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Chapter

Connecting Pedagogical Interactions in the Twenty-First Century Classrooms: The Role of the Learners' Perspective in Knowledge Production in the Curriculum Transformation in South Africa

Mamsi Ethel Khuzwayo and Kwanele Booi

"Education is what survives when what has been learnt has been forgotten"

Abstract

This chapter presents the analysis of the interactions in the context of knowledge acquisition and learning. Despite the different contesting approaches to knowledge acquisition, this chapter unveils the confusion prevailing in classrooms concerning the gaps and questions arising from knowledge that is asserted to be empirically verified. The observation sheets and notes were the primary sources of data gathered from the evaluation of lesson presentations conducted in classrooms, with the focus being on teacher-learner-interaction. Learners' reflections, questions, comments as well as feedback from teachers were analysed through qualitative procedures. The results and the findings highlighted that the preparation of the lessons by the teachers have unforeseen gaps, blind spots, and undesired learning outcomes. This work concluded that teachers are experiencing challenges and difficulties in addressing the cognitive and intellectual needs of the twenty-first generation learners in classrooms. This study recommends the review of factual knowledge by school subject curriculum experts, and teacher educators in the faculties.

Keywords: pedagogical, interactions, knowledge, productions, perspectives

1. Introduction

The changes and advancement in the socio-economic and cultural systems globally, indicate the need for rethinking knowledge construction in schools as well as teacher education and training. The transformation of the mindset of knowledge recipients to knowledge constructors in teachers should be the main focus in the teachers' education and training. This work contests the view of the

perennial and essential philosophy to reproduce knowledge of discoveries, inventions and construction which does not inspire and challenge those who receive it. The assertion of [1] about education raises questions about education as a concept and the phenomenon thereof. If education was indeed about knowledge creation and not reproduction of knowledge, what has been learnt could not been forgotten. The Phenomenologist Psychologist describes learning as the process of creating lived experiences, from the environment and one's surroundings. The knowledge therefore becomes part and parcel of one's being, and the lived experiences are the basis for any further knowledge creation. If learning is about mental, emotional, and physical development, firstly, the person acquiring knowledge will have the understanding of; what knowledge, why knowledge and how knowledge? The explorations, inquiry and search for suitable and relevant information is driven by the inquest to solve problems experienced from the real-life environment, not about idealised situations. It is this sense that this work conceptualises B.F Skinner's assertion about education. The other issue that is linked to Skinner's assertion about education is viewed in this work to be the compartmentalised knowledge into the abstract realities, which are delinked from the real-life experience. According to [2], knowledge that is brought into the classroom as reported reality, is more relative than the actual lived experience, which is authentic practical experience and the reality of the process and results of problem solving, exploration and inquiry. The post-school education and training cannot be the continuation of the approach to knowledge acquisition at a school level. Research has highlighted that the conformist approaches to knowledge acquisition in South Africa and globally had deprived teachers the opportunity for lifelong learning, reflective thinking, and subsequently teachers have become technicians [3–5]. This work supports the trajectory of scholarship, which promotes the descriptions of educational practices as a process of engagement with the reality and surrounding environment for the purpose of creating knowledge and developing essential cognitive, affective, and psychomotor skills. According to the educational psychology, the mental growth and development is the results of the process of becoming, meaning that adaptation in the environment demands problem solving, exploration and inquiry. These are therefore cognitive skills, or the functions performed by the mind for the purpose of enabling the individuals to master the demands and challenges posed by the environment. The mind alone cannot complete the function of adaptation and mastery of the environment and surroundings, but the affective skills also play a role, for example, the decision-making processes are based on; a willingness to participate, the choice to respond or to receive, and interest. The aspect of psychomotor skills is the physical actions or movement driven by the affective and cognitive abilities to address the desire to adapt to the environment and to master the realities in the surroundings.

The argument on the necessity and importance of the learners' perspective in knowledge construction in teacher education and training is informed by the data collected from lesson observations. The desire that manifested from teacher-learners' interaction regarding factual knowledge, confirmed the ideas advocated by constructivist, humanist, cognitive and phenomenologist approaches, which identify the nature of the learners to rely on their interest, familiarity with context and experiences to conceptualise knowledge [6]. The findings presented in this work are the extension of this narrative, that promotes the contestations and debates in the classroom to allow learners to express their opinions, interests and experiences of what is presented to them. In addition, the findings from the data influenced this work to firstly assert that factual knowledge presented to learners in the field of Natural Science and Social Science in grade nine is irrelevant to the learners' interests, familiar contexts and real-life experiences. Secondly, learners have no confidence in the textbook knowledge and in the teachers' abilities to transverse knowledge and

general outlooks to real-life world experiences, to assist learners to develop an in-depth understanding of scientific phenomena. The lack of opportunities for debates and reflective argumentation in Natural Science and Social Science classrooms, is perceived in this work to be incongruent with the assertion that "education is what survives when what has been learnt has been forgotten" [1]. The assimilation of raw facts deprives learners in the Natural Science and Social Sciences classes the opportunities to explore, discover, and investigate facts through deductive reasoning and logical thinking, hence learners were not complaisant with the explanations from the teachers and the textbooks in the observed lessons for this chapter.

