# TEACHERS' AFFECTIVE DEVELOPMENT DURING AN INDIGENOUS KNOWLEDGE PROFESSIONAL TEACHER INTERVENTION

**Cherine Jackson**
**North-West University**
**South Africa**
**cherinejackson@outlook.com**

**Josef de Beer**
**North-West University**
**South Africa**
**Josef.debeer@nwu.ac.za**

**Lounell White**
**North-West University**
**South Africa**
**Lounell.white@nwu.ac.za**

**ABSTRACT–**This paper provides a view on Natural Sciences and Life Sciences teachers' affective development during and after an indigenous knowledge professional development intervention at the North-West University. Using Krathwohl's taxonomy for the affective domain, this paper sheds light on teachers' attitudes, values and beliefs on indigenous knowledge, and the role of the intervention in providing teachers with a more nuanced view of the nature and affordances of indigenous knowledge. Data was collected using the Views of the Nature of Indigenous Knowledge Questionnaire (VNOIK), one-on-one teacher interviews and observations during the intervention. This qualitative study used Engeström's third-generation cultural-historical activity theory (CHAT) as a research lens, in order to identify factors that promote or inhibit affective development in the teaching of indigenous knowledge. The data collected showed an increased positive attitude on indigenous knowledge after the intervention. The results indicate primarily that teachers are more motivated and interested in teaching indigenous knowledge in the classroom after the intervention. However, data also indicate that continuous professional development (within communities of practice) is needed, for the continued scaffolding of teachers' PCK.

**Keywords:** Affective domain, cultural-historical activity theory, indigenous knowledge, Krathwohl's taxonomy, pedagogical content knowledge, teacher professional development.

## 1. BACKGROUND TO THE PROBLEM

Grenier (1998) defines indigenous knowledge as *"the unique, traditional, local knowledge existing with and developed around the specific conditions of women and men indigenous to a particular geographic area."* Similarly, Fien and Hoppers (2005) suggest that indigenous knowledge is unique to specific cultures within a particular society and environment. This unique knowledge is transferred from one generation to the next, either by repeated traditional rituals or stories told which has benefited society in farming, medicinal practices, education and conservation. Senanayake (2006) describes indigenous knowledge as "a way of knowing that local people developed through the ages whilst busy with their everyday activities". Indigenous knowledge encompasses traditional practices including languages, values, ethics and health practices.

South Africa is a culturally diverse country, with numerous ethnic groups, hosting various types of indigenous knowledge and eleven official languages (Hattingh, 2013). Multi-cultural teachers (Webb, 2016) teach groups of learners from various cultures which creates difficulties for teachers (Meier & Hartell, 2009). Teachers may not have the necessary pedagogical content knowledge to effectively build, in constructivist fashion, on the indigenous knowledge background of diverse learners. Neither does a teacher necessarily have the intrinsic value system (affective domain) to value the teaching of indigenous knowledge systems. Mothwa (2011) has shown that some teachers hold negative perceptions about indigenous knowledge, e.g. that it is pseudo-science. This often results in teachers being less sensitive (Shizha, 2008) to cultural traditions other than their own culturally engrained mental models. Teachers find it difficult to accept a view different to their existing mental models (Gentner & Stevens, 2014). As an example, a traditional healer in South Africa, commonly known as a herbalist or "sangoma" may be seen as practicing "witchcraft" from a western point of view (Keane, 2015). Moreover, teachers do not necessarily see indigenous knowledge as a scientific discipline and

therefore, Natural Sciences and Life Sciences teachers have hesitations with regards to teaching indigenous knowledge in their classrooms (Webb, 2013). In 2008 Keane explored the notion of "relevant science" focusing on the importance of indigenous knowledge integration in the science curricula. This notion is also advocated by Gibbons (2000) who, with his construct of Mode 2 knowledge production, refer to contextualized science. Similarly, Hattingh (2013) questions which indigenous knowledge should be included in the South African classrooms and curriculum, given the multiple ethnic groups found in this country.

The concern however, is that the South African Curriculum and Assessment Policy Statement (CAPS) for Natural Sciences and Life Sciences stress the importance of including African indigenous knowledge in the classroom without stipulating a specific ethnic group (Department of Education, 2011). The Curriculum and Assessment Policy Statement for Life Sciences (CAPS) (Department of Education, 2011:5) states that *"valuing indigenous knowledge systems: acknowledging the rich history and heritage of this country as important contributors to nurture the values contained in the constitution"* should receive attention in the classroom. Indigenous knowledge such as peoples' use of medicinal plants and food preservation (agriculture) and many more are at risk of becoming extinct due to changes in a progressive society (Department of Education, 2011). Experts such as botanists, biologists, pharmacists and archaeologists are documenting this knowledge to be preserved for future generations (Department of Education, 2011). Therefore, the assumption is that a blend of different types of ethnic indigenous knowledge is selected as content for inclusion in daily teaching practices. Indigenous knowledge is considered as an important national resource and can promote conservation, biodiversity (Warren, 1996) and a sense of unity within the South African multicultural context. Learners as well as teachers should in essence understand this notion of preserving various inputs of indigenous knowledge and show consideration of the relationship between science, western society, cultural traditions, technology and the environment (Ogunniyi, 2002) and understand the value thereof.

