



**Abstract:** *This exploratory qualitative case study explored the pedagogical beliefs and classroom practice of four Post Graduate Certificate in Education (PGCE) students when they implement Information and Communication Technology (ICT) for teaching and learning, including what influences their beliefs. Data were gathered by means of a teacher belief system (TBS) tool, drawing prompts that led to individual interviews, an open-ended questionnaire, lesson plans and assessment feedback forms, short summaries of how they used the ICT resources and feedback from the method lecturer and an appointed mentor teacher. The findings suggest that there appears to be a mismatch between the participants' espoused beliefs and enacted beliefs when using ICT at this point in time. The participating student-teachers used ICT tools predominately in teacher-centred ways, yet they indicated that they held learner-centred beliefs. At the same time, this does not imply that there were no learner-centred activities during their lessons. The data seems to suggest that their exposure to teacher-centred pedagogy while being learners at school, as well as their tertiary experience could have played a role in how they taught Science. It is therefore important that lecturers model constructivist learner-centred pedagogy to students and provide opportunities for students to plan and model such practice.*

**Key words:** *habitus, ICT beliefs, learner-centred pedagogy, student-teacher beliefs, teacher-centred pedagogy.*

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## STUDENT-TEACHERS' PEDAGOGICAL BELIEFS: LEARNER-CENTRED OR TEACHER-CENTRED WHEN USING ICT IN THE SCIENCE CLASSROOM?

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### Introduction

Teachers have epistemic and pedagogical beliefs which influence how they facilitate learning (Chai, 2010). Epistemic beliefs refer to what is viewed as knowledge and how do we learn (Chai, 2010), whereas pedagogical beliefs denote teachers' "educational beliefs about teaching and learning", hence how a teacher believes he/she should teach, which includes the selection of the pedagogical approach or strategy (Ertmer, 2005, p. 28).

Ertmer (2005) argues that teacher beliefs are not only extremely personal in nature, but that our previous experiences also influence beliefs, hence her argument is very similar to Kagan (1992), Pajares (1992) and Bai and Ertmer (2004), as these authors posit that previous teaching experiences could play a role in the manner that teachers teach. The implication thus seems to be that previous school experiences, as well as what prospective teachers experienced at university or college, appear to influence their practice. The above has been alluded to by Nespor (1985, p. 1) who stated that "Teachers are thus said to have learned about teaching while they themselves were students" and "teachers' practices are heavily influenced by their experiences in classrooms – more so, indeed, than by their formal training." Fives and Buehl (2012, p. 478) argue that "beliefs act as filters, frames, or guides." Their position is that our beliefs influence and guide practice (Fives & Buehl, 2012, p. 478) as "Beliefs guide intention and action" (Five & Buehl, 2012, p. 479). The implication from the above is thus that beliefs influence not only what a teacher decides to include or exclude as being important, but also how the teacher would approach the content, including his/her teaching strategy (Five & Buehl, 2012). It is thus evident that changing beliefs is not something that occurs on the spur of the moment, yet change is possible (Belland, 2009).

Kember (1997) categorises pedagogical beliefs as either being teacher-centred or student-centred. The teacher-centred position focuses on transmission or direct instruction (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurer & Sendurer, 2012, p. 427, citing Ertmer et al., 2001) where learners are mere passive listeners (Brooks & Brooks, 1999). In a teacher-centred classroom the focus is on memorization (remembering), traditional tests, the presentation of knowledge by the teacher, the completion of individual tasks, etc. which



suggest that it is product orientated (Ertmer et al., 2001 cited by Ertmer et al., 2012, p. 427). The learner-centred position advocates collaboration among learners (Brooks & Brooks, 1999) through meaning making and the presentation of their understanding, which from an Information and Communication Technology (ICT) perspective requires that learners use ICTs as cognitive tools (Jonassen & Reeves, 1996). In addition, learner-centredness advocates active learning, guided discovery, focusing on understanding instead of memorization, application of knowledge, alternative forms of assessment, self-assessment, reflection, etc. (Ertmer et al., 2001 cited by Ertmer et al., 2012, p. 427). However, Kember (1997) also stated that an individual could be in a transitional position, *i.e.* between these above-mentioned positions and as such be moving towards an alternative position or orientation. The above indicates that the teacher-centred position refers to the behaviouristic perspective, whereas the learner-centred perspective refers to constructivism (see Brooks & Brooks, 1999). Deng, Chai, Tsai and Lee (2014), Ertmer et al. (2012, with reference to Ertmer, Gopalakrishnan & Ross, 2001) and Niederhauser and Stoddart (2001) have also categorised ICT classroom practice similar to the above as being either teacher-centred or learner-centred. Chipunza (2011, p. 69) suggested that teachers' pedagogical beliefs can be extended to the following five categories namely, "*traditional, close-to-traditional, transitional, close-to-constructivist and constructivist*", which she used in her study.

It is important to take cognizance of the fact that not all teachers who profess to hold constructivist beliefs, implement ICTs in pure constructivist ways; rather it appears that there is a tendency that these teachers use ICT by implementing both traditional and constructivist approaches in a "*blended*" manner (Ertmer et al., 2012, p. 424 with reference to Ertmer, Gopalakrishnan & Ross, 2001). Prestridge (2010, 2012 with reference to Albion & Ertmer, 2002) states that there often appears to be a mismatch between teacher beliefs and the manner in which ICT is implemented at classroom level. The above refers to what Argyris, Putnam and McLain Smith, (1985, p. 81) articulated as "*espoused theory*" and "*theory-in-use*". These authors claimed that it often occurs that the theoretical perspective a person claims to follow could be different from how the theory '*plays out*' or is implemented during practice (Argyris et al., 1985), hence alluding to the potential for contradictions or misalignment between intention and actual usage.

Ertmer (2012) posits that constructivist teachers appear to be more aware of their learners' needs, suggesting also that constructivist teachers are more aware of the possibilities constructivism offers. Howard, Chan and Caputi (2015) and Petko (2012) argue that the potential benefits that ICT holds could become a persuading factor – similar to Rogers' (2003) relative advantage, thus also aligning with perceptual control theory (PCT) (Powers, 1973; Zhao & Cziko, 2001). Zhao and Cziko (2001, pp. 15-17, 27) argue with reference to PCT that teachers who believe that ICT can promote the attainment of higher-level goals when implemented without causing disturbances to other existing higher-level goals that they want to achieve, will be more inclined to change their ICT usage, *i.e.* their technology practice. However, they add that the teacher has to believe that he/she will be able to master the tool (Zhao & Cziko, 2001, p. 27), which thus also implies self-efficacy (Bandura, 1977, 1997). If constructivist learner-centred approaches seems to promote higher level goals, then from a PCT perspective the teacher who holds traditional teacher-centred beliefs will have to be convinced that it is worthwhile to embrace constructivist learner-centred principles and that the usage of ICT as technology tool will assist him/her to achieve these higher level goals - hence, teacher belief in the tool is thus central in PCT. In addition, resources are also imperative (Zhao & Cziko, 2001) and these resources include technical support and physical resources. The teacher thus has to believe that when ICT tools are implemented, these ICT tools will assist him/her to achieve these higher level goals and beliefs in a more effective manner than before (Zhao & Cziko, 2001) which could require a fundamental change from previous beliefs. Belland (2009) and Zhao and Cziko (2001) have argued that change is possible despite many '*obstacles*', but that it is important to take note that change does not happen overnight. It is also important to note that it appears to be easier for teachers to implement ICT in certain subject areas due to the outcomes or nature of the subject (Howard et al., 2015; Prestidge, 2010, 2012).