2. Background

The educational and curriculum transformation in South Africa reflects ideas and perceptions that had been advocated by international research. With regards to knowledge production, the Department of Education established the National Qualification Framework, to articulate phases in the educational system, and curriculum design and organisation. The restructuring of knowledge in the national school curriculum encapsulated ideas of the so-called mode two knowledge; the clustering of compartmentalised knowledge in a broader field of study [7, 8]. The first curriculum introduced by the new education ministry for the democratic South Africa was called, Curriculum for the 21st century, and this curriculum introduced a concept of 'Learning Areas', to replace subjects in the national curriculum for schools, for example, Life Sciences in a school curriculum encapsulated knowledge regarding aspects of life and sciences and it was for this reason that it changed from being a subject to being called a 'Learning Area'.

The curriculum transformation in South Africa from 1997 to 2010 has been criticised in the works of academics and researchers [9, 10] for being vague and too broad, in the sense that the adopted design for Curriculum 2005 or Curriculum for the 21st century did not take the capacity of the current cohort of teacher into account. The criticisms were justified by the revelations and findings in the report of the ministerial task team appointed by the Department of Education to investigate the challenges and difficulties which findings are highlighted in the works of [11, 12]. According to [13] the main focus of the investigation covered; the field testing, teacher orientation and follow up training, professional support services provided within provincial systems, classroom practices, the quality, quantity, use of learning support materials in support of the Curriculum for 21st century, and the level of understanding of outcomes- based education. The findings highlighted by the task team from its review provided this work with the understanding of the background and the process that resulted in the current educational and pedagogical practices of teachers in schools. This background provides a clue about the views and the purpose of the designers of the curriculum for the 21st century concerning the transformation of a paradigm of knowledge production and pedagogy suitable for equipping citizens with skills, abilities, and knowledge of global standards. According to the task team's report the decline in the levels of abilities and skills to read, write and to understand and perform numerical calculation in mathematics was of great concern, the levels of incapacity of teachers to comprehend the philosophical and theoretical principles and ideas underpinning the curriculum changes resulted in chaos in the learning environment. Teachers were struggling to understand and to implement curriculum guidelines due to the inability to conceptualise the new terminologies and concepts that were introduced in the Curriculum for 21st century. According to the curriculum guidelines teachers were expected to create a knowledge structure by integrating conceptual knowledge to

in order to promote correlations within the Learning Area (related subjects), for example Natural Science, which is a cluster of physical science and life sciences in the General Education and training phase of the National Qualification Framework. The systemic evaluations conducted by the department in the subsequent years through the annual assessment (ANA) highlighted that curriculum transformation in spite of all various interventions by the department, implementation of the purposes and intentions of the curriculum designers were not attained in South Africa. Despite the recommendations and proposal to the department based on the continuous reviews of the curriculum to; adjust the curriculum by scrapping the new terminologies and concepts and reversing 'Learning Areas' in favour of subject content knowledge, supply schools with textbooks, allow teachers to utilise the traditional ways of teaching and learning, which they are familiar with, and assess learning of knowledge as they have been professionally trained to do. The reversal of the changes introduced in the Curriculum for 21st century in South African terms was aimed at getting education "back to basics" and this implied the perpetuation of traditional practices based on the absolutist and perennial view of knowledge, conceptualisation of learning and traditional behaviourist pedagogical content knowledge. This study finds it interesting that the recommendations referred to in this work were from the ministerial team whom the minister considered to be a skilled, prominent South African educationist-curriculum and evaluation specialists, school-based practitioners and department-based policy makers [13].

The recommendations of the 2000 and 2008 ministerial task teams persuaded the ministers of education to consider revising the school curriculum and indeed, in 2005 the National Revised Curriculum (NRCS) and NCS were the version of the streamlined curriculum changes, and later in 2008 the curriculum became the Curriculum and Assessment Policy Statement (CAPS). The education ministers in the education department proclaimed that the revisions in the curriculum statement for the 21st are still based on the principles of constructivism and outcome [14].

3. Literature review

This section presents the conceptual framework drawn from the synthesis and analysis of the contesting perspectives concerning the conceptualisation of knowledge structure and knowing. Literature points to the emerging perspective advocated in the works of [15–19] which contest the classification of knowledge into heterogeneous subject or discipline content. Researchers who pursue the narrative of knowledge integration [20, 21] had proposed different approaches to hybridism of heterogeneous knowledge structure and those are: interdisciplinary, multidisciplinary and cross-disciplinary. [22], in the same vein suggested that an outcomes-based curriculum model is an appropriate tool for promoting an integrated knowledge structure in the school subject curriculum. In pursuit of the relevant curriculum design for implementing hybridisation of knowledge [23, 24] proposed the consideration of two approaches to curriculum designs; first is the subject-based designs which entails: broad fields curriculum that merge several disciplines into interdisciplinary subject areas, this curriculum allows more correlation, integration, and holism, for example, Natural Sciences, Social Studies or Sciences and humanities etc. Second, is integrated the curriculum design, which encourages integration of concepts across, within and to future knowledge [25].