Nonetheless, the Department of Education requires Natural Sciences and Life Sciences teachers to incorporate indigenous knowledge into the classroom (Department of Education, 2011), but does not provide teachers with sufficient content knowledge or skills of indigenous knowledge topics which they are expected to teach. Researchers such as Mothwa (2011) and Cronje (2015) indicate that teachers do not have the necessary pedagogical content knowledge to pay justice to the teaching of indigenous knowledge in the science classroom. Teachers educated in Western education systems lack sensitivity of indigenous knowledge (Shizha, 2008). The research of Cronje (2015) and Cronje, De Beer & Ankiewicz (2015) also show that many teachers lack a true understanding of the tenets of and the importance of the Nature of Science (NOS) and the nature of indigenous knowledge (NOIK), as there is little emphasis on these two phenomena in teacher education. The latter authors have shown that science and indigenous knowledge share many characteristics, both on epistemological and ontological level. Professional development programmes and resources such as textbooks offered by the department do not include knowledge, skills and attitudes which can aid teachers to have a better view or PCK of indigenous knowledge and NOS (Cronje, 2015). Therefore, it is crucial for teachers to develop their pedagogical content knowledge to understand and teach indigenous knowledge, creating a more nuanced view of the nature and affordances of indigenous knowledge. Teachers' understanding of the NOS and indigenous knowledge can assist learners in acquiring scientific and indigenous knowledge skills allowing them to solve problems practically inside and outside the classroom (Ogunniyi, 2002). However, this brings us to the importance of this research. PCK development also entails conceptual change. Pintrich, Marx and Boyle (1993) state that we often look at conceptual change through a "cold" and only cognitive lens. With "warm" conceptual change (De Beer & Henning, 2010), as opposed to "cold" conceptual change, it is acknowledged that human emotions, worldviews and belief systems influence how conceptual change occurs. Hynd (2003) alludes to true conceptual change that implies acceptance of the construct of study. Therefore, if teachers do not affectively embrace indigenous knowledge, there cannot be true conceptual change. It is therefore of the utmost importance to also

address the affective development of teachers during this short course, and not just focus on their cognitive development.

Consequently, the Natural Sciences and Life Sciences teachers need to design and contextualise learning activities to provide opportunities for learners to incorporate indigenous knowledge before the knowledge is lost (Gibbons, 2000). Mode 2 knowledge production (context-sensitive science) as suggested by Gibbons, incorporate society into science learning, this could create motivation and interest among the learners, rather than mode 1 knowledge that only concentrates on the cognitive domain (Gibbons, 2000). Subsequently, teachers, need to be well equipped with the knowledge and understanding of indigenous knowledge to ensure the transmission of this valuable resource before it vanishes. If teachers familiarise, value, internalise and make indigenous knowledge relevant for themselves it could inspire them to integrate these concepts into the real-life context of learners (Ogunniyi, 2002), thus addressing the affective domain (Krathwohl, 2002). The CAPS document emphasise this notion in Aim 3 where learners *"relate to understanding the applications of Life Sciences in everyday life, as well as understanding the history of scientific discoveries and the relationship between indigenous knowledge and science"* (Department of Education, 2011:13).

A large and growing body of literature emphasises the importance of the affective domain (Birbeck & Andre, 2009; Buma, 2015; Wormeli, 2015), teacher reflections (Rodgers, 2002), indigenous knowledge (Odora Hoppers, 2005; Webb, 2016) and professional teacher development (Pretorius, 2015). Yet, there is limited literature on the intrinsic value, affective learning and the affective development of teachers- and pedagogical content knowledge (PCK) development related to this curriculum imperative of indigenous knowledge. As a result, this paper will attempt to reveal teacher's affective development- which is, according to researchers like Pintrich, Marx & Boyle (1993) and Hynd (2003), of big importance for teachers' conceptual change and PCK development.

## 2. RESEARCH QUESTIONS, AIM AND OBJECTIVE

### 2.1 Primary research question:

What are the affordances of an indigenous knowledge professional development intervention for the affective development of Natural- and Life Sciences teachers?

### 2.2 Secondary questions:

How do Natural- and Life Sciences teacher's values, beliefs and attitudes change towards the teaching of indigenous knowledge during and after the intervention?

How does the affective development of a Natural Sciences and Life Sciences teacher shape their pedagogical content knowledge (PCK)?

### 2.3 Aim:

The aim of the research is to investigate the affordances of an indigenous knowledge professional development intervention and the affective development of Natural Sciences and Life Sciences teachers.

### 2.4 Objectives:

The objectives of the research are:

to explore the Natural Sciences and Life Sciences teachers' perceptions, values and attitudes regarding the teaching of indigenous knowledge (their affective stance);

to determine what the affordances are of such a short course, by analyzing the teacher responses in the questionnaires before and after the intervention;

to explain why teachers' pedagogical content knowledge and conceptual change cannot be only studied through a 'cold' cognitive lens, but why the focus on the affective domain is so important.

