelation that the amount of time most participants took to complete the survey was 15 minutes;
- all responding participants indicating that the instructions were sufficiently clear;
- a final selection of 68 items; and
- a valid and reliable survey.

Suggested Applications

Possible applications of the instrument include:

- assistance in providing direction for areas such as additional teacher training and development, resource requirements, support, and research;
- establishment of an understanding of current practice in classroom environments;
- sections of the survey may be used as a tool for teachers wishing to improve on certain areas of their classroom practice; and
- use by teachers to reflect on their current practice.

Limitations

The study has been designed to extract the maximum amount of information given the limited resources available to the researcher. However, it should be noted that some limitations exist with respect to the generalisability of the results obtained. The main restrictions are concerned with the pilot sampling method, subjectivity of reporting, and the volunteer effect.

The pilot sample has been drawn from a single school district in Perth, the capital city of Western Australia. Immigration and suburban growth patterns in Perth have resulted in areas of relative socioeconomic and cultural homogeneity. Educational Districts in Perth are distributed in such a way that generally does not challenge this homogeneity. The sample of participants is from schools closer to central Perth city, which generally tend to be more affluent. Gathering data from teachers in one district alone means exploring a relatively homogeneous sample, not necessarily representative of the state-wide population, or the teacher body as a whole. The sample actually drawn was a convenience sample. Therefore, the population to which the survey's results can be generalised may be small, but the conclusions drawn may be useful as indicators to areas of further research across the wider population.

The absence of a 'normal number' of recent graduates from the sample district may result in a bias from the involvement of older, more experienced teachers. Moreover, any comparison to Australia wide teachers is limited due to the different curriculum and training techniques Western Australian teachers experience.

Further selection bias may have occurred as those teachers participating are volunteering and may have different motives for doing so. For this reason the voluntary participation may affect the composition of the sample and the results received. The data collection technique utilised involves teachers self-reporting their observations. This may influence the data collected through the subjectivity of the teachers' observations of themselves. These observations are influenced by peer group and individual norms, together with those of the Principals.

Reliance on a largely quantitative approach has limitations, as the richness of qualitative data is not available. It is to be noted that this study is only based on teacher's perceptions.

Future research

The development of a valid and reliable tool has been the sole aim of this research. Areas for future research would include:

- collection of data with this tool, involving a larger sample of teachers;
- classroom observations to triangulate the teachers' view of their classroom; and
- a 'snapshot' of current practice.

Additionally, it is suggested that differences may be investigated in respect to teacher age, gender, experience, year level taught and location.

As previously discussed item 68 'Students were able to challenge an answer' would be divided into two specific items:

- Students were able to challenge an answer provided by a teacher or parent; and

- Students were able to challenge an answer provided by a peer.

If this tool was to be further developed, predictive validity would be used and cross-validation would be carried out. An expectancy table would be developed and the four-step process previously explained used.

If further refinement of this instrument was desired, the 13 items that were identified to be considered for changes would be modified and another pilot study to re-test reliability, and confirm changes completed so that final correlation figures could be obtained.

A final comment by Dykstra (1996) summarises the relevance of this research area, in promoting the idea that changing beliefs about knowledge is an important element in educational change.

> If there is a key to reinventing our educational system, it lies in what our teachers believe about the nature of knowing. Without a re-examination and change in beliefs about the nature of knowing, there will be no substantial change in the enterprise of education; we will stay in a vicious cycle. (p. 202)

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APPENDICES

APPENDIX ONE

Letter to Validators

October _____ 2001

Mr/ Mrs/ Dr/ Professor
School name
School address

Dear _____,

I am currently completing my Bachelor of Education with Honours at Edith Cowan University.

My thesis is entitled ''Constructivist practices in Primary classrooms - The development of an instrument''. I am particularly interested in answering the research question "Does the instrument reliably and validly measure teachers' perceptions of constructivist practices in their classrooms?"

I have developed a survey based on my review of the relevant literature and personal experience in the primary classroom. I would greatly appreciate your opinion, as a researcher in a relevant field, on all aspects of the instrument in order to establish its content validity.

Please feel free to make notes or comments directly on the instrument, and make any amendments you see fit.

Attached is the instrument in question and a feedback sheet for your convenience.

If you have any questions please feel free to contact me.
at b.herlihy@cowan.edu.au or on _____

I hope this request meets with your approval and I look forward to hearing from you in the near future. Please return your feedback to me at PO BOX 893, Subiaco 6904 (see the attached envelope).

Yours Sincerely,

Bianca Herlihy

APPENDIX TWO

Feedback sheet for Validators

Please provide any additional feedback here.

APPENDIX THREE

Letter to Principal

November _____ 2001

Mr/ Mrs _____
School name
School address

Dear _____,

I am a teacher of fifteen years experience and am currently completing my Bachelor of Education with Honours at Edith Cowan University.

To complete my thesis 'Constructivist practices in Primary classrooms- The development of an instrument' I need school participation. The object of the study is to find out more about actual teaching and learning practices in primary classrooms. The research, when complete, will add to our knowledge base of such practices, and will be used to improve the learning and teaching environment, thus benefiting teachers and students. In order to carry out my research I require approval to distribute surveys to staff.

The questionnaire is anonymous, so no identifying information about you or your school will be recorded. However, some demographic information is requested to enable useful statistics to be generated. A copy of the aggregated results will be made available for participating teachers and principals.

Any questions concerning the project can be directed to Bianca Herlihy, School of Education, Edith Cowan University at b.herlihy@cowan.edu.au
phone: _____

If you have any concerns about the project or would like to talk to an independent person, you may contact Dr Tony Fetherston at t.fetherston@cowan.edu.au
phone: 9370 6373

I do hope that this request meets with your approval, if so I look forward to hearing from you in the near future.

Yours Sincerely,

Bianca Herlihy

APPENDIX FOUR

Consent form

Dear Madam/Sir,

I am a teacher of fifteen years experience and am currently completing my Bachelor of Education (Honours).

The object of the study is to find out more about actual teaching and learning practices in primary classrooms. The research, when complete, will add to our knowledge base of such practices, and will be used to improve the learning and teaching environment, thus benefiting teachers and students.

The questionnaire is anonymous, so no identifying information about you or your school will be recorded. However, some demographic information is requested to enable useful statistics to be generated. A copy of the aggregated results will be made available for participating teachers, through your school.

Completing the questionnaire means you agree that you can withdraw at any time and that the researcher can publish results, provided neither the school nor yourself are identified. If you agree to participate, no risks or discomfort are foreseen. Please complete the attached questionnaire and return it to the school registrar or secretary. The questionnaire should take no more than fifteen minutes of your time and your contribution is important to the quality of the research.