The opinions and ideas from the works of [26–28] informed this study regarding alternative ways to knowledge production that are recommendable for a lifelong-long process. These researchers share similar views of knowledge as a social

construct; its production reflects elements of engagement of humans with reality in a specific time and context, interaction between human and environment as well as real-life problems. The understanding of knowledge established from this perspective highlights that knowledge is time and context specific and therefore knowledge is fallible and not everlasting. Similarly, the constructivism and progressive philosophical ideas support the view of knowledge as a process, which is driven by socio-economic needs and demands [29, 30]. The issue of knowledge in the classroom should be assessed in terms of relevance to the current socio-economic needs of the nation or society, worthiness to provide solutions to the current and future problems in the society. By the same token, [31, 32] argue that subject content knowledge in textbooks present the narrow and linear programmed or structured factual knowledge, which is mostly based on the unilateral world view of the author. Ideas drawn from ([31], 16) affirm the importance of questions that lead to the construction of a new set of connections and fresh perspective of knowledge structure. ([33], 5) also, alluded to composition of knowledge structure, to be both a social construct and real, while [27, 34] pointed out that knowledge comprises of commonsense, assumptions, conclusions, and hypothesis, therefore the validating and verifying of knowledge is an ongoing process. [14] supports the notion of knowledge as a fallible product and argued that knowledge is neither universal nor absolute because its production is regulated by contexts in terms of time, socio-cultural and economic advancements.

In the context of a school curriculum, [35] stated that subject content knowledge should not be confined to textbooks, instead learners and teachers should focus on current and future realities and current phenomena that affect the society. [19], extended the rhetoric of classroom-based knowledge construction when expressing the recognition and acknowledgement of learners' perspectives of world outlooks in the process of curriculum development. [25], supports the promotion of contemporary ideas and knowledge when pointing out that the view that knowledge is generated through senses meaning, the sense of sight, hearing, touch, taste and smell. The constructivist such as John Dewey posits that knowledge is both tacit or implicit and explicit; the tacit knowledge is the collective noun for ideas, views, experiences and opinions constructed as individuals interact with reality and the environment, whereas the explicit knowledge is the expressions of the tacit knowledge, in other words the experiences and ideas an individual prefers to share with other individuals.

The opinions and ideas drawn from [24, 27] reveal contestations surrounding the philosophical and theoretical paradigms of knowledge production, which are empiricism or analytic, interpretive or hermeneutics, praxis or critical pedagogy. The empiricism paradigm pursues the scientific methods and procedures to produce knowledge, hence the countenance of knowledge is based on verification and validation of facts through scientific methods. According to [2, 13] subject content taught in classrooms is the product of scientific procedures conducted far away from the place of learning. The argument expressed by these researchers is that the main aim and the core for learning the subject content is the knowledge of the process of production rather than receiving the product. [19], also pointed out that the subject content curriculum that promotes perennial philosophical views of knowledge emphasises an absolute and universal approach to knowledge acquisition; memorisation and acceptance of facts without reflections and argumentative debates.

The discussion of different paradigms and philosophical underpinning are of importance to this work, because the main focus is on the issue of worthwhile, truthfulness and relevance of knowledge or information taught in the Natural Sciences and Social Sciences to school learners. The problem statement was to

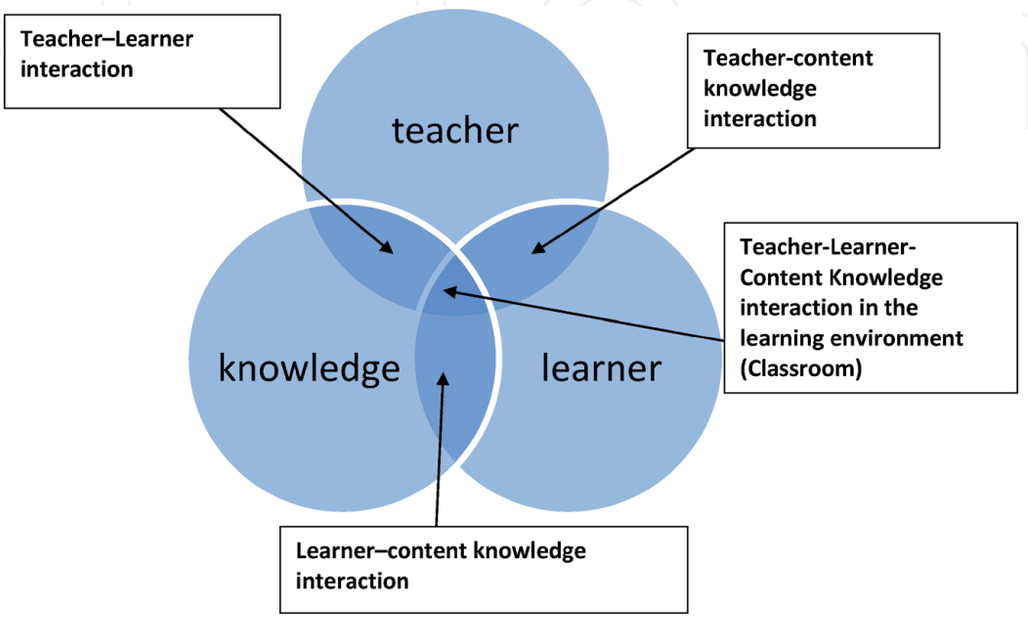
investigate the perspective of knowledge from the manner in which learners view knowledge that is taught, teachers' perspectives of knowledge and the engagement of teachers and learners during knowledge acquisition. [28], argued that knowing is not only limited to empirical or scientific knowledge, but other ways such as intuition, revelations, reasoning, and logic, are recognised ways of knowledge construction. The data collected from classroom practices of pre-service teachers and the challenges they encounter in reproducing the traditional facts of the ancient times pointed to outdated facts and pedagogical content knowledge of the teachers.