## 3. THEORETICAL AND CONCEPTUAL ORIENTATION

This paper employs social constructivism as a theoretical framework. Vygotskyan theory stresses the role of social interaction within a community to "make meaning" and thus develop cognition as well as skills, values and attitudes (Vygotsky, 1978). Language as well as culture, are vital for cognitive and affective development and how humans understand reality (Powell & Kalina, 2009). As suggested by Vygotsky, learning is largely a social phenomenon and is therefore, constructed through language and culture.

Lev Vygotsky's social constructivist ideas underpin the ideas in this paper. The 'zone of proximal development' (Vygotsky, 1978) is identified as the area between the 'potential development' and 'actual development' of the teacher. The 'zone of proximal development' according to Vygotsky can be overcome if valuable intervention occurs. This paper focuses on the 'zone of proximal development' of Natural Sciences and Life Sciences teachers (Warford, 2011) during a professional development intervention at the North-West University in South Africa. The 'zone of proximal teacher development' (ZPTD) proposed by Warford (2011) incorporates Vygotskyan theory into Western models of teacher education. The paper focuses on the affordances of a short course for the affective development of teachers, and how this mediation could bridge the gap between their actual development and their potential development with regards to teaching indigenous knowledge. Our basic assumption is that if teachers have positive attitudes towards the incorporation of indigenous knowledge in the science classroom, they would learn more about indigenous knowledge, and so develop their own PCK.

### 3.1 Third-generation cultural-historical activity theory (CHAT)

Activity theory was pioneered by constructivist Lev Vygotsky (1978) and Engeström built on this knowledge and developed the third generation activity theory (Engeström, 2000). This paper utilised CHAT as a theoretical lens. The CHAT lens can be utilized by the researcher to identify tensions or contradictions related to the affective development of the teachers with regards to indigenous knowledge. Figure 1 illustrates CHAT as a theoretical lens for this paper, and highlights how tensions could emerge between the different 'nodes' in the activity system, namely the subject, object, tools, rules, community and division of labour. Natural Sciences and Life Sciences teachers are the 'subject' that will utilise tools such as hands-on activities, cultural artefacts, critical thinking sessions and excursions to develop their own PCK and worldviews/ attitudes (affective domain) for teaching indigenous knowledge. The intervention activities during the short course are intended to develop teachers' values, attitudes, motivation (the affective domain) and pedagogical content knowledge (cognitive and psychomotor domains) for teaching indigenous knowledge. As argued earlier, cognitive development can never be seen in isolation from affective development. The rules governing the intervention rely on various aspects, such as the active participation and reflection of the teachers. The rules also imply the tenets of the nature of science, as well as the tenets of the nature of indigenous knowledge. "Hot" factors, such as religious or cultural concerns, may influence teachers' learning (Pintrich, Marx & Boyle, 1993). The community members include teachers, the facilitators, learners and the principals. The division of labour suggests that the teachers should become a facilitator for indigenous knowledge as well as a life-long learner. The overall outcome of the intervention strives to empower and motivate teachers to teach indigenous knowledge effectively creating an interest among learners.

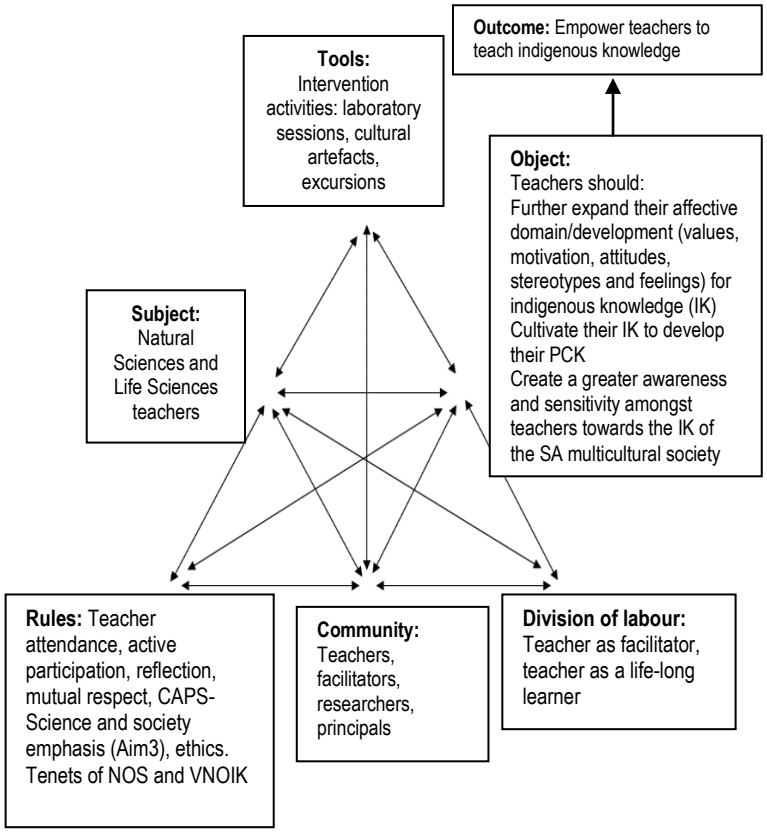


**Figure 1: Third-Generation Cultural-Historical Activity Theory adapted from Engeström (1987) integrating the affective domain (Krathwohl, 2002).**