Any questions concerning the project can be directed to Bianca Herlihy, School of Education, Edith Cowan University at b.herlihy@cowan.edu.au

If you have any concerns about the project or would like to talk to an independent person, you may contact Dr Tony Fetherston at t.fetherston@cowan.edu.au
phone: 9370 6373

Your assistance by completing the attached questionnaire is greatly appreciated.
Feel free to keep this letter for your records.

Bianca Herlihy

Edith Cowan University

November 2001

APPENDIX FIVE

Survey (V06 Validated by teachers and academics)

Questions asked were based on Table 1 'Summary table of key elements of constructivism' (see Data Analysis Section) where components of constructivism have been identified based on the literature review. The instrument used is a questionnaire in a survey.

Teaching and learning practices in primary classrooms.

The object of the study is to find out more about actual teaching and learning practices in primary classrooms. The research, when complete, will add to our knowledge base of such practices, and will be used to improve the learning and teaching environment, thus benefiting teachers and students.

All results will remain confidential, as no name is required on this sheet no teacher will be identified.

In this survey you are asked to respond to questions similar in a form to this, please tick the correct answer:

Example question:

In Perth, it rains more in winter than in summer

❑	❑	❑	❑	❑
strongly disagree	disagree	neither agree nor disagree	agree	strongly agree

This question has been completed.
Most of the questions in this survey use a scale like this one.

The following information will assist, please provide the answers.

The year level that you are currently teaching is: Year _____.

The number of students that you have in your class is: _____ students.

The number of years that you have been teaching is: _____ years.

Your gender is: ❑ F ❑ M

How old are you? _____ years.

I believe that most of the time I teach in constructivist ways: ❑ yes ❑ no

Please turn over

In most of the lessons that I conducted yesterday:

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
1. I actively provoked initial interest at the beginning of lessons.	❑	❑	❑	❑	❑
2. Students' own ideas were the main focus of the lesson.	❑	❑	❑	❑	❑
3. I knew what were students' existing ideas.	❑	❑	❑	❑	❑
4. The activities I used challenged students' existing understandings.	❑	❑	❑	❑	❑
5. Students' responses gave me a good understanding of their mental representations of the main concepts of my lesson.	❑	❑	❑	❑	❑
6. I attempted to integrate students' new understandings with previous understandings.	❑	❑	❑	❑	❑
7. The activities I used were based on students' existing understanding.	❑	❑	❑	❑	❑
8. I encouraged students to express their prior understandings.	❑	❑	❑	❑	❑

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
9. Students took an active role in their own learning.	❑	❑	❑	❑	❑
10. The students used 'hands on' materials.	❑	❑	❑	❑	❑
11. I was able to promptly provide sufficient materials to most students.	❑	❑	❑	❑	❑
12. Students wrote about their understandings.	❑	❑	❑	❑	❑
13. Students drew their understandings.	❑	❑	❑	❑	❑
14. I encouraged students to explore their own ideas.	❑	❑	❑	❑	❑
15. Students investigated their own understandings.	❑	❑	❑	❑	❑
16. Students were given many opportunities to discuss their ideas with others.	❑	❑	❑	❑	❑
17. Students were able to compare their ideas with the teacher or parents or others.	❑	❑	❑	❑	❑

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
18. I encouraged students to talk about the concepts.	❑	❑	❑	❑	❑
19. I encouraged students to talk about what they were doing.	❑	❑	❑	❑	❑
20. Students worked in pairs.	❑	❑	❑	❑	❑
21. Students were given opportunities to work in groups.	❑	❑	❑	❑	❑
22. I provided ample opportunities for individual students to talk about their learning experiences.	❑	❑	❑	❑	❑
23. Students talked more than I did.	❑	❑	❑	❑	❑
24. I encouraged students to express any disagreement with what others were saying.	❑	❑	❑	❑	❑
25. I modelled for students the way I would go about a problem.	❑	❑	❑	❑	❑
26. I modelled key skills for students.	❑	❑	❑	❑	❑

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
27. Students usually checked your work.	❑	❑	❑	❑	❑
28. Students were able to offer suggestions for improvement of your work.	❑	❑	❑	❑	❑
29. I continually provided hints to students until they could perform some tasks on their own.	❑	❑	❑	❑	❑
30. A parent was able to assist individuals to understand new ideas.	❑	❑	❑	❑	❑
31. A more advanced student was able to assist individuals to understand new ideas.	❑	❑	❑	❑	❑
32. I actively facilitated learning with particular individuals.	❑	❑	❑	❑	❑
33. Students were taught concepts which with my assistance, they were able to understand.	❑	❑	❑	❑	❑
34. I was able to promptly provide suggestions or help to most students.	❑	❑	❑	❑	❑
35. I made the learning expectations clear to students.	❑	❑	❑	❑	❑

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
36. I modelled expected standards to students.	❑	❑	❑	❑	❑
37. When students were beginning to understand concepts assistance was gradually withdrawn.	❑	❑	❑	❑	❑
38. I encouraged students to keep a diary or similar, to reflect on their growing understandings.	❑	❑	❑	❑	❑
39. Students were able to compare their thinking with my thinking.	❑	❑	❑	❑	❑
40. Students were able to apply their new understandings to new situations.	❑	❑	❑	❑	❑
41. Students were able to investigate their new understandings through other problems they were given.	❑	❑	❑	❑	❑
42. I encouraged students to integrate ideas across lessons.	❑	❑	❑	❑	❑
43. I gave students many opportunities to apply ideas in different situations.	❑	❑	❑	❑	❑
44. Students had ample opportunity to demonstrate new concepts to the teacher.	❑	❑	❑	❑	❑

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
45. Students were able to see how their ideas had changed.	❑	❑	❑	❑	❑
46. Students developed their own explanations of the concepts covered.	❑	❑	❑	❑	❑
47. Students were encouraged to question their previously held beliefs.	❑	❑	❑	❑	❑
48. I encouraged students to justify their opinions.	❑	❑	❑	❑	❑
49. I assessed how students' own ideas had changed.	❑	❑	❑	❑	❑
50. Students were able to evaluate their own learning.	❑	❑	❑	❑	❑
51. Students worked at many different levels.	❑	❑	❑	❑	❑
52. Students were able to make choices in regard to the activities they chose.	❑	❑	❑	❑	❑
53. Students were able to make choices in regard to the sequence of the activities they chose.	❑	❑	❑	❑	❑