4. Theoretical framework

This work draws theoretical ideas and views from constructivist, progressive and phenomenologist theories. The advocates of the constructivist theory assert that learners have their points of view and perspectives to life and reality resulting from the process of adaptation in their environment [35]. To the constructivist theory, learning is a process of becoming and it is through mastery of abilities, knowledge, and skills that the learners attain self-realisation, meaning that the learner seeks to find answers to the questions and solutions to the real-life problems [14, 24, 29, 32, 33] in the same viewpoint assert that it is in the nature of the learner to ask questions about their surroundings, and the relationships between entities that constitute their world. The researchers in theory recommend that learners should be exposed to real-world problems rather that abstract realities, for them to construct their knowledge by means of explorations, investigating, problem-solving, trial and error, and experimentation [18, 29]. In the same narrative, ([27], 7) argues that the nature of knowledge and characteristics in a progressive and pragmatic context, meaning knowledge that reflects the past, present and projecting the future possibilities are; engaging, existential, expressive, evolving, experimental, anti-entropy, and entertaining. These six aspects or characteristics provide guidelines. The constructivist theory supports the learner-centred strategies to teaching and learning; allowing learners to ask questions or identify problems that they want to solve. [32, 33, 36, 37] point out that, learners could enjoy the freedom to explore and construct their own world view if the curriculum designers perceive knowledge as a process or means to an end, not as infallible and indisputable facts. Similarly, the phenomenologist theory echoes the sentiment of the consideration of individuals' interests, emotional and cognitive needs, freedom of choice, and their experiences, as fundamental aspects of the process of knowledge acquisition and construction [24, 25]. The recent researchers of the learning revolution [38] advise that learning for the future advancements in human life, should account for the demands of the changing times in human cultural development, and shift from the traditions of handling learners as empty vessels to be filled with insignificant and outdated factual knowledge. These researchers recommend the recognition of talents and imaginative abilities as essential meta-cognitive and intellectual abilities which are innate in learners.

This work also drew ideas from [22, 35, 39] about quality teaching and learning, as he asserted the importance of the three interactions. First is the learner-knowledge interaction, second, teacher-knowledge interaction and third, the teacher-learner interaction. The conceptualised interactions demonstrated in the diagram, indicate the worlds or dimensions from which the participants create their own meaning of the content knowledge. According to constructivist and phenomenologists' theories, the teacher should allow learners to engage with the content knowledge and to build up new understandings, and if learners are to construct their own understanding of the content knowledge, teachers should capitalise on the learners' prior knowledge and imaginations [18, 19, 29]. ([35], 49) proposes ways in which teachers could support

and encourage learners to interact with knowledge for an in-depth understanding and creation of new knowledge, and this should be done through asking simple questions, for example, 'How did you know about that? Did anyone approach this problem in a different way? Is there anyone with the similar view of knowledge? [35] is of the view that teachers should always establish the patterns of thoughts of the learners, be aware of and accept learners' perspectives and to organise concepts and ideas such that learners are able to discern for themselves issues or knowledge that require more exploration and investigations.



The three interactions are the focus of this work used during the analysis of the three scenarios or case studies with the purpose of understanding the perspective of knowledge, its relevance to their cognitive abilities, emotional development, and construction of their own outlook to reality and world views. In this work the problem statement is the perennial knowledge structure promoted by the current curriculum design and its relevance to the transformation of South African learners' world outlook. The question linked to this problem statement is: How do learners perceive school knowledge and the problem and challenges in real world systems?

The constructivist theory warns that imposing knowledge to learners as fallible and conclusive deprives learners the opportunities to develop intellectual skills; logic, evaluation, critical thinking, hypothesising and creative thinking [7, 23, 29, 33]. The Piaget theory on human cognitive development revealed that at a formal operational stage, children can think hypothetically and critically about things around them, therefore an exposition of knowledge that acts against this principle is viewed in this work to be oppressive and manipulative to the young generation.

5. Research method

This research is guided by the views and opinions of the critical study to expose the manipulation and oppressive approaches to knowledge acquisition in South African schools, and the purpose is to evoke a rethinking of the approach to knowledge structuring that is suitable for liberating learners' minds in the 21st century. According to ([40], 471) critical study is a qualitative research in which the researcher is committed to exposing social manipulation and changing oppressive social structures for the purpose of finding the discourse to the current practices.