### 3.2 Krathwohl's taxonomy of the affective domain

The three domains for human development comprise of the affective domain, the cognitive domain and the psychomotor domain (Krathwohl, 2002). The affective domain refers to values, attitudes and motivation, and offers a spectrum ranging from the simple awareness of internal organisation which guides teacher behaviour (Birbeck & Andre, 2009), to the "*internalisation of values*" (Lynch et al., 2009:1). *"The affective domain includes objectives which describe changes in interest, attitudes and values"* (Lynch, Russell, Evans, & Sutterer, 2009:48). Research alludes that the affective domain is the "*gateway to learning*" (Pierre & Oughton, 2007). Affective learning according to Kearney (1994) is "*an increase internalisation of positive attitudes toward content or subject matter*" (Rovai, Wighting, Baker, & Grooms, 2009:7). Krathwohl's taxonomy of the affective domain (Krathwohl, 1964), is utilised as an intermediate theory to explore if any affective development has taken place and if teacher perceptions has changed positively or negatively toward teaching indigenous knowledge.

Organisation signifies conceptualisation, internalisation and organisation of values (Rovai, Wighting, Baker, & Grooms, 2009:8) to develop a personal value system. Characterisation is the highest level of internalisation of values, promoting a consistent value system (Rovai, Wighting, Baker, & Grooms, 2009:8) where teachers will act on their values or beliefs. Teachers' positive attitudes and excitement toward what they will experience and learn during the indigenous knowledge intervention can in turn promote self-directed learning and develop their pedagogical content knowledge. These theoretical views form part of the paper's conceptual framework. The combined theoretical and conceptual framework shown in figure 2 below will provide a clearer overview of the aim of this paper.

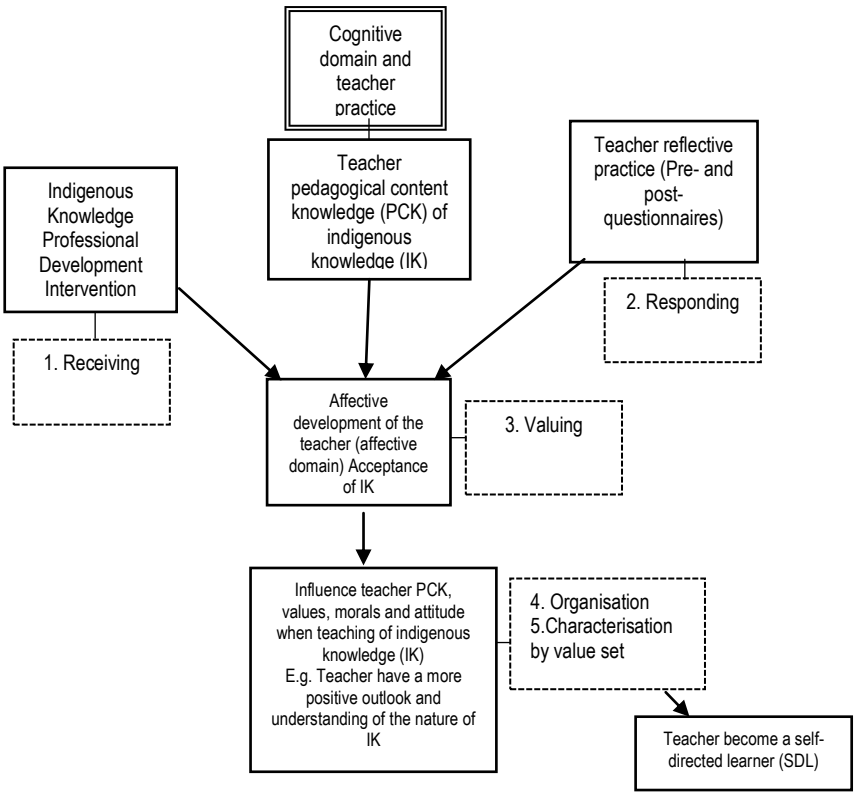


**Figure 2: Conceptual framework model of the affective development of teachers adapted from (Krathwohl, 1964) during an indigenous knowledge intervention**

## 4. RESEARCH DESIGN AND METHODOLOGY

### 4.1 Research design

This paper follows an interpretive empirical qualitative approach. Qualitative research according to Patton (cited by Merriam, 2002:5) "strives for the depth of understanding." The interpretive qualitative approach will attempt to create an understanding of how specific participants (Natural Sciences and Life Sciences teachers) make sense of a specific phenomenon (indigenous knowledge). The empirical slant ultilised actual hands-on practical's to allow for rationalising science teaching and learning (Pretorius, 2015). This qualitative inquiry will attempt to describe, using words, the affective development of teachers. Data collected is of a qualitative nature to encourage real-life circumstantial perceptions in the Natural Sciences and Life Sciences teachers' world (Creswell, 2013; Henning, Van Rensburg, & Smit, 2004).