In order to make sense of our beliefs and practices, it is argued that Bourdieu's (1977; 1984, 1990, 1991, 1993, 1994) theory of habitus appears to be useful (see Belland, 2009; Noyes, 2007; Adam & Wright, 2014). Habitus can be defined as "*A set of dispositions which incline agents to act and react in certain ways. The dispositions generate practices, perceptions and attitudes which are 'regular' without being consciously co-ordinated or governed by any 'rule'*" (Thompson, 1991, p. 12). These dispositions refer to our perceptions, feelings, thinking, actions and behaviour (Maton, 2008). Bourdieu (1993, p. 86) states that habitus is "... *a product of history, produces individual and collective practices - more history - in accordance with the schemes generated by history. It ensures the active presence of past experiences ...*" (Bourdieu, 1990, p. 54) and as such is "*structured and structuring structure*" (Bourdieu, 1994, p. 170), *i.e.* past and present structures influence and shape the present and future. From the above, it becomes evident



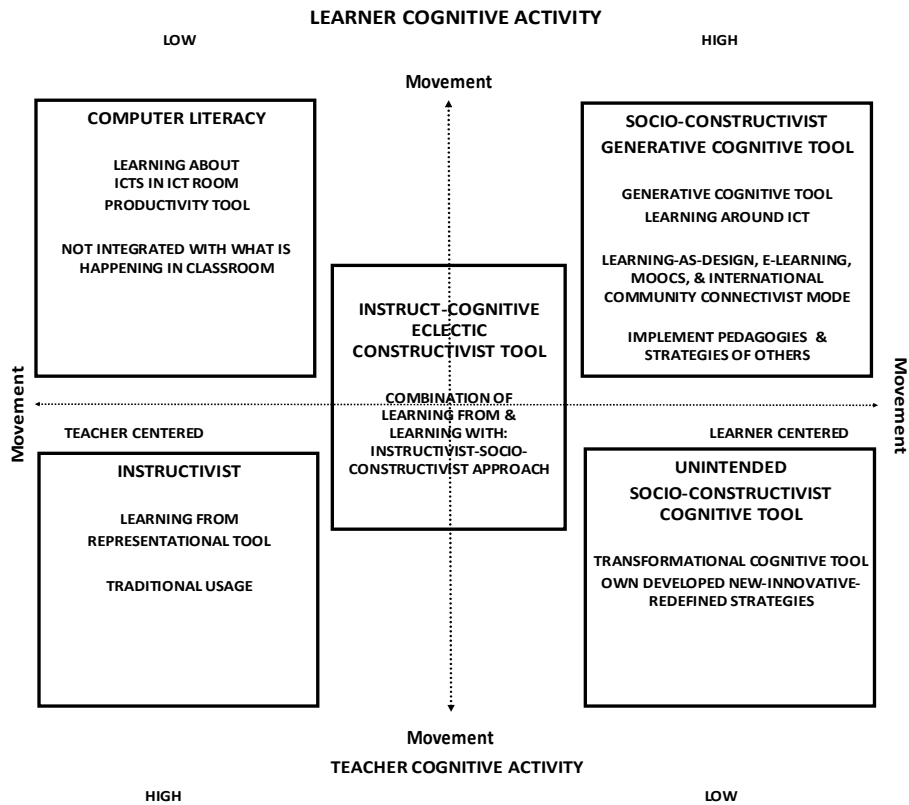
that habitus as disposition has a historical dimension that influences practices or actions in such a manner that we are sometimes not even aware of its influence on us as human beings (Matton, 2008). It is thus argued that habitus encompasses beliefs, beliefs that guide action, similar to what Reay (2004, p. 433) alluded to when stating “*while the habitus allows for individual agency, it also predisposes individuals towards certain ways of behaving.*” However, we have choices despite the schema that our habitus creates, or as Belland (2009, p. 257) states, “*Habitus generates schema, which in turn tends to lead to certain actions,*” hence it ‘tends’ and does not predict: its dispositional nature refers to “*a predisposition, tendency, propensity or inclination*” which influences actions and thinking (Bourdieu, 1977, p. 214). It appears thus that habitus is a powerful force that shapes and reproduces our dispositions and actions, hence from a teaching context perspective these historical ‘*folk pedagogies*’ (Belland, 2009 with reference to Brunner, 1996) that learners experienced while at school from an early age until the time they leave school, influence perceptions related to teaching and learning practices, including our beliefs. These previous teaching and learning experiences can thus become unconscious tacit beliefs (Belland, 2009). It is thus evident that teachers’ beliefs, and here the researcher includes student-teacher’s beliefs, appear to be one of the key aspects that drive how teachers perceive and engage with ICT implementation for teaching and learning (Chai, 2010; Chipunza, 2011; Deng *et al.*, 2014; Ertmer, 2005; Howard *et al.*, 2015; Judson, 2006; Petko, 2012; Prestridge, 2010, 2012; Sang, Valcke, Van Braak & Tondeur, 2010).

The researcher is also of the opinion that the dispositions of a student-teacher or qualified teacher pertaining to ICT implementation can be influenced by aspects that Rogers (2003) highlighted in his perceived attributes theory and innovation-decision process theory, as well as aspects that Bandura (1977, 1997) referred to related to social learning and self-efficacy. Rogers (2003) emphasized the importance of knowledge and persuasion, as well as simplicity, trialability, observability, relative advantage and compatibility when innovations are diffused. It is argued that these aspects above also have the potential to influence change and agency with reference to practice to which Belland (2009) referred to as pedagogic action. Hence, in order to be persuaded to embrace constructivist learner-centred strategies in which ICT is utilized as a tool based on Rogers’ (2003) perspective, student-teachers and qualified teachers require information and skills pertaining to the design of strategies (see also Tsai & Chai, 2012), as well as how to implement these constructivist learner-centred ICT orientated strategies. It appears that the ‘*Responsive instructional design*’ approach of Ertmer (2001) could assist to realize the perspectives of Rogers (2003) and Bandura (1997, 1997) referred to above, as Ertmer’s (2001) approach highlights the importance of self-reflection and the development of self-efficacy by means of an approach tailored to the individual’s needs. Self-efficacy as concept within this context refers to believing that one can succeed (Bandura, 1977, 1997) or as Bandura (1997, p. 3) states, it refers to “*beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments.*” In order to promote confidence and self-efficacy, it appears that personal observation of how someone else implements a strategy or strategies holds the key (Bandura, 1997; Rogers, 2003). However, if the strategy is too complex, it could result in not believing in the self. Hence, support to assist the individual towards mastering the strategy is vital and this could be achieved when the individual tries-out and implements the strategy in his/her own classroom context (Bandura, 1997; Rogers, 2003). This is why continuous support is vital (Wilson, Sherry, Dobrovolny, Batty & Ryder, 2001), support in different forms to promote adoption (Ertmer, 2001) and where possible this support could thus even be on-site (also see Zhao & Cziko, 2001). Support includes design skills (Tsai & Chai, 2012) to enable the individual as student-teacher or qualified teacher to embed ICT in learner-centred constructivist activities during their lessons. In addition, if the student-teacher or qualified teacher can realize and experience the relative advantage (Rogers, 2003) of constructivist learner-centred strategies in which ICT is utilized, the possibility for adoption and pedagogic action appears to be greater.

### ICT Implementation Matrix

In order to position possible perspectives on how ICTs can be implemented within the school context, Kember’s (1997) categorisation of teaching beliefs as being teacher-centred, learner-centred or transitional, the ‘*from*’ and ‘*with*’ ICT perspective of Jonassen *et al.* (1996) and Jonassen, Howland, Moore, Marra and Crismond (2008), Hokansen and Hooper’s (2000) ICT as generative tool, Hodgkinson-Williams (2006) perspective that ICTs can be integrated as representational tool, cognitive tool, mediational tool and transformational tool, Donnelly, McGarr & O’Reilly’s (2011) matrix, as well as the connectivist perspective of Siemens and Tittenberger (2009) informed the conceptualization an ICT implementation matrix presented in Figure 1.