The case study design was chosen for the study and the rationale was that the researchers intended to utilise interviews and observations of the interactions in the teaching and learning processes in the classrooms. In this vein ([41], 41) refers to the case as the situation selected by the researcher in which a phenomenon is described by participants' meanings of the process or events. The second connotation of the case study refers to the research design which enables the researcher to apply qualitative procedures and techniques to obtain an in-depth understanding of the phenomenon. In this study the first connotations describe the focus, which in this case is the interaction between learners and subject content knowledge interaction in the broad field curriculum for the 21st century in South Africa; Social Sciences and Natural Sciences.

The participants in the research were selected from the group of in-service teachers in their post-graduate teacher qualification. The purposive sampling strategy was used to select students with the highest qualifications in the knowledge of the disciplines, for example, Social Sciences students who specialised in Geography and History, and for Natural Sciences, students who specialised in Physical Science and Chemistry or Life Sciences.

The research ethics were considered during the selection of participants and the application of research instruments. Firstly, students were informed about their rights which were: to participate voluntarily, to opt out if they wish to do so, they will not be coerced to answer or provide information which they feel is confidential; their identity and personal details were to be kept anonymous. The learners were informed that the information gathered is not about them, but the observations focussed on the process of learning and teaching.

6. Sample

The selection of the participants in the study adopted a snowball sampling strategy. Snowball sampling is about recruiting participants from the larger sample [40, 41]. The participants in the focus group consisted of sixteen grade nine learners and two teachers who taught Natural Sciences and Social Sciences. The criteria used to recruit participants were: active participation in the class discussions, and a willingness to share opinions and ideas during the lesson.

7. Data collection and its analysis

The primary sources of data were notes developed during the observation of lessons focussed on the learner-knowledge interaction, teacher-knowledge interaction, and teacher-learner interaction. The second set of data was obtained from interview transcripts developed from the students' reflections during face-to-face discussions after the lesson observations.

The study utilised an observation schedule focussing on the four areas of pedagogical interactions, which are learner-teacher interaction, learner-content knowledge interaction, teacher-content knowledge interaction, and teacher-learner-subject content knowledge interaction in the teaching and learning environment. The capturing and analysis of data focussed on learners' perceptions of subject content knowledge and opinions about how best the subject content knowledge could be taught more meaningfully to them. The second set of data focussed on the appropriateness and adequacy of feedback and explanations of the teachers to learners' questions and opinions.

> *"Researcher needs to live in classrooms, to see the complex forms of interaction that occur in classrooms. In this way, more accurate pictures can be got of which particular kind of students get what particular kind of knowledge and dispositions, one can also see how knowledge is actually created and used in classroom settings" ([32], 15).*

The qualitative data analysis procedures were followed; first the data recorded in the observation schedule was given codes. According to [42] a code is a descriptive name for the topic of subject of a data segment. Second, the codes were organised into units focussing on the learners' reflections, questions and comments and the category for this data was learner-knowledge interactions. The codes that highlighted teachers' comments, explanations and feedback comprise the category of teacher- knowledge interaction and the last category was formed by actions and behaviour indicating satisfaction, doubts and confusion, and all these were classified under teacher-learner interaction.

8. Data presentation or results

Data coded and classified under learner-knowledge interaction were questions asked by learners during the conclusion of the Social Sciences (Geography) lesson and comments made by learners comprise the data summarised in the table.

9. Clarity seeking questions directed to the Geography teacher A

Learner X asked: "Is earth moving or revolving from the east to the west?"

Learner T asked: "Does the sun rise and set or is it the earth rises?

Learner C asked: "Why does the teacher say the sun rises from the east and sets on the west? Is there such a thing?

Learner R: "Sir, there is something that worries me about the shape of the earth. The globe shows that earth is round, but on the chart the earth is flat. If the earth is like that globe what makes water in the oceans and rivers change position as the earth rotates?"

10. Comments made by Learners

Learners G: "Sir, I have learned from the Natural Science textbook that the sun does not move, only the earth and other planets rotate around the sun."

Learner K: "It is wrong to say the sun rises from the east and sets on the west. There is no rising and setting of the sun here."

Learner F: "And then..... (*Throwing hands in the air),* what is the truth sir?"

Learner J: "I believe the earth is flat, no earth round rather I can say it is round and flat."

Learner L: "Why are [we] learning this because the Natural Science books and the teacher say something different and the Social Science books and the teacher teach us another thing. What is the truth?"

11. Clarity seeking questions addressed to the teacher during Natural Sciences lessons

Learner N asked; "Madam, is the ocean water a soluble or solution?"

Learner Z asked; "What makes ocean water taste so much salty because there is no salt?"

Learner P asked; "Is it true, teacher that all human beings were apes, long-long ago? This information is in the Natural Science textbook."

Learner S asked; "Who saw these changes and why are we learning about this? How is this information preparing us for jobs?"

12. Comments of learners on knowledge

Learners commented:

Learner C, "Learning about these things is boring to me and I see no need of knowing anything about apes and this evolution."

Learner E, "I like to know more about cars and aeroplanes, not the apes and soluble and solvents. At home I spend time reading about cars and drawing cars."

Learner J: "School is boring because we sit in class, listen to all these lies from the books, writing notes from the book and writing tests."