### 4.2 Methodology

A professional development intervention is aimed at teachers, in order to learn new skills or improve particular skills. It is a strategy to encourage and promote professional development of teachers. During the teacher intervention, Krathwohl's taxonomy will be used as a set of criteria (levels of internalisation) to streamline the complexity of the thinking and reflection processes. This taxonomy was used by the researcher to describe the affective development of the teachers who attended the short course (Anon, 2010; Lynch, Russell, Evans, & Sutterer, 2009).

This paper describes a short (three day) professional development intervention at the North-West University at Potchefstroom Campus (NWU) to develop Natural Sciences and Life Sciences teachers' pedagogical content knowledge (PCK) and affective domain for teaching indigenous knowledge. This

intervention was offered to teachers who attended voluntarily and who were interested in engaging with indigenous knowledge content and hands-on activities to incorporate indigenous knowledge into their own classrooms.

During the intervention teachers engaged in various activities to encourage indigenous knowledge pedagogy and teacher professional development. Teachers went on an excursion to a museum (where they could potentially also take their own learners to) to promote indigenous knowledge in the classroom. Teachers were exposed to various medicinal plants, cultural artifacts as well as Bakgatla technological advances, e.g. in food preparation. Teachers completed a hands-on anti-microbial practical with agar plates and indigenous plants. These types of practical labs expose teachers to incorporating indigenous knowledge into the classroom, creating learner interest, while incorporating the scientific method. It was intended to show teachers how science and indigenous knowledge share common tenets, e.g. both are empirical and creative (Cronje, De Beer & Ankiewicz, 2015). These experiences and perspectives of the intervention allow teachers to create an understanding, sensitivity and value toward a more nuanced view of the world that they work in and teaching indigenous knowledge (Pretorius, 2015).

**4.3 Sampling and data collection methods**

A purposeful sampling strategy was employed (Creswell, 2013), as the research was aimed specifically at Natural Sciences and Life Sciences teachers from high schools in the North-West Province. Teachers volunteered to take part the intervention in aid of their own professional development. The teachers came from various ethnic groups and cultural backgrounds. Teachers that participated in the intervention ranged from inexperienced to highly experienced teachers – with regard to both the number of years they have been teaching, and their pedagogical content knowledge. Qualitative data collection instruments consisted of questionnaires including the Views of the Nature of Science (VNOS) questionnaire (Abd-El-Khalick, 2013) and Views of the Nature of Indigenous Knowledge (VNOIK) (Cronje, De Beer, & Ankiewicz, 2015). The questionnaires included an online (google forms) or paper based pre-questionnaire and post-questionnaire in an attempt to see if any affective development was encouraged. This can provide evidence for the 'zone of proximal teacher development (Warford, 2011) during the intervention. Face-to-face, one-on-one personal teacher interviews (Creswell, 2013) were conducted during the intervention, by means of various questions relating to the affective domain. Observations of the participants actively engaging in the activities during the intervention were completed (Creswell, 2013), and we utilized the Reformed Teaching Observation Protocol (Arizona Board of Regents, 2000) in doing so. Artefacts such as photographs were taken (Creswell, 2013:181), to provide visual evidence, which will aid in the validity of this study.

**4.4 Ethical considerations**

According to Creswell (2013), ethical issues should be considered throughout the study, not only during the data collection stage. Research in essence is collecting data from people (Punch & Oancea, 2014), and therefore research participants must not feel overwhelmed or intimidated (Creswell, 2013). Ethical clearance was obtained from the Ethics Committee at the North-West University (NWU) (NWU-00271-16-A2). Consent and confidentiality agreement forms were completed by all the respondents (Natural Sciences and Life Sciences teachers) involved. Confidentiality of the respondents as the participants will remain anonymous (using pseudonyms).

**4.5 Methods of data analysis**

Data analysis is an attempt to make sense of text and image data (Creswell, 2013) which will provide answers to the original primary research question (Merriam & Tisdell, 2015). Teacher interviews and questionnaires were transcribed and coding-to-theory as suggested by Saldana (2015) was used. Coding identified shorts phrases from teacher responses to create categories and group these categories into themes to obtain a better understanding of the data that was collected. The VNOIK instrument was administered as described by Cronje (2015), and her suggested method of data analysis

was also used. A rubric was used to code responses to the questions, and was coded as an informed view, a partially informed view or an uninformed view.