**Figure 1: ICT implementation matrix.**

The matrix suggests that ICT implementation does not have to follow a linear process, as this matrix implies that teachers entering the profession, as well as teachers within the current system have different ICT skills, are on different levels and have their own personal pedagogical beliefs. As such, the matrix suggests that a teacher could engage with ICT at any of these positions. Hence, one does not have to start engaging with learners at the computer literacy level, but could decide to implement perspectives in any of the five perspectives, even using an eclectic approach. The matrix proposes that one could pinpoint a teacher’s current ICT implementation for teaching and learning at five levels that range from mere computer literacy to re-invented constructivist implementation. The horizontal plane indicates whether the usage is teacher-centered or learner-centered, including whether the learner or teacher cognitive activity is high or low. The horizontal and vertical arrows suggest that a teacher or lecturer could enter the ICT implementation or usage at any of these five positions.

**Rationale, Gap and Research Questions**

Kim, Kim, Lee, Spector and DeMeester (2013, cited by Adam & Wright, 2014) have specifically called for research to investigate whether beliefs about knowledge and beliefs about teaching relate to ICT integration practices. Beijard, Korthagen and Verloop (2007, cited by Adam & Wright, 2014) and Korthagen (2010, cited by Adam & Wright, 2014) have argued that there appears to be a theory-practice gap between beliefs and practice. The problem with teacher belief studies, including teacher ICT beliefs, is the type of data gathering tools that are used (Judson, 2006). Judson (2006) argued that quantitative surveys and self-reporting data gathering tools seem not to be portraying the real picture, as it appears that teachers report what they think researchers want to hear. Hence, she argues that qualitative gathering tools could assist to portray a more comprehensive picture. Large research surveys, for example teaching practices reported by the OECD (2009) as one reported aspect in this survey, was also quantitative in nature. Consequently, this qualitative exploratory case study attempts thus to utilize qualitative data gathering tools to explore beliefs based on Judson’s (2006) position in order to ascertain:



- To what extent, if any, do the pedagogical beliefs and classroom practice of four PGCE students teaching at a rural South African school in the Eastern Cape Province align with their usage of Information and Communication Technology (ICT) for teaching and learning and what influences their beliefs?

In order to answer this main question, the following sub-questions have been formulated:

- What are these PGCE students' beliefs pertaining to teaching and learning?
- How do these PGCE students use ICT for teaching and learning?
- What influences these PGCE students to use ICT for teaching and learning in the manner they implement it?

The rationale for investigating four PGCE (Post Graduate Certificate in Education) student-teachers' beliefs is to enable the researcher to ascertain to what extent pedagogical beliefs are reflected in the classroom context, as it seems that there could be a mismatch between an *"espoused theory"* and *"theory-in-use"* (Argyris *et al.*, 1985, p. 81). These participating students were exposed to various learning strategies and learning theories at university. However, it appears that despite exposure to different teaching practices or strategies that in many instances, teacher-centred teaching practices persist (Adam & Wright, 2014 with reference to Beijjaard, Korthagen & Verloop, 2007; Korthagen, 2010). The research was also influenced by Chipunza (2011) as the posed research questions of this study were similar, but not identical. Chipunza's (2011) focus was on lecturers, whereas this study's focus is on four PGCE students during their school based learning experience.

## Methodology of the Research

### *Exploratory Case Study*

Ontologically this exploratory descriptive qualitative case study posits that reality is socially constructed (Creswell, 2003; Denzin & Lincoln, 2005) and as such subscribes to a subjective socially constructed epistemological perspective (Johnson & Onwuegbuzie, 2004) with the focus on understanding reality from the participants' perspective. Hence, the rationale is to provide a voice to the four participating PGCE Science and Mathematics students in order to portray their reality by means of language as tool (Henn, Weinstein & Foad, 2006) to obtain the participants' perceptions and experiences through their eyes (Cohen, Manion & Morrison, 2007) with reference to their teaching philosophy, beliefs related to ICT, the alignment between their beliefs and the way in which they use ICT for teaching and learning and lastly, what influences their beliefs and what constrains their beliefs.

Case study research has been criticised due to the argument that one cannot generalise from its findings (Cohen *et al.*, 2007), however, Stake (1995) argues that the generalisation debate is not an issue, as those who read the case study results engage in forming their own assertions and as such decides whether the findings appear to be truthful and generalisable within their own context.

### *Participants and Context*

The PGCE is a one year post graduate qualification that requires students to obtain a relevant diploma or degree that contains two school method subjects at second year level before they can enroll for the PGCE (Department of Higher Education and Training, 2015). The four participating PGCE students, two males and two females, specialised in Mathematics and Science in their undergraduate qualification. They enrolled for the one year PGCE qualification at the Nelson Mandela Metropolitan University (NMMU) in Port Elizabeth in the Eastern Cape Province in South Africa after they completed their degree. The participants are referred to as Mr Kuwani, Mr Lemka, Miss Zonda and Miss Amafi - pseudo names. During their schooling from grade 1 to 12, the participants attended under resourced township schools where there was no access to ICT. Three of them enrolled for FET Mathematics method and FET Physical Science method (Grade 10 to 12) and one in FET Physical Science Method (Grade 10-12) and Natural Science Method SP (Senior Primary Grade 7-9) in the PGCE qualification. They completed their school based learning (SBL) at a rural school in two blocks of nine weeks each.



### *Data Gathering*

Data were gathered in the following manner: Firstly, participants completed the teacher belief system (TBS) tool (Benjamin, 2003; Woolley, Benjamin & Woolley, 2004) at the beginning of October 2015 in order to ascertain in a quantitative manner whether they position themselves as behaviourist traditionalist teacher-centred or constructivist learner-centred. Based upon Kember (1997), one can hold either of these two indicated positions above, as well as being transitional. Chipunza (2011) added that it is also possible to add to the above a close to constructivist or close to behaviourist position. Secondly, the participants were provided with six prompts to explore their beliefs about teaching and learning and ICT. This was done mid-October 2015 after their school based learning. These prompts were 'Draw how you see or view teaching and learning', 'Draw how you see yourself as a teacher', 'Draw how you see yourself as an ICT teacher', 'Draw how you see yourself as an ICT teacher in a rural school', 'Draw feeling safe as ICT teacher' and 'Draw feeling not so safe as ICT teacher'. Participants were given four days to complete the drawings and also had to insert a caption for each drawing. This was followed by semi-structured individual interviews during which the participants explained what each prompt and drawing entails. The interview question posed was 'Explain what this drawing entails'. Participants responses were further probed e.g. 'You state you use YouTube. How do you use it in class?' or 'You referred to being a bright light. Elaborate what you mean by this.' Data pertaining to the above are referred to as 'Drawing Interview' when presenting the data. In addition to the interview based drawings, participants also had to provide examples of lessons that they have taught when they have used ICT. Thirdly, an open-ended questionnaire which also included some closed questions, was also completed by the participants in mid-November 2015. Fourthly, the participants' provided lesson plans (assessed and non-assessed lesson plans) and assessment feedback forms to the researcher during November 2015. Fifthly, the participants also emailed the researcher with short summaries in PowerPoint pertaining to how they implemented ICT in their lessons. Lastly, two telephonic interviews were conducted with their Science Method lecturer and the NMMU mentor assessment teacher who was appointed to visit them. This teacher did not reside at the school where they taught. These interviews were conducted in order to obtain their perspectives on how the participants used ICT for teaching and learning. They were then both asked to email the researcher with a short summary of their classroom observations based on the interview. They also validated what was written and reported, as they were provided with an opportunity to comment on the completed research paper related to the accuracy of the reporting and interpretation.

### *Ethics*

Ethical clearance was obtained from the Research Ethics Committee and the four participants were asked if they wanted to participate. Pseudo names were provided for each participant to protect their anonymity.