Learner M "I am sick and tired of knowledge that does not help us to know how cell phones are made, televisions and music."

13. Findings from the learner-knowledge interaction

The importance of the data from the questions asked by the learners and comments in this work, as highlighted under the section of data analysis, was to establish the holistic perspective of learners concerning firstly, their interpretation of reality and the environment, and relating knowledge that is an abstract form with their common-sense knowledge, and prior knowledge. Secondly, the comments revealed the perceptions of knowledge learned from the subjects or broad fields in the school curriculum in relation to learners' feelings, interests, experiences, and views on the relevance of information to their actual life beyond the school. The data from the comments and questions pointed to the criteria used by learners to evaluate knowledge, teaching and learning. The data highlighted that the main premise for logic and reasoning in the learner-knowledge interaction are: (i) relevance, (ii) truthfulness, (iii) worthiness, (iv) evidence and (v) context for the content knowledge. The question asked seeking relevance was for example, "How is this information preparing us for jobs?" Whereas comments that expressed the similar sentiment were: "I am sick and tired of knowledge that does not help us to know how cell phones are made, televisions and music". According to [2, 14], highlighted in their work, that meaningful knowledge is not just information, but its essence is in the process of production, because the process of production encapsulates the relevance in terms of time and environment contexts. These researchers contended that the only choice in knowledge production currently is between positivism, absolutist, and constructivist relativism, and this trajectory limits the insight into the multifaceted, evolving, and dialogic nature of content knowledge.

14. Learners' perception of the prescribed subject content knowledge

Learners distanced themselves from the confusion they identified in the information presented in the textbooks. The contradiction presented in what had been taught for so many years in the subject as factual knowledge, was considered by

learners as fallible because it does not provide sense to their questions. To emphasise the importance of knowledge and knowing [10, 11] cited Maton's legitimating theory, to reveal that knowledge structure had a knower structure, this assertion, is in congruence with the evidence highlighted in the learners' propensities expressed in their comments and questions, for example, "school is boring because we sit in class listen to all these lies from the books, writing notes from the book and writing tests", "I am sick and tired of knowledge that does not help us to know how cell phones are made, televisions and music." These comments highlight that the current generation of learners are not the knower structure for the knowledge structure that is prepared for them. The perspective of the school and classroom being "boring", was interpreted in this study to mean an oppressive and manipulative environment, because of the comparison drawn between the content knowledge and the expectations, interest and desires for the future, which are not taken care of in the knowledge structure. The argument, about the knowledge structure and knower in the works of ([32], 15) is, in whose interest is certain knowledge (facts, skills, propensities and dispositions) taught in the school curriculum? The concerns of the learners indicate blind spots in the selection and organisation of knowledge in the textbooks and in the school curriculum at large. The dimension of the learner in the selection and sequencing of learning content, from the learners' perspective does not consider relevance, interest, future plans and desires of the learners, who are the consumers of the product. Instead, knowledge is packaged for the sake of keeping busy in the classroom, which in their view was just a waste of their time and opportunities. The definition of the term 'education' by the international researchers and the theorist, B.F Skinner is confirmed in the findings on learner-knowledge interaction, there are specific aspects pointed in the definition "education is what survives when what has been learnt has been forgotten." The findings provided evidence to the definition of education in the quotation, which implies meaningless and contradictory factual knowledge taught in classroom, the survival implies awareness of the contradictory and meaningless factual knowledge, recall of factual knowledge for the purposes of marks and to obtain a certificate. The conceptualisation of the phrase, "what has been learnt has been forgotten" insinuates that some of the knowledge will be for the short while, which could be for the purposes of test and exams. The learners' comments and questions made it clear that content knowledge that does not have value to their present and future is a waste of time at the expense of what is of significant to them. The imposed worthless knowledge to them in the school curriculum creates negative perceptions about schooling and knowledge. The phenomenologist and constructivist principles about the learner, learning and knowledge, recommends that learners should be viewed and treated as active participants in knowledge production or construction; learners have their own desires, interests and perceptions about knowledge, and skills that are learnt; learners should not be treated as empty vessels [7, 33]. Concerning knowledge and meaningful learning, [8, 22, 35] emphasise the importance of context and content, the context is the authentic world of knowledge production and its application, whereas content is the collective of conceptual, practical, procedural domains of knowledge about real life phenomena. In the context of the finding highlighting the rejection of content knowledge about the positions of the earth and the sun, the main issue was that learners wanted the practical and procedural understanding of the positions, for them to be convinced. The debate and contradictions contributed to the rejection of the factual knowledge due to the lack of evidence from practical and procedural knowledge from the authentic context where the knowledge is produced.

15. Ability of learners to integrate knowledge across subject domains

The ability to connect factual knowledge from Natural Sciences and Social Sciences highlighted in the data provided confirmed the Piaget theory of cognitive development, which states that learners at the age of ten and up, are able to think at an abstract level and generate hypotheses. The critical thinking and evaluation skills on the truthfulness and worthiness of scientific facts in the Natural Science and Social sciences about the positions of the sun and the earth was to learners a theme with contradictions in both fields of knowledge production.