**4.6 Validity and reliability**

Validity and reliability are important aspects to consider with regard to qualitative research (Morse, Barrett, Mayan, Olson, & Spiers, 2002). 'Qualitative rigour' and 'trustworthiness' of the nature of qualitative research as suggested by Lincoln and Guba (1985), includes four aspects namely "credibility, transferability, dependability and confirmability" (Morse, Barrett, Mayan, Olson, & Spiers, 2002:14). Data collected was linked and compared to literature using data triangulation (Abowitz & Toole, 2010; Denzin & Lincoln, 2008). The different types of data such as teacher interviews and responses from the questionnaires and evidence from literature were be compared, to support the validity, reliability and trustworthiness in this study (Golafshani, 2003). This was an attempt to avoid bias. Construct validity was ensured by asking a panel of experts to peruse the questionnaire and interview protocol.

**5. RESULTS AND DISCUSSION**

As an ongoing study that only commenced in 2016, various initial themes emerged from analysing the limited data.

**5.1 Theme 1: The intervention provided teachers with a more nuanced understanding and appreciation of indigenous knowledge**

The Views of the Nature of Indigenous Knowledge questionnaire captured teachers' knowledge of and views of indigenous knowledge. From the preliminary analysis, it is clear that there has been a general shift towards a more nuanced understanding of indigenous knowledge among teachers. A number of teachers progressed from an uninformed view of indigenous knowledge, to a partially informed view. Several teachers also progressed from a partially informed, to an informed view.

**5.2. Theme 2: Teachers acknowledge that the teaching of indigenous knowledge (IK) can stimulate learners' interest and motivation to learn Natural Sciences and Life Sciences**

The second theme that emerged was that teachers acknowledged the affordances of indigenous knowledge for more effective science teaching and learning. One teacher commented that *"Learners mostly do not relate with the scientific knowledge so indigenous knowledge will contribute to their learning process*". Another teacher stated that "*I can see how my class will become alive, when we start discussing traditional healing. This course has made me realize that I as a teacher should ensure that I stimulate learners' interest in science*". This is pertinent to context-sensitive science (Mode 2 knowledge production) as suggested by Gibbons (2000). Science education and society cannot be separated; it is important to integrate the two spheres to make learning more meaningful. Learners can relate better to their own indigenous knowledge and teachers can integrate indigenous knowledge into science content to foster mode 2 knowledge production rather than the traditional mode 1 cognitive approach.

**5.3 Theme 3: The affective and cognitive goes hand-in-hand in teacher professional development**

Teachers who are not knowledgeable about indigenous knowledge (thus having an under-developed pedagogical content knowledge) become demotivated to incorporate indigenous knowledge into their teaching. This could create poor learner interest with regard to indigenous knowledge. One of the teachers stated that "*I have never considered teaching indigenous knowledge, because I did not have the necessary knowledge. I guess that made me negative about indigenous knowledge. This course has changed it, and I feel inspired to infuse all these new ideas into my teaching*". The flipside is also true. Where teachers have negative perceptions (affective domain) of indigenous knowledge, they might not teach it: "*I always saw indigenous knowledge as mumbo-jumbo and not as real science, so I did not teach it. After these three days, I feel inspired to go and teach indigenous knowledge in my Natural Science class*". These findings reminded us of how important the affective domain is in teacher professional development, and that the emphasis should not only be on cognitive outcomes.

**5.4. Theme 4: Teachers' lack of knowledge on indigenous knowledge should also be viewed in terms of available resources**

One of the teachers said she felt *"confusion because most of the time it* (indigenous knowledge) *encompasses knowledge known within a community and that knowledge may be known only by tribal elders or people from rural areas*." This not only indicated that teachers are not familiar with the concept of indigenous knowledge and are not aware of its value, but also that the textbooks used in schools do not adequately address indigenous knowledge. Teachers who are not aware (Krathwohl, 1964) of the value of indigenous knowledge and its affordance close the door on the use of resources such as knowledgeable holders of indigenous knowledge, for example, elders or traditional healers, or the use of pedagogies such as drama and puppetry that is aligned with the oral tradition of indigenous knowledge. Lack of resources for teaching indigenous knowledge, and similarly lack of PCK (e.g. in improvising materials that could be used to teach indigenous knowledge), are some of the tensions identified using the third generation activity theory (CHAT). One of the teachers commented: "*I was so inspired by the anti-microbial lab activity we did, and I would love to go and do it in my classroom too, but we do not have the apparatus in my school, and I just cannot think of other ways of doing these experiments*". If one would use CHAT as a research lens, it shows that teachers do not always receive the necessary support in their professional development in their schools (e.g. the subject advisors- as part of the "community" in the activity system, providing scaffolding and ideas).

**5.5 Theme 5: Many teachers have negative attitudes themselves about indigenous knowledge related to 'myth' or 'witchcraft', but the short course does play a role in changing this**

Another theme surfaced that confirms Keane's (2015) idea that some teachers as well as learners view indigenous knowledge as a 'myth' or 'witchcraft'. A teacher said *"I do not believe in this stuff".* Evidence shows that teachers have negative attitudes themselves about indigenous knowledge that relates to stereotypes such as supernatural practices that do not align with religion. A teacher noted that *"some believe it is witchcraft and do not believe in it"* and another teacher said that *"there is a contradiction to rules and regulations of God our creator*". Teachers and learners have misconceptions with regard to indigenous knowledge due to the various cultures and religions existing in the classroom. However, several teachers indicated that they have changed their views on indigenous knowledge after the course. One of the teachers commented: "*It was so interesting to hear that there is scientific merit in using "Impinda", and that it is not witchcraft. I was impressed with this indigenous knowledge*".