### *Analysis and Credibility*

The data were analysed by grouping the responses related to the sub-questions in order to enable the researcher to compile, tell and present a comprehensive story of what transpired. Short codes were allocated to the data sources and these codes were then linked to constructs from the literature for example teacher-centred inclination, learner-centred inclination, usage of ICT, contradictions, similarities, influence of teachers, influence of lecturers, etc. In the discussion section, the findings from the data are linked to the literature and theoretical framework. It is important to note that English is the second language of these students, as their mother tongue is Xhosa, an indigenous language. As such, in some of the transcriptions square brackets were added to indicate what was implied when the participants omitted something.

At the time when the data were analysed and interpreted, the participants were already away and did not return to the NMMU, as they completed their one-year post-graduate qualification. In order to establish credibility, specifically with reference to whether there appeared to be a mismatch between beliefs and practice – including whether the findings appear to be in line with what they observed when visiting the participants at school, the Science Method lecturer and the NMMU mentor assessment teacher were consulted in order to validate the findings and interpretation pertaining to the data, hence they became a source for triangulation purpose and assisted to confirm the credibility (See Bryman, 2004; Ary, Jacobs, Razavieh & Sorenson, 2006). In addition, this research paper has also been emailed to the Science Method lecturer and the NMMU mentor assessment teacher in order to comment on the paper with a view to indicate whether they agreed with the final reporting and interpretation.



## Results of the Research

### *PGCE students' Beliefs Pertaining to Teaching and Learning*

Mr Kuwani's teaching and learning beliefs pertaining to teaching Science is that Science teaching is an active process that requires demonstration and not mere teacher talk. He also indicated that planning is vital when teaching and that one has to anticipate what the learners could ask in the form of questions. In addition, he highlighted the importance of providing opportunities for learners to question the teacher and not take whatever the teacher shares as unquestionable. He stated it as follows, "[Science teaching is] ... about doing, doing science. You cannot; not only talk about [it]... I believe that the teacher must engage more with the learners, so that the learners must not be scared to come to the teacher [to ask questions] ... Planning, that is crucial ... [Teachers should] provoke ... so you make them so that they question everything that you say, you want them to be creative, you don't want them to just take everything, so that if they have another method of doing things, they may be able to answer in a different way (Drawing Interview). Furthermore, he believes that he is also a co-learner with his learners and not the only authority that holds all the knowledge. He also highlighted the importance of group work when he stated, "I put myself in the middle, because I see myself even a learner even myself... So I don't want them to see me as someone who's bigger than them, who knows everything, so I put myself in the middle so that we discuss, put them in a group where we share ideas" (Drawing Interview). In addition, he emphasized that the teacher should always consider the needs of the learners and take note of their level of understanding and thinking, "When I plan the lesson I have to consider the type of learners that I have ... and I must make sure that I put that what I'm giving, to their level... And mostly to be practical in everything that I do, I mean the examples that I make [use], make sure that it's an example that they will understand" (Drawing Interview). Furthermore, he added to the above that he is promoting a humanizing pedagogy, a pedagogy that promotes learners to engage with the teacher without the learner feeling scared. As such, he invites introverted learners to ask questions when he is seated at his classroom table or when he is doing his visiting rounds at their desks, "I focused mostly on humanizing [pedagogy] where if you can see here I'm going to every learner trying to give them time so that if they want to ask any question they may come. Even here, where I'm sitting, a learner is coming to me to ask a question ... So I'm more focusing on humanizing pedagogy where you speak, you must not be scared to say what you want to say" (Drawing Interview). The data hence seem to suggest learner-centredness.

Mr Lemka indicated that his beliefs pertaining to teaching and learning is that learners are individuals with huge potential, candles that can provide light to society when the teacher acts, "For me I view learners as candles which means they've got a huge potential of lighting up brightly, they only need one matchstick ... So I view myself as that matchstick that gives the lights to the candles which is unlocking everything that they are not clued up on" (Drawing Interview). The above appears to suggest that there is some form of teacher-centredness, yet he also indicated in the drawing interview that he is a constructivist as he wants his learners to construct knowledge, "Personally I'm a constructivist, cognitive constructivist, whereby I allow learners to construct their own meanings and their own understanding and reflect with others on their experiences. In this drawing I just give the light, I just give the light so that they can grow and develop ... I can, also get the light from them" (Drawing interview). The above suggests learner-centredness. In addition, Mr Lemka also indicated that all learners learn in different ways, hence one has to be patient and create different spaces where all learners feel comfortable to learn, "... learners also they learn differently. Some they learn slow so you have to be very patient with the learners so that's why those candles you see that this one has bent a little bit and is shorter, this one is taller than the others so yah it just reflects that learners are different. They've got different strengths so you have to go down [to their level] into the learners so that you can find the best out of them" (Drawing interview). At the same time, it also appears that Mr Lemka seems to subscribe to teacher-centred approaches, as he views himself as a 'weed remover', i.e. someone that has to provide the structure to learners and as such someone that the learners need, as they cannot function without him. He stated it as follows, "as teachers we remove off the ... So without this hand hoe [rake], we [teachers] cannot get these plants [learners] as taller and as productive as this one ... So to use that hand hoe [teachers] that information to give life into this mealies [learners] by weeding off all the challenges that the learners are facing on a daily" (Drawing interview). It seems thus he is the person the has to take the lead, but he also referred to learner-centred aspects, as he referred to each learner as having unique potential and their own unique strengths.

Miss Zonda drew her learners as plants that she feeds with knowledge, implying a teacher-centred approach, but at the same time she also learns from her learners, as they also have something to contribute, "I'm feeding the plants and here it's also me using the plants as food to get some [crops]. You see in teaching you feed the students with



the information and all that and also learn from the students while you are teaching ... I would say its sharing information, like the students, when you teach the students they already have something they know so you're adding" (Drawing Interview). She also mentioned that she tries to ascertain what her learners know during her lesson introduction, i.e. their prior knowledge, "Ok I prefer to find the information from the learners before I give them mine. So when I start the lesson I first ask to check what they already know" (Drawing Interview). The above thus also suggests that she is teacher-centred with respect to gaining insight of their prior knowledge, but at the same time the "feeding" of her learners could also suggest learner-centred facilitation. Miss Zonda also mentioned that her learners are sometimes grouped, but at other times they work as individuals. The data suggest that when they were grouped, it was not to engage in discussion and sharing, rather, it was due to practical consideration as there was not enough apparatus. She stated it as follows, "They sit in groups sometimes. Sometimes they sit separately, like when we are doing a practical they sit it groups ... They do the experiment because they can't have like one on one thing, so they have to be grouped because the apparatus is not enough. So I let each of them have a chance to do the experiment and then they observe" (Drawing Interview). The above appears to indicate learner-centredness.

Miss Amafi believes that teachers have the power to build or destroy their learners' potential, alluding to the influence teachers have, as well as the huge responsibility that rests on their shoulders, "I view teaching and learning as the power to build or destroy so as a teacher you have the power to build those learners or destroy them" (Drawing Interview). She was not pleased with how teachers taught her at school and stated that her philosophy and beliefs are different from the textbook centred and teacher-centred approaches that her school teachers enacted, "It's the way I was taught in school. I wanted to be different because at school it was the teacher, the textbook and then that's it" (Drawing Interview). She continued by stating that learners have to be involved in the classroom, "I want to involve learners more in my class. I don't want them to see me as the source of information. I want them to be able to ask questions if they don't understand" (Drawing Interview). She stated in the questionnaire that "I am a constructivist. I believe that learners do think and have something to say ... so they should have a say in class." The above suggests that she wanted to promote learner-centredness, as she wanted to be different than her school teachers when she was a learner.