16. Learners' perception of the ability of teachers to relate subject content knowledge to real life contexts

Researcher into teachers' professional development push the rhetoric of high-quality instruction for quality learning in classrooms [12–14, 20, 35]. The clarity seeking questions asked by the learners highlighted the deep inquest for knowledge that is not provided in the textbooks. The learners' questions exposed the limitations in the teacher's competence to think beyond the textbook knowledge, and as a result learners demonstrated their dissatisfaction and loss of hope and trust in their teachers. The data highlighted that teachers in the two classrooms relied on the perennial approach to knowledge and teaching strategies, which do not take heed of learners' perspective or viewpoints, hence teachers were caught off guard when confronted by questions requiring in-depth explanation of scientific knowledge. [24, 25] highlighted that a perennial view of knowledge promotes reproduction and transmission of factual knowledge, and does not provide room for contestations, however, the behaviour demonstrated by learners confirmed John Dewey's counter view on knowledge, which pointed out that learners are interested in knowledge that relates to their daily life experiences. The attitude of the teacher to learners' questions dented the trust in the teacher-learner relationship, which according to [19, 28, 32] is fundamental to effective learning. The learner-knowledge interaction revealed that teachers lacked the ability to relate content knowledge to the real-life situations and context. This research exposed that learners think beyond the book's factual knowledge and were able to challenge the teacher-knowledge interaction, which proved to be meaningless to the learners' search for in-depth understanding.

17. Data from teacher-knowledge interaction

Reflections on the lesson, according to the evaluation form, the teacher was expected to allow learners to ask questions for clarity purposes. The data presented in two columns show the learner-teacher interaction about the plane earth and the positions of the sun, east and west.

18. The comments and reflections of the teachers on the learning content and expositions

"*Yes, the sun rises from the east, read your Social Science textbook*".

"*The earth is round and revolves around the sun*".

"*The earth is the circumference, with imaginary lines*".

"The sun is the source of energy for the biosphere".

"The sun is static, meaning that it does not move".

"Yes, I know it, I am a graduate meaning I have a degree in Geography".

"The forces of nature make the sun to rise up from the east and set on the west. When you wake up in the morning you can see this for yourself."

"Yes, the sun moves up from the east and move down in the afternoon and sets in the west".

"I do get your point, but you should not worry about this for now".

"The textbook is written by expects and scientists they have conducted experiments".

"This means that what they say is true and you should believe it".

"All what you should know is that the sun rises from the east. East is the direction on the compass".

"In Natural Science, yes we know that the sun does not move".

"There is only one sun. Do not be confused by these two".

"There scientist in the Natural Science have tested this and discovered that it to be true, that the sun does not move only the planets rotates around the sun".

19. Teachers' adherence to transmission factual knowledge

Despite the proposals of the Department of Higher Education in the renewal curriculum policy guidelines, to ensure that pre-service and in-service teachers are equipped with the competence to master theoretical knowledge as well as contexts and conditions under which knowledge is produced in the field or discipline. This work revealed that teachers' knowledge interaction lacked evidence of epistemological principles highlighted by ([33], 25) and [27] which include: logical thinking; the application of deductive reasoning or syllogism that consists of premises. The first premise is called a major premise that comprises generalised perceptions of the reality, second is, the minor premise; the particular perceptions, and third is the conclusion. The questions asked by learners about the rising and setting of the sun were based on the generally accepted fact, which was confirmed by the subject teacher and the authors of the textbooks for Social Sciences for grade nine, on the other hand learners turned the fact into a hypothesis to be verified. The teacher–learner interaction was viewed by learners to be an opportunity to test the hypothesis to verify the truthfulness of the fact about the rising and setting of the sun. The teacher was unable to assist learners to understand the scientific procedures which led to the conclusion presented in the textbook. Instead, the teacher forced learners to accept the facts as presented in the textbooks. The disposition revealed that the role of the teacher in classroom is to perpetuate traditional practices in learning that promote regurgitation and memorisation of facts, and these traditional practices applied by teachers are in contradiction to the constructivist principles

underpinning the curriculum, knowledge integration and contextual construction of knowledge.

The questions from learner-knowledge interaction confirmed the view expressed by [29, 31] that priori or common sense is the basis of knowledge production. Learners' priori exposed the dimension which the teachers were not aware of and had never expected from grade nine learners; hence the teachers were unable to address those questions.

20. Disregard of learners' perspective in knowledge construction

The findings highlighted in the teachers-knowledge interaction and teacher-learner interaction pointed out that those teachers in the Social Science and Natural Science lesson show no interests in how learners internalise knowledge. Instead of adjusting the teaching techniques to acknowledge and accommodate learners' queries and concerns, teachers defended the content knowledge, and cautioned learners about questioning knowledge generated by experts and the teachers' knowledge of the subjects. According to [18, 20, 28, 29], the tendency to suppress learners' points of view to knowledge and their perspectives is detrimental to meaningful and effective knowledge acquisition and learning. The learners expressed their discontent about the contradictions in the scientific knowledge presented in the textbooks and the views of the teachers. According to [27, 34] warned that the knowledge structure in textbooks is not authentic knowledge because it does not engage learners in the procedure through which that factual knowledge was produced. In the same vein, [35] expressed that factual knowledge without understanding of procedural processes involved in the production of knowledge is worthless to learners. The data presenting learners' disgruntled dispositions confirms that learners were not satisfied with the knowledge of facts, the common interests were on how such facts were generated, and beyond that, they wanted the contradictions in the factual knowledge to be addressed.