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
54. Ideas I presented were mostly well structured.	❑	❑	❑	❑	❑
55. Ideas I presented were sequenced in increasing levels of difficulty.	❑	❑	❑	❑	❑
56. Students were provided with many alternatives in the lesson to advance their learning.	❑	❑	❑	❑	❑
57. Students helped to design the learning activities.	❑	❑	❑	❑	❑
58. Students helped to manage the learning activities.	❑	❑	❑	❑	❑
59. Most of my lessons followed a pre-determined sequence of instruction.	❑	❑	❑	❑	❑
60. Most of my lessons followed a prescribed set of activities.	❑	❑	❑	❑	❑
61. Students worked on real-world problems.	❑	❑	❑	❑	❑
62. Students carried out their own research.	❑	❑	❑	❑	❑

63. Students often gave their own relevant examples.

strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
❑	❑	❑	❑	❑

64. Students often suggested new activities.

strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
❑	❑	❑	❑	❑

65. Students often suggested their own ways of doing things.

strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
❑	❑	❑	❑	❑

66. Students were encouraged to ask questions.

strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
❑	❑	❑	❑	❑

67. Students often asked me when they didn't understand.

strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
❑	❑	❑	❑	❑

68. Students often asked me why they went wrong if they had problems.

strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
❑	❑	❑	❑	❑

69. Students often asked me if they didn't understand instructions.

strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
❑	❑	❑	❑	❑

70. Students often asked why they were learning particular concepts.

strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
❑	❑	❑	❑	❑

71. Students were able to challenge an answer.

strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
❑	❑	❑	❑	❑

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
72. I encouraged students to tell me when they disagreed with what others were saying.	❑	❑	❑	❑	❑

What do you understand to be the meaning of constructivist learning?

End of survey.

Thank you for your time.

APPENDIX SIX

Survey (V07 piloted by teachers)

Teaching and learning practices in primary classrooms.

Preferred return date: Friday 9th November
Please return this survey to the person indicated on the attached sealable addressed envelope.
School __

The object of the study is to find out more about actual teaching and learning practices in primary classrooms. The research, when complete, will add to our knowledge base of such practices, and will be used to improve the learning and teaching environment, thus benefiting teachers and students.

All results will remain confidential, as no name is required on this sheet no teacher will be identified.

In this survey you are asked to respond to questions similar in a form to this, please tick the correct answer:

Example question:

In Perth, it rains more in winter than in summer

❑	❑	❑	❑	❑
never	occasionally	sometimes	quite often	all the time

This question has been completed.
Most of the questions in this survey use a scale like this one.

The following information will assist, please provide the answers.

The year level that you are currently teaching is: Year _____.

The number of students that you have in your class is: _____ students.

The number of years that you have been teaching is: _____ years.

Your gender is: ❑ F ❑ M

How old are you? _____ years.

I believe that most of the time I teach in constructivist ways: ❑ yes ❑ no

Please turn over

In most of the lessons that I conducted in the last fortnight:

	never	occasionally	sometimes	quite often	all the time
1. I actively provoked initial interest at the beginning of lessons.	❑	❑	❑	❑	❑
2. Students' own ideas were the main focus of the lesson.	❑	❑	❑	❑	❑
3. I knew what students' existing ideas were.	❑	❑	❑	❑	❑
4. The activities I used challenged students' existing understandings.	❑	❑	❑	❑	❑
5. Students' responses gave me a good understanding of their ideas about the main concepts.	❑	❑	❑	❑	❑
6. I attempted to integrate students' new understandings with previous understandings.	❑	❑	❑	❑	❑
7. The activities I used were based on students' existing understanding.	❑	❑	❑	❑	❑
8. I encouraged students to express their prior understandings.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
9. Students took an active role in their own learning.	❑	❑	❑	❑	❑
10. The students used 'hands on' materials.	❑	❑	❑	❑	❑
11. I was able to promptly provide sufficient materials to most students.	❑	❑	❑	❑	❑
12. Students wrote about their understandings.	❑	❑	❑	❑	❑
13. Students drew pictures of their understandings.	❑	❑	❑	❑	❑
14. I encouraged students to explore their own ideas.	❑	❑	❑	❑	❑
15. Students were given many opportunities to discuss their ideas with others.	❑	❑	❑	❑	❑
16. Students were able to compare their ideas with those of the teacher or parents or others.	❑	❑	❑	❑	❑
17. I encouraged students to talk about the concepts.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
18. I encouraged students to talk about what they were doing.	❑	❑	❑	❑	❑
19. Students worked in pairs.	❑	❑	❑	❑	❑
20. Students were given opportunities to work in groups.	❑	❑	❑	❑	❑
21. Students talked more than I did.	❑	❑	❑	❑	❑
22. I encouraged students to express any disagreement with what others were saying.	❑	❑	❑	❑	❑
23. I modelled for students the way I would go about a problem.	❑	❑	❑	❑	❑
24. I modelled key skills for students.	❑	❑	❑	❑	❑
25. Students usually checked my examples.	❑	❑	❑	❑	❑
26. Students were able to offer suggestions for improvement of my explanations.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
27. I continually provided hints to students until they could perform some tasks on their own.	❑	❑	❑	❑	❑
28. A parent was able to assist individuals to understand new ideas.	❑	❑	❑	❑	❑
29. A more advanced student was able to assist individuals to understand new ideas.	❑	❑	❑	❑	❑
30. I actively facilitated learning with particular individuals.	❑	❑	❑	❑	❑
31. Students were taught concepts which with my assistance, they were able to understand.	❑	❑	❑	❑	❑
32. I was able to promptly provide suggestions or help to most students.	❑	❑	❑	❑	❑
33. I made the learning expectations clear to students.	❑	❑	❑	❑	❑
34. I modelled expected standards to students.	❑	❑	❑	❑	❑
35. When students were beginning to understand concepts assistance was gradually withdrawn.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
36. I encouraged students to keep a diary or similar, to reflect on their growing understandings.	❑	❑	❑	❑	❑
37. Students were encouraged to compare my ideas with theirs.	❑	❑	❑	❑	❑
38. Students were able to investigate their new understandings through other problems they were given.	❑	❑	❑	❑	❑
39. I encouraged students to integrate ideas across lessons.	❑	❑	❑	❑	❑
40. I gave students many opportunities to apply ideas in different situations.	❑	❑	❑	❑	❑
41. Students had ample opportunity to demonstrate new concepts to the teacher.	❑	❑	❑	❑	❑
42. Students were able to see how their ideas had changed.	❑	❑	❑	❑	❑
43. Students developed their own explanations of the concepts covered.	❑	❑	❑	❑	❑
44. Students were encouraged to question their previously held beliefs.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
45. I encouraged students to justify their opinions.	❑	❑	❑	❑	❑
46. I assessed how students' own ideas had changed.	❑	❑	❑	❑	❑
47. Students were able to evaluate their own learning.	❑	❑	❑	❑	❑
48. Students worked at many different levels.	❑	❑	❑	❑	❑
49. Students were able to make choices in regard to the activities they did.	❑	❑	❑	❑	❑
50. Students were able to make choices in regard to the sequence of the activities they did.	❑	❑	❑	❑	❑
51. The ideas I presented were mostly well structured.	❑	❑	❑	❑	❑
52. The ideas I presented were sequenced in increasing levels of difficulty.	❑	❑	❑	❑	❑
53. Students were provided with many different strategies in the lesson to advance their learning.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
54. Students helped to design the learning activities.	❑	❑	❑	❑	❑
55. Students helped to manage the learning activities.	❑	❑	❑	❑	❑
56. Most of my lessons followed a pre-determined sequence of instruction.	❑	❑	❑	❑	❑
57. Most of my lessons followed a prescribed set of activities.	❑	❑	❑	❑	❑
58. Students worked on real-world problems.	❑	❑	❑	❑	❑
59. Students carried out their own research.	❑	❑	❑	❑	❑
60. Students often gave their own relevant examples.	❑	❑	❑	❑	❑
61. Students often suggested new activities.	❑	❑	❑	❑	❑
62. Students often suggested their own ways of doing things.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
63. Students were encouraged to ask questions.	❑	❑	❑	❑	❑
64. Students often asked me when they didn't understand.	❑	❑	❑	❑	❑
65. Students often asked me why they went wrong if they had problems.	❑	❑	❑	❑	❑
66. Students often asked me if they didn't understand instructions.	❑	❑	❑	❑	❑
67. Students often asked why they were learning particular concepts.	❑	❑	❑	❑	❑
68. Students were able to challenge an answer.	❑	❑	❑	❑	❑
69. I encouraged students to tell me when they disagreed with what others were saying.	❑	❑	❑	❑	❑