The TBS tool (see Table 1) revealed that when the two behavioural constructs are combined, as well as the two constructivist constructs; then the difference between the two constructs suggests that Mr Kuwani, Miss Zonda and Miss Amafi were leaning more towards learner-centred constructivist beliefs, but at the same time the teacher-centred behaviouristic beliefs appeared to be high too. Mr Lemka's TBS indicated that he was neither constructivist, behaviourist, eclectic or transitional. It is quite possible that he interpreted the Likert Scale incorrectly as the high disagree response rates appear to suggest this. If this is taken into account, then he appeared to be more constructivist learner-centred than behaviourist teacher-centred.

**Table 1. TBS teaching and learning and management beliefs (%).**

Belief constructs	Agree	Disagree
Mr Kuwani		
Behavioural teaching	70.0	30.0
Behavioural management	40.0	60.0
Constructivist management	72.7	27.3
Constructivist teaching	88.2	11.8
Mr Lemka		
Behavioural teaching	40.0	60.0
Behavioural management	30.0	70.0
Constructivist management	9.1	90.9
Constructivist teaching	17.6	82.4
Miss Zonda		
Behavioural teaching	60.0	40.0





Belief constructs	Agree	Disagree
Behavioural management	80.0	20.0
Constructivist management	72.7	27.3
Constructivist teaching	88.2	11.8
Miss Amafi		
Behavioural teaching	40.0	60.0
Behavioural management	70.0	30.0
Constructivist management	54.5	45.5
Constructivist teaching	81.3	18.7

### Using ICT for Teaching and Learning

Mr Kuwani describes himself as a progressive ICT teacher that is very excited to implement ICTs for teaching and learning. He said that he decided to do his teaching practice at this rural school as they had ICT resources. He stated that he often searches for YouTube Science videos when there is an experiment that he had to conduct when he did not have the necessary equipment to demonstrate it practically. It appears that when he used YouTube videos, he followed a teacher-centred approach, as he indicated that he explained a lot to the learners. This was evident when he indicated *"...if there's an experiment that they want to see, make sure that you go to YouTube .... Maybe if they don't have maybe equipments or materials to do the experiment they can just watch that video ...I'll let them watch the video, stop [the video]. [I'll] make sure that it's in intervals ... after stopping it, I explain what has just been done [seen]. So that will be helpful that we could have laptops where they can just watch the videos and everything"* (Drawing Interview).

An analysis of Mr Kuwani's lesson plans, portfolio and emailed summaries of how he implemented ICTs highlighted that he frequently used PowerPoint, simulations and YouTube videos for teaching Science. The PowerPoint presentations and simulations (e.g. PowerPoint on velocity) reflected traditional teacher-centred pedagogy. His Science Method lecturer and the NMMU mentor teacher assessor frequently commented on the assessment sheets that he was too reliant on PowerPoint. However, the lecturer also commented that he occasionally switched to board work. In addition, he also asked a great deal of questions, but it was noted that he could still work on his questioning techniques. Furthermore, he also implemented various group work activities for which he was commended, suggesting a constructivist approach when he used group work. The data from the questionnaire also concurred that Mr Kuwani used PowerPoint and YouTube videos extensively. The portfolio feedback also indicated that he used the words *"explain"*, *"demonstrate"* and *"show"* often in his reflective feedback pertaining to what he had done in class. Interviews with both the NMMU Science lecturer and NMMU appointed mentor teacher suggested that at this point when the research was conducted, Mr Kuwani's approach was more teacher-centred, but that he was also trying to include learner-centred aspects, e.g. when learners discussed questions in groups.

Mr Lemka used Mathematics and Science Computer Assisted Learning (CAL) software, videos that he downloaded from YouTube and also video simulations for electricity circuits. An analysis of his lessons and his reflections suggest that he used this software in a teacher-centred manner. He commented that he did not play the videos in their entirety, but viewed them prior to his lesson and then decided which sections to play which the learners can then watch. This was then followed by discussion, which suggests in this instance a more learner-centred approach. He described it as follows, *"We have used the computers that are preloaded with some applications which is CAMI maths, CAMI science, Khan maths and Khan science and also I have been using the simulations that are pre-downloaded to express some of the things that sometimes there are no resources to do the practical especially when doing the chemistry but there are downloaded videos that we can get like on YouTube and also the simulations that can help us to make like the circuits ... we've downloaded some YouTube videos and then they displayed a lot of things especially to those experiments that we don't have the resources at school to do them practically ... I almost forgot that the PowerPoint also I've used it"* (Drawing interview).

The mentor teacher (not the NMMU mentor teacher) indicated on the lesson assessment form that the



learners were engaged when he was teaching and that he involved the learners. An analysis of his lesson plan of electro magnetism revealed that he used the question-and-answer approach extensively, but that there were also various references to the teacher explaining. At the same time, he also indicated that learners were practically engaged in his lesson pertaining to generating static electricity with a ruler and that he allowed for discussion related to the effect of deflection of the compass needle. However, the NMMU appointed mentor assessor indicated on one of his lesson assessment forms that learner engagement and participation requires more work. His lesson plans suggested a teacher-centred approach. It also appears that he was the driver of the lessons. Both the Science lecturer and the NMMU appointed mentor assessor indicated that the ICT usage was more teacher-centred than learner-centred at present, but that the student was trying to shift.

Miss Zonda implemented PowerPoint presentations in a teacher-centred manner to replace traditional chalk board writing. She stated that using PowerPoint was not difficult and at the same time she was able to display drawings as pictures that saved time, as she did not have to redraw them on the chalk board, *"I think it's easy for me because sometimes when you're writing the notes on the chalk board you end up running out time, writing the notes. It's better when you are presenting. And when you are presenting, you are able to show the pictures rather than making drawings"* (Drawing Interview). At the same time, she stated that one should not become too attached to PowerPoint or YouTube videos. Hence, it is important to provide opportunities for learners to engage at the chalk board to write explanations and to ask questions than merely presenting:

*Like if you say you are going to teach using PowerPoint all the time, the learners get bored they want to participate. Like, you don't have to use the PowerPoint all the time. Sometimes you have to use the chalk board so that you can give them a chance to go and write, ask question. And also if you say you are going to teach using the video they get bored also, they end up not watching and not concentrating ... Sometimes I use PowerPoint throughout my lesson or sometimes I just show them the examples that are on PowerPoint or videos and then I play a video and then stop it and explain or ask them what they saw in the video (Drawing Interview).*

When she showed YouTube videos, she often asked them to reflect and write what they have learned, *"Sometimes I just, I play the video and let them watch and then after they have watched, I ask them to reflect on what they saw on the video and sometimes I explain, I introduce the lesson and explain everything, then play the video that they can see what I was talking about"* (Drawing Interview). Here lesson summaries indicated that she also provided questions that the learners had to answer based on the YouTube videos prior to viewing them. She indicated that these videos assisted her learners to understand complex topics, hence to provide clarity to them. In addition, the videos also assisted her when science apparatus was not available and as such she could use the YouTube videos as an alternative. The acting principal wrote on her lesson assessment form that she implemented problem solving, self-discovery, group work and the question and answer approach.

With reference to the YouTube video usage referred to above, the NMMU appointed mentor assessor stated that this student used the YouTube videos very well and in the manner that she referred to above, as he stated *"she was particular good in this sense [YouTube]."* He also indicated that she implemented discussion activities with her learners. In spite of this, both the Science Method lecturer and NMMU appointed mentor teacher assessor indicated that they were of the opinion that ICT usage and teaching was more teacher-centred than learner-centred. She also used the word *"show"* a great deal when she referred to activities, which also seemed to indicate teacher-centredness.