**5.6 Theme 6: The course played a role in making teachers more reflective practitioners, setting professional development goals for themselves**

Data points to the fact that teachers who attended the short course realize the importance of being reflective practitioners, setting professional development goals for themselves after the indigenous knowledge intervention. This shows that the short learning programme serves to make teachers more aware of indigenous knowledge (receive – level 1 in Krathwohl's taxonomy) (Krathwohl, 1964) as they get the opportunity to engage with indigenous knowledge during the intervention (respond – level 2) (Krathwohl, 1964) and this lead to start valuing indigenous knowledge systems (value – level 3) (Krathwohl, 1964). A teacher indicated after the intervention that *"it was very interesting and fruitful to me"*, another teacher responded *"I have learnt new things that will help me be a better science teacher, it is never enough with learning, you will always discover new things."* This data also shows that teachers are becoming more aware of the affordances of indigenous knowledge. Data suggests that teachers aim to develop their understanding of indigenous knowledge such as medicinal plants. This is evidence that teachers are 'accepting' indigenous knowledge and are more open to this notion. The various teachers listed skills that they have expanded after the intervention such as observation, laboratory, research and safety skills.

**6. CONCLUSION**

The preliminary research suggests that teachers' do benefit from the three-day indigenous knowledge intervention, in terms of both cognitive and affective outcomes. It is unlikely that teachers have developed their affective domain fully during the short course and it is therefore important that teacher professional development is further developed in communities of practice. The intervention is only a stepping stone toward a more nuanced view of indigenous knowledge pedagogy, and will not allow for organization (level4) (Krathwohl, 1964) and characterisation of values (level 5) (Krathwohl, 1964). It is recommended that the affective development of teachers receives more emphasis in both pre-service and in-service teacher educations.

Teacher professional development programmes and mode 2 knowledge production as suggested by Gibbons (2000) should receive more attention in teacher professional development. Teachers should understand how important it is to contextualise Natural Sciences and Life Sciences so that it is more meaningful to the learners, but for indigenous knowledge to be meaningful to learners it must start with the teachers' affective development, and nuanced understanding and appreciation of indigenous knowledge. There is a call for further research in this regard especially in a South African context. So often teacher PCK development is only viewed through "cold" lenses (Pintrich, Marx & Boyle, 1993), and not a hot lens that also focuses on teachers' affective development, values and attitudes towards indigenous knowledge.

## 7. REFERENCES


Abd-El-Khalick, F. (2013). Teaching with and about nature of science, and science teacher knowledge domains. *Science & Education, 22*(9), 2087-2107.

Abowitz, D., & Toole, T. (2010). Mixed methods research: Fundamental issues of design. *Validity, and Reliability in Construction Research, ASCE*.

Anon. (2010). Krathwohl's Taxonomy of the Affective Domain. Retrieved from http://www.det.wa.edu.au/curriculumsupport/giftedandtalented/detcms/navigation/identification-provision-inclusivity-monitoring-and-assessment/provision/teaching---learning-models/taxonomy-of-affective-domain/

Arizona Board of Regents (2000). Reformed Teaching Observation Protocol.

Birbeck, D., & Andre, K. (2009). *The affective domain: beyond simply knowing.* Paper presented at the ATN Assessment Conference 2009: Assessment in Different Dimensions.

Buma, A. (2015). *A short intervention program to develop science teachers' pedagogical content knowledge to teach for the affective domain.* (PhD), University of Johannesburg.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*: Sage publications.

Cronje, A. (2015). *Epistemological border crossing between western science and indigenous knowledge and its implications for teacher professional development.* (PhD), University of Johannesburg.

Cronje, A., De Beer, J., & Ankiewicz, P. (2015). The Development and Use of an Instrument to Investigate Science Teachers' Views on Indigenous Knowledge. *African Journal of Research in Mathematics, Science and Technology Education, 19*(3), 319-332.

De Beer, J. & Henning, E. (2010). Om te fluister teen die donderweer: onderwysers leer oor evolusie. Unpublished manuscript.

Denzin, N. K., & Lincoln, Y. S. (2008). *Collecting and interpreting qualitative materials* (Vol. 3): Sage.

Department of Education. (2011). *National Curriculum Statement. Curriculum and assessment policy statement: Life Sciences*. Pretoria: Government Printing Works.

Engeström, Y. (2000). Activity theory as a framework for analyzing and redesigning work. *Ergonomics, 43*(7), 960-974.

Fien, J. (2010). Indigenous knowledge and sustainability. Retrieved from http://www.unesco.org/education/tlsf/mods/theme_c/mod11.html

Gentner, D., & Stevens, A. L. (2014). *Mental models*: Psychology Press.