21. Discussion of the findings

The findings presented in this work pointed to the limitations in the development of the Natural Sciences and Social Sciences subject content knowledge. The first limitation is the promotion of the absolutist view of knowledge and traditional pedagogy. The reflections and learners' perspectives of reality are not considered as part of knowledge interaction in the teaching and learning. According to [37, 39] constructivism, pedagogy and learner-centred teaching and learning provides learners with opportunities to engage critically with abstract reality by asking questions and developing hypotheses, to seek concrete examples that facilitate understanding of the facts. The second limitation was the teacher knowledge interaction, which pointed to the adherence of teachers to the textbook knowledge and lack of ability to relate abstract knowledge to reality. The findings of the study revealed that learners were frustrated by the teachers' feedback and comments which indicated that teachers were unable to address the intellectual and cognitive needs of the learners. The questions asked by learners in the Natural Sciences and Social Science lessons pointed to the desire of learners to link abstract and factual knowledge presented by teachers and the textbook with the perceptual knowledge which forms learners general or prior knowledge. According to [21] prior knowledge or general knowledge forms the foundations for meaningful learning since learners use what they perceive from their surroundings to understand abstract factual knowledge.

The other limitation highlighted by the findings was the lack of research and investigating skills for science teachers, for example, questions asked by learners based on the use of the globe to teach a lesson about the structure of the earth should have been considered by the teacher as a hypothesis for investigating and research instead of suppressing the intellectual seeking questions. [8, 25, 31, 43] argued that scientific discoveries are not infallible, however, in their empirical nature, the space for further questions and hypothesis are inevitable.

22. Conclusion and recommendations

This work concluded that the teacher-knowledge interaction promoted regurgitation and reproduction of factual knowledge whilst learner-knowledge interaction demanded interpretation, reasoning, deductive thinking and logic about subject content knowledge. The interpretation of this contrast is considered in this work to be an obstacle to the principles of the learner-centred approach underpinning the curriculum of the 21st century education in South Africa. According to [5, 12] teachers should encourage active learner participation of learners in the learning process, and the strategies recommended to teaching and learning are: investigation, research project, exploration, and experimentation, instead of memorisation and reproduction of knowledge. This work also concluded that learners' intellectual capacity was suppressed by the beliefs of teachers about knowledge production, which was rigid and confined to textbook knowledge. The limitations in the teachers' abilities to relate factual knowledge to everyday life reality, subsequently developed negative attitudes in learners towards the subject content knowledge.

The questions which this work raises for future research are: what qualities do prospective teachers require to engage learners in the process of knowledge production? Second, how is the principle of a learner-centred approach being conceptualised in the structuring of knowledge to benefit learners' interests above those of the curriculum developers? Thirdly, how could knowledge structuring cater for differentiated interests and aspirations about life beyond the school? [14, 19, 23, 28] argue that learning and knowledge should not be confined within classroom frameworks, but it should empower learners with ideas and skills to adapt in the world beyond the school.

This work recommends the review of the knowledge structure, on the basis of findings from the comments of the learners which indicated that textbook knowledge is worthless and valueless in terms of helping them to achieve their goals. The narrative in this work serves to motivate for the recognition and acknowledgement of the importance of learners' perspectives of subject content knowledge, and intellectual and cognitive needs of learners as well by teachers, teacher educators and national school curriculum developers. Education for the liberation of the mind can begin by equipping teachers with the competences of mastering knowledge production. In Scientific Studies knowledge production implies knowing and understanding procedures and scientific processes involved in scientific discoveries, verification of scientific knowledge, for example, investigations, experimentations, creation of hypotheses and methods of testing hypotheses, reasoning and logical thinking. Twenty-first century learners are more technologically inclined, and therefore the use of technology, as learner V indicated, that their interest as young citizens is to be knowledgeable about technology so that they can be part of the technological discoveries of the twenty-first century. The learners expressed views which indicated that they regard themselves capable or achieving their goals should they be allowed to explore their areas of interests using knowledge of modern technology. This work considered this determination and enthusiasm demonstrated by

learners in the study, as an opportunity to be explored through alternative strategies to knowledge structuring, which will incorporate or apply learners' perspective as a threshold to curriculum design, development, and implementation in practice.

The argument presented by this work confirms the definition of education in Skinner (1964) that, "education is what remains after all which has been learnt has been forgotten." Teacher educators should think critically about this definition and begin to change the perceptions about learning and learners.

Author details

Mamsi Ethel Khuzwayo[1*] and Kwanele Booi[2]

1 Curriculum and Education Studies, Cape Peninsula University of Technology, South Africa

2 Science Education Studies, Cape Peninsula University of Technology, South Africa

*Address all correspondence to: kuzwayom@cput.ac.za

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