Miss Amafi used Google, PowerPoint and YouTube videos in her classroom. The data suggest that this ICT usage tends to be teacher-centred. Although she used ICT resources, the learners were merely watching the videos and PowerPoint slides and it appears that there was no reference to learner discussion or other collaborative learning strategies. She indicated that she provided explanations after the videos. It appears that she did not ask learners to explain their understanding related to what they viewed:

*I use YouTube videos, I use Google, I use a PowerPoint ... I use PowerPoint in class as a slide, so I'll prepare my lesson then check if the PowerPoint is relevant to what I'm teaching and then go through slides and explain it to the learners slide by slide ... Sometimes I use YouTube as introduction in class ... I want them to watch the video, then will explain later or give them the questionnaires [worksheets] to answer while they are watching the video and then we discussed it ... (Drawing Interview).*



Data from various student-teacher assessment forms completed by the Method Lecturer and School Mentor suggest that she involved her learners when teaching, but no references were made pertaining to a specific collaborative teaching strategy. The portfolio data and images in terms of ICT usage suggest that learners were also watching YouTube videos in order to promote understanding. Data from the Drawing Interview indicated that she was using YouTube videos either at the beginning, middle or end of her lessons. Although references to discussion or collaborative strategies were not evident in the Drawing Interviews with this participant, the NMMU appointed mentor teacher indicated that she engaged well with her learners during her lessons in his email response to the researcher after the telephonic interview. He stated it as follows, "[Miss Amafi] also had a good lesson making use of a PowerPoint that she created. She displayed good skill[s] in engaging the learners while doing her presentation." The NMMU Science Method lecturer indicated on his lesson assessment form that the learners were engaged, but he did not refer to group work, nor did he tick the group work box on the lesson assessment form. Both the Science method lecturer and the NMMU appointed mentor teacher indicated that teacher-centredness was more prevalent than learner-centredness in her lessons at this point in time.

In conclusion: The findings from the TBS tool (see Table 1) and qualitative data above suggest that there appears to be a contradiction or mismatch between what the participants reported in the TBS and what was found in the qualitative data when they actually taught. Hence, although the TBS tools as well as the personal interviews suggest that they hold constructivist beliefs, when the participants implemented ICT, their enactment suggested a teacher-centred and instructivist pedagogy with some elements of learner-centredness. This became apparent from their lesson plans and the PowerPoint examples and PowerPoint reflections that they supplied to the researcher. It was also evident from both interviews and the email responses of the NMMU appointed mentor teacher and Science Method lecturer that teacher-centredness was more prevalent at this point in time in the participants' lessons. The Science Method lecturer indicated that the ICT tools were used to drive the lesson and that the student-teachers remained in charge of the lesson, "in an instructivist mode" (email response after interview). He elaborated further as follows, "They all used premade PowerPoint presentations that they had sourced and delivered the lessons in a linear fashion relying heavily on content ... The ICT lessons [in which ICT was used] observed were also largely teacher centred in a step by step fashion" (email response after interview). He also stated that the students tried to shift more towards learner-centredness in subsequent lessons, "This was mentioned to them during reflection on lessons with marginal changes being noted in subsequent lessons" (email response after interview). The above suggests that there was positive movement towards teacher-centredness. In addition, he also indicated that he promoted discovery as approach to the participants, but that discovery was not evident in their lessons. The above does not imply that all the participants' lessons were always teacher-centred, as there were discussions and group work at some points too, however the Science Method lecturer indicated that this was "little". The NMMU appointed mentor teacher concurred that teacher-centredness was more evident, but also indicated that there were elements of learner-centredness. He stated it as follows, "All four students used technology extensively. Video clips mainly and PowerPoints to a lesser extent were used. Mostly teacher-centred approach. They did attempt to engage learners while presenting the clips and PowerPoints with questions and answers [approach] to get responses from [the] learners" (email response after interview). He continued, "Over-all, there was a lack in skill and knowledge in how to use technology in a learner centred approach" (email response after interview). The above suggests that more time and planning is required pertaining to learner-centred lesson design and here we as lecturers will have to take the lead to assist our students.

From the above it is evident that both of them indicated that at this point however, teacher-centredness were more evident than learner-centredness when they visited them. They also hinted that the participants were trying to move or shift to become more learner-centred, hence suggesting that these participants are growing and developing, *i.e.* moving towards realizing their teaching beliefs. The data from the lesson assessment forms confirmed that the participants were developing very well as prospective qualified teachers.

### Possible Influences on Their Teaching

The data from the questionnaire indicated that Mr Kuwani's high school Science teachers implemented a teacher-centred approach, as he referred to their practice as "a banking model method of teaching science because were [we were] just objects ... we memorise[d] things without understanding" (Questionnaire). The questionnaire data also indicated that the same applied to his high school Mathematics teachers. In addition, the data also indicated that there were not any ICT resources at the high school that he attended. Miss Zonda concurred with



the above as she stated that her Science teachers used the "banking model" as they "would just read and explain what [is] in the textbook. No practical experience and also no example[s]" (Questionnaire). She stated that she was not pleased with this as "It is not a good method to use in teaching because it does not give learners opportunity to construct on their prior knowledge and it does not engage the learner ... learner[s] do not participate in class, they listen only" (Questionnaire). Miss Amafi also agreed to the above and described it as follows, "It was destroying us, because we only knew what was said or what we were told to read and write. It was the Banking model, according to Paulo Freire" (Questionnaire) and added "we did not have the opportunity to express our views and be ourselves in class. You just had to take everything that was said" (Questionnaire).

Mr Kuwani indicated that both his Science and Mathematics PGCE Method lecturers used ICTs during Method lectures, but also stated that this did not happen often. With reference to his Science Method lecturer's teaching strategies, he stated on the questionnaire that his Science lecturer's methods inspired him, i.e. his practical examples instead of abstract knowledge, including the manner in which he explained difficult aspect in understandable ways. Furthermore, his lecturer emphasized learner-centred and problem centred approaches when engaging learners in the Science classroom. Mr Lemka concurred, as he stated that ICT was often used in the Science method lectures, "Lectures were done using [the] tablet, showing also how to use the iLearn NMMU site [<http://learn.nmmu.ac.za>] and scientific enquiry" (Questionnaire). The above was also affirmed by Miss Zonda and Amafi.

In addition, it also appears that lecturers in the Education Modules also influenced him. This became evident when he stated that these lecturers often used PowerPoint and YouTube videos. They sometimes paused these videos to foster discussion and debate. In other PGED Education modules, he stated in the questionnaire that the one "lecturer used a lot of PowerPoint to drive his lesson [lecture]. He would play [a] video ... we would engage afterwards about that video" and another "lecturer used a lot of PowerPoints in her lesson, but I feel she want no engaging with us. Everything came from her" suggesting that some of the lecturers implemented a teacher-centred approach indicated by the words 'driving' and 'no engaging'. In another module the lecturer also used PowerPoint, but used it in a student-centred manner, as she allowed for discussion and debate, providing the students with their voice "because it was the learners [students] who [was] doing the talking." He also indicated that his PGED201 plenary lecturer "played videos related to topics" and used "PowerPoint activities" (Questionnaire). In addition, he also alluded to the fact that most of his lecturers teaching PGED modules used "PowerPoint slides, videos and activities" (Questionnaire) very often or always, except in one specific PGED module. Miss Zonda and Amafi also concurred with the previous participants. Miss Zonda added that she was influenced by her lecturers. She alluded to it as follows, "... most of the lecturers they use the projector and they also show us videos ... I'm influenced by some of our lecturers. So when they teach I usually say I wish I could do the way they do. So when I'm in class I try to be like them" (Drawing Interview). Miss Zonda also added that her Science Method lecturer influenced her Science teaching philosophy when she wrote in the questionnaire, "My Science lecturer [influenced me]. I am influenced by his philosophy of teaching, his teaching styles and also how he does experiments." She continued, "... when he teaches Science, he brings the world into the classroom and make [use] it real world examples. He does the experiments in the classroom with what is available." In addition, she also indicated that she is influenced by the constructivist learner-centred philosophy, however, the data seem to portray a picture of a greater inclination to teacher-centredness.