A. Can you write for me what you understand to be the meaning of constructivist learning?

B. Are there any other comments that you would like to make?

In addition, could you please answer:

C. Approximately how much time did this survey take to complete? _____ minutes.

D. Were the instructions for this survey clear enough? ❑ yes ❑ no
If not which and why (feel free to write underneath the actual instruction).

E. Were there any questions in which you felt the wording or the meaning was unclear? ❑ yes ❑ no
If so which ones? (feel free to write underneath the actual question).

F. What do you think are the questions that are most relevant to your classroom teaching situation?

End of survey.

Thank you for your time.

APPENDIX SEVEN

Survey (V08 Final survey)

Teaching and learning practices in primary classrooms.

Preferred return date:
Please return this survey to the person indicated on the attached sealable addressed envelope.
School __

The object of the study is to find out more about actual teaching and learning practices in primary classrooms. The research, when complete, will add to our knowledge base of such practices, and will be used to improve the learning and teaching environment, thus benefiting teachers and students.

All results will remain confidential, as no name is required on this sheet no teacher will be identified.

In this survey you are asked to respond to questions similar in a form to this, please tick the correct answer:

Example question:

In Perth, it rains more in winter than in summer

❑	❑	❑	❑	❑
never	occasionally	sometimes	quite often	all the time

This question has been completed.
Most of the questions in this survey use a scale like this one.

The following information will assist, please provide the answers.

The year level that you are currently teaching is: Year _____.

The number of students that you have in your class is: _____ students.

The number of years that you have been teaching is: _____ years.

Your gender is: ❑ F ❑ M

How old are you? _____ years.

I believe that most of the time I teach in constructivist ways: ❑ yes ❑ no

Please turn over

In most of the lessons that I conducted in the last fortnight:

	never	occasionally	sometimes	quite often	all the time
1. I actively provoked initial interest at the beginning of lessons.	❑	❑	❑	❑	❑
2. Students' own ideas were the main focus of the lesson.	❑	❑	❑	❑	❑
3. I knew what students' existing ideas were.	❑	❑	❑	❑	❑
4. The activities I used challenged students' existing understandings.	❑	❑	❑	❑	❑
5. Students' responses gave me a good understanding of their ideas about the main concepts.	❑	❑	❑	❑	❑
6. I attempted to integrate students' new understandings with previous understandings.	❑	❑	❑	❑	❑
7. The activities I used were based on students' existing understanding.	❑	❑	❑	❑	❑
8. I encouraged students to express their prior understandings.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
9. Students took an active role in their own learning.	❑	❑	❑	❑	❑
10. The students used 'hands on' materials.	❑	❑	❑	❑	❑
11. I was able to promptly provide sufficient materials to most students.	❑	❑	❑	❑	❑
12. Students wrote about their understandings.	❑	❑	❑	❑	❑
13. Students drew pictures of their understandings.	❑	❑	❑	❑	❑
14. I encouraged students to explore their own ideas.	❑	❑	❑	❑	❑
15. Students were given many opportunities to discuss their ideas with others.	❑	❑	❑	❑	❑
16. Students were able to compare their ideas with those of the teacher or parents or others.	❑	❑	❑	❑	❑
17. I encouraged students to talk about the concepts.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
18. I encouraged students to talk about what they were doing.	❑	❑	❑	❑	❑
19. Students were given opportunities to work in groups.	❑	❑	❑	❑	❑
20. Students talked more than I did.	❑	❑	❑	❑	❑
21. I encouraged students to express any disagreement with what others were saying.	❑	❑	❑	❑	❑
22. I modelled for students the way I would go about a problem.	❑	❑	❑	❑	❑
23. I modelled key skills for students.	❑	❑	❑	❑	❑
24. Students usually checked my examples.	❑	❑	❑	❑	❑
25. Students were able to offer suggestions for improvement of my explanations.	❑	❑	❑	❑	❑
26. I continually provided hints to students until they could perform some tasks on their own.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
27. A parent was able to assist individuals to understand new ideas.	❑	❑	❑	❑	❑
28. A more advanced student was able to assist individuals to understand new ideas.	❑	❑	❑	❑	❑
29. I actively facilitated learning with particular individuals.	❑	❑	❑	❑	❑
30. Students were taught concepts which with my assistance, they were able to understand.	❑	❑	❑	❑	❑
31. I was able to promptly provide suggestions or help to most students.	❑	❑	❑	❑	❑
32. I made the learning expectations clear to students.	❑	❑	❑	❑	❑
33. I modelled expected standards to students.	❑	❑	❑	❑	❑
34. When students were beginning to understand concepts assistance was gradually withdrawn.	❑	❑	❑	❑	❑
35. I encouraged students to keep a diary or similar, to reflect on their growing understandings.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
36. Students were encouraged to compare my ideas with theirs.	❑	❑	❑	❑	❑
37. Students were able to investigate their new understandings through other problems they were given.	❑	❑	❑	❑	❑
38. I encouraged students to integrate ideas across lessons.	❑	❑	❑	❑	❑
39. I gave students many opportunities to apply ideas in different situations.	❑	❑	❑	❑	❑
40. Students had ample opportunity to demonstrate new concepts to the teacher.	❑	❑	❑	❑	❑
41. Students were able to see how their ideas had changed.	❑	❑	❑	❑	❑
42. Students developed their own explanations of the concepts covered.	❑	❑	❑	❑	❑
43. Students were encouraged to question their previously held beliefs.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
44. I encouraged students to justify their opinions.	❑	❑	❑	❑	❑
45. I assessed how students' own ideas had changed.	❑	❑	❑	❑	❑
46. Students were able to evaluate their own learning.	❑	❑	❑	❑	❑
47. Students worked at many different levels.	❑	❑	❑	❑	❑
48. Students were able to make choices in regard to the activities they did.	❑	❑	❑	❑	❑
49. Students were able to make choices in regard to the sequence of the activities they did.	❑	❑	❑	❑	❑
50. The ideas I presented were mostly well structured.	❑	❑	❑	❑	❑
51. The ideas I presented were sequenced in increasing levels of difficulty.	❑	❑	❑	❑	❑
52. Students were provided with many different strategies in the lesson to advance their learning.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
53. Students helped to design the learning activities.	❑	❑	❑	❑	❑
54. Students helped to manage the learning activities.	❑	❑	❑	❑	❑
55. Most of my lessons followed a pre-determined sequence of instruction.	❑	❑	❑	❑	❑
56. Most of my lessons followed a prescribed set of activities.	❑	❑	❑	❑	❑
57. Students worked on real-world problems.	❑	❑	❑	❑	❑
58. Students carried out their own research.	❑	❑	❑	❑	❑
59. Students often gave their own relevant examples.	❑	❑	❑	❑	❑
60. Students often suggested new activities.	❑	❑	❑	❑	❑
61. Students often suggested their own ways of doing things.	❑	❑	❑	❑	❑