Gibbons, M. (2000). Mode 2 society and the emergence of context-sensitive science. *Science and public policy, 27*(3), 159-163.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report, 8*(4), 597-606.

Grenier, L. (1998). *Working with indigenous knowledge: A guide for researchers*: IDRC.

Hattingh, M. (2013). Cultural diversity in South Africa. Retrieved from http://www.dreamstoreality.co.za/cultural-diversity-in-south-africa/

Henning, E., Van Rensburg, W., & Smit, B. (2004). *Finding your way in qualitative research*: Van Schaik Pretoria.

Hynd, C. (2003). Conceptual change in response to persuasive messages. In: G. Sinatra and P. Pintrich, Intentional conceptual change. Mahwah, N.J. (pp 291 - 315).

Keane, M. (2015). Why indigenous knowledge has a place in the school science curriculum? Retrieved from http://theconversation.com/why-indigenous-knowledge-has-a-place-in-the-school-science-curriculum-44378

Krathwohl, D. R. (1964). *Taxonomy of Educational Objectives: Affective domain* (Vol. 1): Longmans, London.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into practice, 41*(4), 212-218.

Lynch, D. R., Russell, J. S., Evans, J. C., & Sutterer, K. G. (2009). Beyond the Cognitive: The Affective Domain, Values, and the Achievement of the Vision. *Journal of Professional Issues in Engineering Education & Practice, 135*(1), 47-56. doi:10.1061/(ASCE)1052-3928(2009)135:1(47)

Meier, C., & Hartell, C. (2009). Handling cultural diversity in education in South Africa. *SA-eDUC Journal, 6*(2), 180-192.

Merriam, S. B. (2002). Introduction to qualitative research. *Qualitative research in practice: Examples for discussion and analysis, 1*, 1-17.

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation*: John Wiley & Sons.

Morse, J. M., Barrett, M., Mayan, M., Olson, K., & Spiers, J. (2002). Verification strategies for establishing reliability and validity in qualitative research. *International journal of qualitative methods, 1*(2), 13-22.

Mothwa, M.M. (2011). Teachers' experiences of incorporating indigenous knowledge in the Life Sciences classroom. University of Johannesburg: Unpublished M.Ed thesis.

Odora Hoppers, C. A. (2005). Culture, indigenous knowledge and development.

Ogunniyi, M. B. (2002). The challenge of preparing and equipping science teachers in higher education to integrate scientific and indigenous knowledge systems for learners (Vol. 18, pp. 289-304): University of South Africa.

Pierre, E., & Oughton, J. (2007). The Affective Domain: Undiscovered Country. *College Quarterly, 10*(4), 1-7.

Pintrich, P.R., Marx, R.W. & Boyle, R.A. (1993). Beyond cold conceptual change: The role of motivational beliefs and classroom contextual factors in the process of conceptual change. *Review of Educational Research*, 63(2): 167 - 199.

Powell, K. C., & Kalina, C. J. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education, 130*(2), 241-250.

Pretorius, E. D. (2015). *Learning Communities for the Professional Development of Science Teachers.* University of Johannesburg.

Punch, K. F., & Oancea, A. (2014). *Introduction to research methods in education*: Sage.

Rodgers, C. (2002). Defining reflection: Another look at John Dewey and reflective thinking. *Teachers College Record, 104*(4), 842-866.

Rovai, A. P., Wighting, M. J., Baker, J. D., & Grooms, L. D. (2009). Development of an instrument to measure perceived cognitive, affective, and psychomotor learning in traditional and virtual classroom higher education settings. *Internet & Higher Education, 12*(1), 7-13. doi:10.1016/j.iheduc.2008.10.002

Saldaña, J. (2015). *The coding manual for qualitative researchers*: Sage.

Senanayake, S.G. (2006). Indigenous knowledge as the key to sustainable development. *The Journal of Agricultural Sciences* 2(1), 87 - 94.

Shizha, E. (2008). Indigenous? What indigenous knowledge? Beliefs and attitudes of rural primary school teachers towards indigenous knowledge in the science curriculum in Zimbabwe. *The Australian Journal of Indigenous Education, 37*(01), 80-90.

Vygotsky, L. S. (1978). Mind in society. *Harvard University Press*.

Warford, M. K. (2011). The zone of proximal teacher development. *Teaching and Teacher Education, 27*(2), 252-258. doi:http://dx.doi.org/10.1016/j.tate.2010.08.008

Warren, D. M. (1996). *Indigenous knowledge, biodiversity conservation and development*.

Webb, P. (2013). Xhosa indigenous knowledge: Stakeholder awareness, value, and choice. *International Journal of Science and Mathematics Education, 11*(1), 89-110.

Webb, P. (2016). *Indigenous knowledge and science education: What knowledge, whose knowledge and how do we bridge the gap?*

Wormeli, R. (2015). The 7 habits of highly affective teachers. *Educational Leadership, 73*(2), 10-15.