Miss Amafi also highlighted the influential role that her Science Method lecturer played related to her teaching and learning when she stated that he encouraged them to use ICT and continually told them that it is important to "bring the outside world to the classroom" (Questionnaire). She continued, "He always encourages us to be creative and always think of ways in which you can make your lessons more interesting" (Questionnaire).

Mr Kuwani and Mr Lemka both indicated in the questionnaire that the Head of Programme (HOP) of the PGCE showed them how to download YouTube videos (including copyright issues) and provided some pointers for implementation. However, this was not done during formal lecture time, but during a voluntary ICT session that students could attend. This became evident when Mr Lemka mentioned that the PGCE HOP showed him how to use "Khan Maths and Science, CAMI Maths and CAMI Science, doing simulations for demonstration" (Questionnaire). He alluded that he often used ICT at the school by "Doing simulations in Science, Khan Maths Khan Academy, CAMI Maths and Science, playing YouTube videos and videos pre-installed that show experiments" (Questionnaire). He stated that the HOP not only inspired and challenged him to implement ICT, but also required feedback about his implementation when he said, "[He] inspired and challenged me to use IT and he wanted the feedback, so I had to do it and I found it interesting and less time consuming than board and chalk" (Questionnaire). The above was also confirmed by Miss Zonda and Miss Amafi,



It also appears that the absence of certain resources influenced teaching and learning. This became apparent when Mr Kuwani alluded to the fact that he wants to teach in a constructivist manner, but that the lack of Science resources and facilities to engage in Science activities appear to side track him, as the absence of the above *"see yourself now not following through with constructivist teaching"* (Questionnaire). He also indicated that although there was ICT resources at school, it appears that other teachers did not use them. This became apparent when he mentioned that learners seemed to be not accustomed to use ICT resources. Besides referring to his school mentor teachers as influencing him when teaching Science, Mr Kuwani did not mention that his lecturers influenced him. Rather, he indicated that what influences his teaching is what scientists do – they discover.

Mr Lemka stated in the questionnaire that his pedagogical content knowledge (PCK) is sometimes a hindrance that caused a mismatch between his espoused beliefs and enacted beliefs pertaining to his teaching philosophy, especially when he is not comfortable with the topic. Likewise, he stated that as he is still a novice teacher implementing ICT as a resource, he is sometimes not confident and feeling comfortable enough to implement the strategies that he wanted to enact, thus suggesting that his strategies would shift as he grows in confidence and experience, *i.e.* moving away from teacher-centredness to learner-centredness. He articulated it as follows, *"I am not yet comfortable with ICT, so sometimes it becomes difficult to teach with something you are not quite comfortable, mind you that I am still a novice in teaching. I still prefer my most comfortable strategy though so I am working hard every day to improve through research and trying it out at home"* (Questionnaire). At the same time, Mr Lemka stated that one's teaching philosophy and beliefs are dynamic and not fixed forever, but fluid, *"Teaching methods and philosophies are dynamic ... it is not fixed, it changes so is my identity in teaching"* (Questionnaire).

Miss Zonda also indicated that she is influenced by the constructivist learner-centred philosophy, *"I'm influenced by the constructivism. If you teach the way the learners want to be taught and that you have to teach them, ok, you have to first know what they already know then, so that you can be able to add more information in what they already know and that you have to make real world examples"* (Drawing Interview). Miss Zonda also indicated that her beliefs related to teaching and learning have been adjusted due to contextual classroom conditions.

Miss Amafi described herself as a constructivist teacher and indicated that she wants her learners to contribute to the class, or as she stated in the Questionnaire *"I believe that learners do think and do have something to say,"* however, she stated what made it difficult for her to align her beliefs is that *"sometimes the learners do not want to say or participate in anything and that [is] when I find [it] difficult to stick to my belief."* She also commented in the questionnaire that YouTube videos is not the panacea for Science teaching and learning, as she often found that when she thought the video would extend her explanations, the opposite occurred resulting that her learners became more confused. As English is not the learners' mother tongue, but Xhosa as indigenous language is, the presentation of videos in English could have attributed to the above.

## Discussion

### *Profess to Hold Learner-centred Teaching and Learning Beliefs*

The findings from the data suggest that the four participants professed to hold constructivist learner-centred principles related to teaching and learning. The participants often referred to constructivist practices such as *'doing science'*, engaging learners and not merely just talking about Science. Furthermore, the participants mentioned that learners should be encouraged to ask questions and not merely accept what they are presented with, hence, learners should be provoked to ask questions, as one participant stated. At the same time the participants indicated that they viewed their learners as co-learners who co-construct knowledge with them as teachers. Hence, the participants did not believe that they as student-teachers were the sole source of knowledge. They were of the opinion that the teacher should take the learners' individual needs into consideration and create a safe space where learners can ask questions, even questions that contradict current beliefs. It was also mentioned that working in groups was important, as the learners construct knowledge when they are actively engaged. All these principles that the participants mentioned, suggest that they had a clear idea of constructivist principles (see Brooks & Brooks, 1999; Ertmer *et al.*, 2012; Ertmer *et al.*, 2001 cited by Ertmer *et al.*, 2012). The data thus suggest that all four of them professed to hold constructivist principles, but on the other hand when their lesson plans, lecturer feedback and their own responses were analysed, it became evident that they engaged more in teacher-centred practices. This then seems to confirm what Judson (2006) alluded



to as the mismatch between what teachers report to do and what they actually do, hence her argument that qualitative data have the potential to illuminate possible contradictions (Judson, 2006).

#### *Teacher-centred ICT Approach Evident when Implementing ICTs*

All four participants were very positive towards implementing ICTs for teaching and learning and it was even mentioned that it appears to simplify lesson planning and resource generation, hence becoming a time saver. It thus appears that ICT offered a relative advantage (Rogers, 2003) to the participants. In addition, the participants not only perceived the use of PowerPoint, YouTube videos, Khan Academy videos, CAMI Science and simulations as compatible (Rogers, 2003) with their needs and the needs of their learners, but they also experienced it as simple to use and felt competent when using it. It appears that their classroom enactment of ICT has thus provided an opportunity for trialability (Rogers, 2003), as the more they used ICT, the more confident they became. However, the data suggest that their implementation of ICT was teacher-centred, as there was a great deal of teacher talk, teacher explanations and learners' listening while using PowerPoint, for example. One participant directly alluded to the fact that it appeared that the learners did not want to engage always with the student-teachers, probably because they were not used to be encouraged to ask questions due to the likeliness that their school teachers embraced a teacher-centred approach. The data also affirmed that PowerPoint as ICT resource became a tool that replaced the traditional chalk board. PowerPoint was used to highlight the main points of their lessons, including using it as a source to show electronic digitized pictures or sketches and as a tool to embed YouTube video clips inside PowerPoint. When they screened YouTube videos, it appeared when analyzing the data that the learners viewed the videos, but that it did not always result in discussions. However, it was noted that participants indicated that they provided in some instances questions that the learners had to answer prior to them watching the YouTube videos. Participants also indicated that YouTube videos were used when there was a lack of resources that prevented them to conduct scientific experiments. The above suggests that they were thus pro-active and novel in their thinking to use these YouTube videos instead of mere explaining without any actual resources. In addition, it also suggests that they were thus prepared to try-out ICT as a replacement tool in order not to disadvantage the learners due to lack of science resources. It is important to note that despite the absence of ICTs during their own twelve years of schooling and completing only one basic computer literacy module at university in their undergraduate qualification, the participants' eagerness to use ICT and to try it out (see Rogers, 2003) indicated that they were prepared to take the leap to ICT. Based on the current evidence from the data, plotting all four participants' ICT implementation position for teaching and learning at this point in time seems to suggest the instructivist teacher-centred quadrant (see Figure 1), as ICT appears to be used in a traditional manner for teaching and learning, although there were group work and discussions during some of the lessons, as well as active participation when the question and answer strategy was used (See Ertmer *et al.*, 2012, p. 42 Table 2 for a comparison of teacher-centred and learner-centred classroom practices). However, the above does not suggest that it will remain this way. It is important to note that using ICT in a learner-centred manner requires that learners use ICT tools for problem solving, data analysis, as a writing tool (Ertmer *et al.*, 2012 citing Ertmer, *et al.* 2001) and generative tool to learn 'with' (see Hokansen & Hooper, 2000; Jonassen & Reeves, 1996; Jonassen *et al.*, 2008). The aspects highlighted in Figure 1 under high learner cognitive activity indicate possible suggestions which could be explored with a view to design activities in which these aspects are embedded.