	never	occasionally	sometimes	quite often	all the time
62. Students were encouraged to ask questions.	❑	❑	❑	❑	❑
63. Students often asked me when they didn't understand.	❑	❑	❑	❑	❑
64. Students often asked me why they went wrong if they had problems.	❑	❑	❑	❑	❑
65. Students often asked me if they didn't understand instructions.	❑	❑	❑	❑	❑
66. Students often asked why they were learning particular concepts.	❑	❑	❑	❑	❑
67. Students were able to challenge an answer.	❑	❑	❑	❑	❑
68. I encouraged students to tell me when they disagreed with what others were saying.	❑	❑	❑	❑	❑

Can you write for me what you understand to be the meaning of constructivist learning?

Are there any other comments that you would like to make?

End of survey.

Thank you for your time.

APPENDIX EIGHT

Raw Data

CASE NO	SCHOOL	YEAR	STUDENTS	YRS TCHN	GENDER	AGE	CONSTR	Q1
1.00	A	2.00	27.00	25.00	1.00	54.00	1.00	4.00
2.00	A	2.50	28.00	26.00	1.00	52.00	-	4.00
3.00	A	4.00	28.00	12.00	1.00	42.00	1.00	4.00
4.00	A	5.50	26.00	16.00	1.00	41.00	1.00	4.00
5.00	A	6.00	28.00	25.00	1.00	58.00	1.00	4.00
6.00	A	8.00	29.00	25.00	1.00	45.00	1.00	4.00
7.00	A	5.00	28.00	15.00	1.00	35.00	-	4.00
8.00	B	8.00	25.00	10.00	1.00	46.00	1.00	4.00
9.00	B	8.00	25.00	25.00	1.00	58.00	1.00	4.00
10.00	B	2.00	24.00	7.00	1.00	34.00	1.00	5.00
11.00	B	3.00	26.00	20.00	1.00	-	-	4.00
12.00	C	.50	27.00	5.00	1.00	25.00	1.00	5.00
13.00	C	3.00	28.00	8.00	1.00	33.00	1.00	4.00
14.00	C	4.00	34.00	25.00	1.00	-	-	4.00
15.00	C	5.00	29.00	21.00	1.00	47.00	1.00	5.00
16.00	C	5.00	29.00	7.00	1.00	29.00	-	4.00
17.00	C	6.50	31.00	11.00	1.00	34.00	1.00	5.00
18.00	C	6.50	31.00	14.00	1.00	35.00	1.00	4.00
19.00	C	7.00	32.00	3.00	1.00	29.00	1.00	4.00
20.00	D	4.50	31.00	4.00	1.00	23.00	1.00	4.00
21.00	D	3.00	29.00	3.00	1.00	22.00	1.00	5.00
22.00	D	2.00	25.00	3.00	1.00	20.00	1.00	3.00
23.00	D	8.00	28.00	17.00	1.00	44.00	1.00	4.00
24.00	E	8.00	30.00	24.00	2.00	47.00	1.00	4.00
25.00	E	4.00	33.00	32.00	2.00	53.00	1.00	5.00
26.00	E	6.00	33.00	19.00	1.00	41.00	1.00	4.00
27.00	E	7.00	34.00	20.00	1.00	52.00	1.00	5.00
28.00	F	1.00	27.00	9.00	1.00	31.00	1.00	4.00
29.00	F	1.50	26.00	6.00	1.00	42.00	1.00	4.00
30.00	F	6.50	31.00	5.00	1.00	29.00	-	4.00
31.00	G	2.50	29.00	27.00	1.00	48.00	1.00	4.00
32.00	G	3.00	27.00	10.00	1.00	42.00	1.00	4.00
33.00	G	3.50	27.00	10.00	1.00	32.00	1.00	5.00
34.00	G	5.50	25.00	17.00	1.00	46.00	1.00	4.00
35.00	H	2.00	22.00	10.00	1.00	31.00	1.00	3.00
36.00	H	2.00	23.00	10.00	1.00	34.00	1.00	4.00

table continues

CASE NO	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
1.00	3.00	4.00	4.00	5.00	4.00	3.00	4.00	4.00	4.00	5.00	4.00	3.00
2.00	4.00	3.00	3.00	3.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00	3.00
3.00	3.00	2.00	4.00	4.00	3.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00
4.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	4.00	3.00	4.00	3.00	3.00
5.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	2.00	3.00	5.00
6.00	4.00	3.00	4.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	3.00
7.00	3.00	3.00	4.00	4.00	5.00	3.00	4.00	4.00	3.00	5.00	4.00	2.00
8.00	4.00	2.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00
9.00	3.00	5.00	4.00	4.00	4.00	5.00	4.00	4.00	5.00	5.00	2.00	2.00
10.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.00	4.00
11.00	3.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	3.00	3.00
12.00	3.00	3.00	5.00	4.00	5.00	4.00	4.00	4.00	5.00	4.00	4.00	5.00
13.00	3.00	4.00	5.00	5.00	5.00	5.00	4.00	4.00	3.00	4.00	3.00	3.00
14.00	4.00	4.00	5.00	5.00	5.00	5.00	4.00	5.00	4.00	3.00	4.00	4.00
15.00	4.00	3.00	4.00	4.00	3.00	3.00	3.00	4.00	4.00	4.00	3.00	3.00
16.00	3.00	3.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	5.00	3.00	3.00
17.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	3.00	3.00	3.00
18.00	3.00	4.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00	3.00	4.00	4.00
19.00	3.00	3.00	4.00	4.00	5.00	5.00	5.00	4.00	3.00	2.00	2.00	2.00
20.00	3.00	3.00	4.00	5.00	5.00	5.00	5.00	4.00	4.00	5.00	4.00	3.00
21.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	3.00	3.00
22.00	2.00	3.00	4.00	4.00	5.00	5.00	4.00	3.00	4.00	4.00	2.00	2.00
23.00	3.00	2.00	4.00	4.00	4.00	4.00	4.00	2.00	2.00	4.00	4.00	4.00
24.00	2.00	5.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00	2.00
25.00	4.00	4.00	4.00	4.00	5.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00
26.00	3.00	4.00	4.00	5.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	3.00
27.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00
28.00	2.00	2.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00
29.00	3.00	4.00	2.00	4.00	3.00	3.00	4.00	4.00	4.00	3.00	3.00	4.00
30.00	4.00	3.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00
31.00	2.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	2.00	1.00
32.00	3.00	3.00	4.00	5.00	4.00	4.00	3.00	4.00	4.00	5.00	3.00	3.00
33.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
34.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	3.00	5.00	4.00	3.00
35.00	3.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	3.00	4.00	3.00	3.00
36.00	2.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	2.00	2.00

table continues

CASE_NO	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25
1.00	4.00	4.00	3.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	4.00	3.00
2.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00
3.00	5.00	2.00	3.00	4.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00
4.00	3.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00	2.00
5.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
6.00	3.00	5.00	4.00	4.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	4.00
7.00	3.00	4.00	3.00	4.00	2.00	4.00	3.00	4.00	3.00	4.00	4.00	4.00
8.00	4.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
9.00	4.00	4.00	2.00	4.00	5.00	5.00	5.00	4.00	5.00	4.00	5.00	5.00
10.00	4.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	4.00
11.00	3.00	4.00	3.00	4.00	4.00	3.00	3.00	4.00	2.00	3.00	3.00	3.00
12.00	4.00	4.00	4.00	5.00	5.00	4.00	5.00	5.00	4.00	5.00	4.00	4.00
13.00	3.00	4.00	3.00	4.00	3.00	3.00	3.00	4.00	2.00	3.00	4.00	2.00
14.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	5.00	3.00	4.00	4.00	4.00
15.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	5.00	4.00	3.00	3.00	3.00
16.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	4.00	3.00	4.00	4.00
17.00	4.00	5.00	3.00	5.00	5.00	4.00	4.00	3.00	3.00	4.00	5.00	3.00
18.00	4.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00
19.00	3.00	3.00	2.00	4.00	3.00	4.00	4.00	2.00	3.00	4.00	5.00	4.00
20.00	4.00	4.00	3.00	5.00	5.00	5.00	5.00	5.00	3.00	4.00	4.00	5.00
21.00	4.00	2.00	2.00	3.00	2.00	4.00	4.00	2.00	3.00	4.00	4.00	2.00
22.00	2.00	3.00	3.00	2.00	2.00	4.00	4.00	3.00	3.00	4.00	4.00	1.00
23.00	4.00	4.00	4.00	4.00	2.00	2.00	2.00	2.00	4.00	4.00	4.00	4.00
24.00	3.00	5.00	3.00	5.00	4.00	4.00	4.00	4.00	1.00	4.00	5.00	4.00
25.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00
26.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00
27.00	4.00	4.00	3.00	5.00	5.00	3.00	4.00	4.00	5.00	4.00	4.00	5.00
28.00	3.00	3.00	3.00	4.00	4.00	3.00	4.00	4.00	3.00	3.00	4.00	3.00
29.00	4.00	4.00	2.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	4.00	2.00
30.00	4.00	5.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
31.00	3.00	4.00	3.00	3.00	2.00	4.00	4.00	4.00	4.00	5.00	5.00	2.00
32.00	4.00	5.00	4.00	4.00	3.00	5.00	5.00	4.00	4.00	3.00	4.00	3.00
33.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	4.00	4.00	3.00
34.00	4.00	3.00	3.00	4.00	4.00	3.00	3.00	3.00	4.00	4.00	4.00	3.00
35.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	2.00	4.00	2.00
36.00	3.00	4.00	4.00	4.00	5.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00

table continues

CASE_NO	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37
1.00	3.00	4.00	2.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	2.00	4.00
2.00	2.00	3.00	2.00	3.00	3.00	4.00	4.00	5.00	4.00	4.00	2.00	3.00
3.00	3.00	5.00	3.00	4.00	3.00	4.00	3.00	5.00	5.00	4.00	3.00	3.00
4.00	2.00	4.00	2.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00
5.00	4.00	3.00	3.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	1.00	3.00
6.00	5.00	5.00	1.00	4.00	5.00	5.00	5.00	5.00	4.00	5.00	4.00	4.00
7.00	4.00	3.00	2.00	4.00	3.00	4.00	3.00	4.00	4.00	4.00	1.00	2.00
8.00	2.00	5.00	3.00	4.00	4.00	4.00	4.00	5.00	1.00	4.00	4.00	1.00
9.00	5.00	4.00	2.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	1.00	4.00
10.00	5.00	5.00	3.00	4.00	4.00	5.00	4.00	5.00	4.00	5.00	3.00	4.00
11.00	3.00	3.00	2.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	1.00	2.00
12.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	3.00	3.00
13.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00
14.00	4.00	4.00	1.00	4.00	3.00	4.00	4.00	5.00	4.00	5.00	3.00	4.00
15.00	3.00	3.00	3.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	2.00	3.00
16.00	4.00	5.00	2.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00
17.00	4.00	3.00	5.00	5.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	3.00
18.00	2.00	4.00	2.00	4.00	4.00	4.00	4.00	5.00	5.00	3.00	2.00	3.00
19.00	4.00	4.00	3.00	4.00	4.00	3.00	3.00	5.00	5.00	3.00	2.00	4.00
20.00	2.00	5.00	1.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	1.00	3.00
21.00	1.00	4.00	3.00	2.00	3.00	3.00	4.00	3.00	5.00	4.00	1.00	3.00
22.00	2.00	4.00	1.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	1.00	3.00
23.00	2.00	2.00	2.00	2.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00
24.00	3.00	5.00	1.00	4.00	4.00	5.00	4.00	5.00	5.00	3.00	1.00	3.00
25.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	5.00	4.00	4.00	3.00	4.00
26.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	3.00	3.00
27.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	4.00
28.00	3.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	2.00	3.00
29.00	4.00	3.00	3.00	4.00	3.00	2.00	3.00	4.00	3.00	5.00	2.00	2.00
30.00	4.00	3.00	2.00	4.00	4.00	4.00	5.00	5.00	4.00	3.00	2.00	2.00
31.00	5.00	3.00	3.00	5.00	4.00	4.00	4.00	4.00	5.00	5.00	1.00	3.00
32.00	2.00	4.00	3.00	4.00	3.00	4.00	4.00	3.00	3.00	4.00	1.00	3.00
33.00	2.00	4.00	3.00	4.00	5.00	4.00	4.00	5.00	4.00	5.00	2.00	2.00
34.00	4.00	4.00	1.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00	2.00	3.00
35.00	1.00	3.00	3.00	3.00	4.00	4.00	3.00	4.00	5.00	4.00	2.00	2.00
36.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	3.00	4.00

table continues

CASE NO	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49
1.00	3.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	2.00	3.00	3.00	2.00
2.00	3.00	3.00	3.00	4.00	3.00	3.00	2.00	3.00	3.00	3.00	4.00	4.00
3.00	3.00	5.00	3.00	3.00	3.00	3.00	4.00	5.00	2.00	4.00	5.00	3.00
4.00	3.00	4.00	3.00	3.00	3.00	4.00	3.00	4.00	3.00	5.00	4.00	4.00
5.00	3.00	4.00	4.00	2.00	3.00	4.00	4.00	4.00	1.00	4.00	4.00	2.00
6.00	4.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	5.00	4.00	4.00	4.00
7.00	2.00	3.00	2.00	3.00	2.00	3.00	3.00	4.00	3.00	3.00	4.00	2.00
8.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	5.00	4.00
9.00	4.00	4.00	3.00	5.00	3.00	5.00	3.00	5.00	3.00	5.00	5.00	4.00
10.00	5.00	4.00	4.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00	5.00	4.00
11.00	4.00	3.00	3.00	4.00	2.00	4.00	2.00	4.00	3.00	3.00	5.00	3.00
12.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00
13.00	4.00	3.00	3.00	3.00	2.00	2.00	3.00	4.00	3.00	4.00	5.00	4.00
14.00	4.00	3.00	3.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00
15.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	3.00
16.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	5.00	4.00
17.00	3.00	4.00	3.00	3.00	4.00	3.00	3.00	4.00	3.00	4.00	5.00	5.00
18.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	3.00	4.00	4.00
19.00	3.00	3.00	3.00	4.00	4.00	3.00	4.00	2.00	3.00	4.00	4.00	2.00
20.00	4.00	5.00	5.00	3.00	3.00	4.00	1.00	5.00	3.00	5.00	5.00	4.00
21.00	2.00	4.00	4.00	3.00	2.00	2.00	3.00	4.00	4.00	3.00	4.00	3.00
22.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00	3.00	4.00	4.00	2.00
23.00	3.00	4.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	2.00	2.00	4.00
24.00	4.00	4.00	3.00	5.00	3.00	3.00	2.00	3.00	2.00	3.00	5.00	2.00
25.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	5.00	4.00
26.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	5.00	3.00
27.00	4.00	4.00	3.00	4.00	3.00	4.00	4.00	5.00	4.00	5.00	5.00	4.00
28.00	3.00	5.00	3.00	4.00	4.00	3.00	3.00	4.00	2.00	4.00	5.00	3.00
29.00	1.00	4.00	3.00	2.00	3.00	4.00	3.00	4.00	1.00	3.00	4.00	4.00
30.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00
31.00	3.00	5.00	4.00	2.00	2.00	2.00	5.00	5.00	4.00	3.00	4.00	3.00
32.00	4.00	5.00	5.00	3.00	3.00	4.00	5.00	5.00	4.00	3.00	4.00	4.00
33.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	5.00	5.00	3.00	5.00	3.00
34.00	4.00	3.00	3.00	3.00	4.00	3.00	3.00	4.00	3.00	3.00	4.00	3.00
35.00	3.00	3.00	3.00	4.00	2.00	3.00	2.00	2.00	3.00	3.00	5.00	4.00
36.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	3.00

table continues

CASE_NO	Q50	Q51	Q52	Q53	Q54	Q55	Q56	Q57	Q58	Q59	Q60	Q61
1.00	2.00	4.00	3.00	3.00	2.00	2.00	4.00	3.00	3.00	2.00	4.00	3.00
2.00	4.00	4.00	3.00	3.00	2.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00
3.00	3.00	5.00	5.00	4.00	3.00	4.00	3.00	3.00	3.00	3.00	4.00	3.00
4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	3.00	3.00
5.00	4.00	4.00	1.00	2.00	2.00	4.00	3.00	3.00	3.00	2.00	4.00	3.00
6.00	4.00	5.00	5.00	4.00	1.00	2.00	3.00	5.00	4.00	4.00	4.00	2.00
7.00	1.00	4.00	5.00	3.00	1.00	2.00	3.00	4.00	3.00	2.00	2.00	2.00
8.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
9.00	3.00	5.00	5.00	5.00	3.00	4.00	5.00	5.00	4.00	4.00	3.00	5.00
10.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00	4.00	3.00
11.00	3.00	4.00	3.00	4.00	3.00	4.00	2.00	3.00	3.00	4.00	3.00	3.00
12.00	4.00	5.00	5.00	4.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.00
13.00	4.00	3.00	4.00	4.00	2.00	2.00	2.00	2.00	4.00	4.00	4.00	4.00
14.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00
15.00	2.00	4.00	2.00	3.00	3.00	3.00	2.00	4.00	4.00	3.00	2.00	2.00
16.00	2.00	3.00	4.00	4.00	2.00	4.00	4.00	2.00	4.00	4.00	4.00	3.00
17.00	5.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	4.00	5.00	4.00	4.00
18.00	4.00	5.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	3.00	3.00	3.00
19.00	4.00	4.00	4.00	4.00	3.00	3.00	2.00	4.00	4.00	3.00	4.00	4.00
20.00	2.00	4.00	4.00	5.00	2.00	4.00	5.00	5.00	2.00	3.00	5.00	2.00
21.00	2.00	4.00	4.00	3.00	2.00	2.00	4.00	4.00	4.00	3.00	3.00	1.00
22.00	3.00	4.00	4.00	4.00	2.00	3.00	3.00	3.00	3.00	2.00	4.00	2.00
23.00	4.00	4.00	2.00	2.00	2.00	2.00	4.00	4.00	4.00	2.00	4.00	2.00
24.00	2.00	5.00	5.00	4.00	1.00	3.00	5.00	3.00	4.00	3.00	3.00	4.00
25.00	3.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	3.00	4.00	4.00
26.00	3.00	5.00	4.00	4.00	4.00	4.00	5.00	4.00	3.00	4.00	4.00	3.00
27.00	4.00	4.00	5.00	5.00	3.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00
28.00	3.00	2.00	3.00	2.00	2.00	3.00	2.00	2.00	3.00	2.00	4.00	3.00
29.00	5.00	3.00	3.00	3.00	2.00	4.00	3.00	3.00	5.00	4.00	3.00	3.00
30.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	3.00	3.00	5.00	4.00	4.00
31.00	2.00	4.00	4.00	3.00	1.00	3.00	4.00	4.00	3.00	5.00	4.00	3.00
32.00	2.00	4.00	4.00	5.00	2.00	4.00	4.00	4.00	4.00	1.00	3.00	3.00
33.00	3.00	5.00	4.00	4.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00
34.00	3.00	4.00	4.00	3.00	2.00	2.00	4.00	3.00	4.00	4.00	4.00	3.00
35.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00	2.00	2.00	3.00
36.00	3.00	4.00	5.00	5.00	4.00	4.00	5.00	5.00	4.00	3.00	4.00	3.00

table continues

CASE_NO	Q62	Q63	Q64	Q65	Q66	Q67	Q68	Q69	Q70	Q71	Q72
1.00	3.00	5.00	3.00	2.00	4.00	2.00	3.00	4.00	30.00	1.00	1.00
2.00	3.00	4.00	4.00	2.00	3.00	2.00	3.00	4.00	30.00	1.00	2.00
3.00	4.00	5.00	4.00	3.00	4.00	1.00	3.00	3.00	40.00	1.00	2.00
4.00	4.00	5.00	5.00	4.00	5.00	3.00	3.00	4.00	20.00	1.00	2.00
5.00	3.00	5.00	5.00	2.00	4.00	2.00	5.00	4.00	20.00	1.00	1.00
6.00	2.00	5.00	4.00	3.00	4.00	2.00	5.00	3.00	15.00	1.00	1.00
7.00	3.00	4.00	3.00	3.00	4.00	2.00	2.00	3.00	12.00	-	2.00
8.00	4.00	5.00	5.00	5.00	5.00	2.00	4.00	4.00	15.00	1.00	1.00
9.00	5.00	5.00	5.00	3.00	5.00	4.00	5.00	4.00	15.00	1.00	2.00
10.00	3.00	5.00	4.00	3.00	4.00	4.00	4.00	5.00	40.00	1.00	1.00
11.00	4.00	3.00	4.00	3.00	3.00	2.00	3.00	4.00	15.00	1.00	2.00
12.00	4.00	5.00	5.00	5.00	5.00	3.00	4.00	4.00	5.00	1.00	2.00
13.00	4.00	4.00	5.00	2.00	4.00	4.00	3.00	4.00	20.00	1.00	2.00
14.00	3.00	4.00	4.00	3.00	4.00	2.00	4.00	5.00	8.00	1.00	2.00
15.00	2.00	4.00	3.00	2.00	2.00	1.00	2.00	4.00	15.00	1.00	-
16.00	4.00	5.00	2.00	3.00	3.00	3.00	4.00	5.00	30.00	1.00	2.00
17.00	4.00	5.00	5.00	2.00	4.00	5.00	3.00	4.00	20.00	1.00	2.00
18.00	3.00	5.00	5.00	5.00	5.00	3.00	4.00	4.00	-	1.00	2.00
19.00	4.00	5.00	4.00	4.00	4.00	3.00	3.00	3.00	10.00	1.00	2.00
20.00	4.00	5.00	5.00	5.00	5.00	3.00	5.00	5.00	15.00	1.00	2.00
21.00	2.00	4.00	4.00	3.00	4.00	3.00	4.00	4.00	15.00	1.00	2.00
22.00	3.00	5.00	3.00	3.00	4.00	1.00	2.00	3.00	15.00	1.00	2.00
23.00	2.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00	15.00	-	-
24.00	4.00	5.00	5.00	3.00	5.00	3.00	4.00	4.00	10.00	1.00	-
25.00	4.00	4.00	4.00	3.00	4.00	3.00	4.00	4.00	30.00	1.00	2.00
26.00	3.00	5.00	5.00	5.00	5.00	3.00	3.00	5.00	20.00	1.00	2.00
27.00	4.00	5.00	4.00	5.00	5.00	3.00	4.00	5.00	30.00	1.00	2.00
28.00	4.00	5.00	5.00	3.00	4.00	3.00	2.00	2.00	10.00	1.00	2.00
29.00	3.00	5.00	5.00	3.00	5.00	3.00	2.00	4.00	10.00	1.00	2.00
30.00	4.00	5.00	3.00	3.00	4.00	2.00	4.00	4.00	5.00	1.00	2.00
31.00	4.00	5.00	5.00	1.00	4.00	1.00	5.00	5.00	20.00	1.00	-
32.00	4.00	4.00	4.00	3.00	4.00	2.00	3.00	5.00	15.00	1.00	2.00
33.00	4.00	5.00	5.00	4.00	5.00	3.00	4.00	3.00	10.00	1.00	-
34.00	4.00	5.00	5.00	5.00	5.00	3.00	4.00	4.00	20.00	1.00	2.00
35.00	4.00	5.00	5.00	4.00	4.00	2.00	3.00	3.00	10.00	1.00	2.00
36.00	4.00	4.00	5.00	3.00	3.00	2.00	3.00	4.00	15.00	1.00	2.00

Note. Vertical lines have been used for clarity, although they are rarely used in APA documents.

Legend:

1 = never; 2 = occasionally; 3 = sometimes; 4 = quite often; 5 = all the time.

Dash in cell = no answer provided.

Composite year level teachers are indicated with a 0.5 decimal. For example, 2.5 represents Year 2/3.

8 = specialist teacher.

Gender: 1 = female, 2 = male.

Constructivist: 1 = yes, 2 = no.