#### *Mismatch between Alignment of Teaching Beliefs and the Manner they Implement ICTs*

The data and discussions from the previous two sections suggest thus that the actual enactments in the classroom context were in contradiction with the participants' professed beliefs; a disjunction to which Argyris *et al.* (1985, p. 81) referred to as disagreement between their "espoused theory" and their "theory-in-use". Similar concerns were also raised by Beijaard, Korthagen and Verloop (2007, cited by Adam & Wright, 2014) and Korthagen (2010 cited by Adam & Wright, 2014) with reference to the enactment of beliefs and the actual practice of teachers. It is thus evident from the data that teacher-talk is still very much evident in the participants' classroom practice, although it was indicated that they grouped learners together sometimes. Feedback from the Science Method lecturer and the NMMU appointed mentor assessor teacher suggests that there was some group work, but it seems that the participants were in most instances 'driving' the lessons.



Despite the apparent mismatch, it appears from the data that the participants are aware of the theory and principles of constructivist pedagogy and learner-centeredness, but there seems to be a theory-practice gap which was alluded to previously. It is quite probable that the mismatch between theory and practice resulted due to a lack of exposure to modelling of such practices and due to a lack of design skills (Tsai & Chai, 2012) that embed ICT constructivist learner-centred principles and activities in their lesson design, as the one-year qualification is quite packed and students are in schools for only two terms of the year. Hence, time is limited. In addition, the Curriculum Policy Statement (CAPS) as curriculum is very prescriptive and packed, which could also influence a teacher to engage in covering and more talk than learner engagement and discovery in order to 'cover' as much of possible in the time allocated. In addition, the lesson assessment implementation forms that lecturers and teachers have to complete during a student visit at school, could also have influenced how they planned their lessons, as the current assessment form indicates aspects that have to be present in the lesson, but these aspects do not indicate wording that is specifically learner-centred.

All of the above thus highlights two important aspects again namely: (1) the importance of modelling (observation) (Rogers, 2003) of lessons - either by lecturers or from other sources - that promote learner-centredness and (2) that we as lecturers have to interact with our students in the planning of their lessons in order that we can support our students before they actually implement their lessons in the classroom context. Although there is currently a mismatch between the participants' current beliefs and practice, this does not imply that the participants will remain 'belief wise' where they are at present, as change and shifting is possible (Belland, 2009), but then the two aspects suggested above are critical and have to be addressed.

#### *Possible Influences on Their Teaching Beliefs*

It appears from the data that teacher-centred experiences had been part of these four participants' habitus for years during their high school days, hence it is highly likely that the influence of 'folk pedagogies' could have played a role (Belland, 2009, with reference to Brunner, 1996) during their enactment. Furthermore, although there is not data to indicate to which teaching approaches the participants were exposed to during their degree course prior to the PGCE, it is highly probable that a lecturer-centred approach were 'communicated' to them, especially in large classes that they had to attend, due to the fact that the majority of lecture venues are row orientated with the lecturer and ICT equipment in the front next to the traditional chalk board. The above could thus instilled certain schemata as beliefs within them (see Bourdieu, 1977).

During their PGCE, these four students were exposed to teacher-centred and learner-centred theories and strategies related to teaching and learning. From the data, it became evident that during the PGCE, the majority of the lecturers used PowerPoint and YouTube videos while the Science Method lecturer introduced them to simulation software and simulation videos. The manner in which these ICT resources were implemented seems to suggest that it was predominantly teacher- or lecturer-centred, and as such this approach was probably instilled in them as disposition as a result of external influences (see Belland, 2009; Bourdieu, 1977). This then again highlights the role that observability plays (Rogers, 2003), as students imitate what they experience from their past and from present exposure (see Bandura, 1977, 1997; Bourdieu, 1977).

In addition, it is highly likely that their School Based Learning (SBL) mentor teachers at the school where they completed their teaching practice during the PGCE, also still engage in teacher-centred chalk-and-talk pedagogy. Literature suggests that teacher-centred pedagogy has been the predominant South African pedagogy that teachers were exposed to when they were at school, something that the South African Department of Education had called for to change. The influence of teachers, lecturers and the experiences of these student-teacher participants while at school prior to university can therefore not be underestimated (Bai & Ertmer, 2004; Belland, 2009; Fives & Buehl, 2012; Kagan, 1992; Nespor, 1985; Pajares, 1992), as it appears that the past and the present influence and shape our actions (Bourdieu, 1994; Fives & Buehl, 2012), as our previous historical and current social contexts influence unknowingly how we choose to enact (Bourdieu, 1977, 1984, 1991, 1993, 1994; Maton, 2008) when we teach. Thus, although a person's habitus is not a deterministic force, it does reproduce certain inclined actions or tendencies (Noyes, 2007) as dispositions due to the schema embedded by history (Bourdieu, 1977).

As the participants were inexperienced teachers due to the fact that they were only student-teachers, their lack of initial confidence could also have influenced them to act in the classroom as field in the manner in which



they did, as they might have felt more comfortable with the traditional experiences or '*ways of doing*' when they enacted. A lack of initial confidence and of experience as a form of capital could thus have played a role in the way they have structured their pedagogic action. Their history as existing knowledge capital (Navarro, 2006) and confidence could thus have influenced them to enact in the field in this particular manner due to their current and past circumstances and experiences. However, despite all aspects mentioned above, the feedback from the NMMU Science Method lecturer and NMMU appointed mentor assessor teacher suggest that these student-teacher participants were trying to shift towards learner-centredness.

## Recommendations

It is suggested that lecturers – and here the researcher includes himself – have to realize that '*talking theory*' or the sharing of constructivist principles are not enough. It is therefore vital that we as lecturers model what we profess in order that our students can observe the '*how to*'. Furthermore, it cannot be assumed that students have all the required ICT skills (see Ertmer, 2001), as well as the design skills to plan and design learner-centred constructivist learning spaces in which ICT tools are used (Tsai & Chai, 2010). It is therefore important that our students are not only exposed to a wide variety of ICT tools and how these tools could be used to promote learner-centredness, but that students are also afforded opportunities to design and model lessons that promote learner-centredness and embrace constructivist principles that their peers and lecturers can observe. Furthermore, lecturers should also assist students with the pre-design of their lessons in order to ascertain whether their students' design promote learner-centred principles, even though they are confronted with very limited time to do so, as there is only one year with 28 weeks of contact time to achieve this.

In addition to the above, the importance of lecturer modeling and student observation of the modelled practices should also be embraced by lecturers (Bandura, 1997; Rogers, 2003). Equally important, critical self-reflection should be encouraged after lesson implementation, as reflection has the potential to promote improvement and growth (Jonson, 2008; see also Ertmer, 2001). It is also recommended that students' lesson plans and their implementation of these lesson plans are shared with fellow students and method lecturers. The sharing could then serve as a platform to promote discussion among students and the method lecturer with a view to identify which sections of a lesson promoted learner-centredness and which constructivist principles were evident during the lesson. These discussions could also assist students to adapt subsequent planning and implementation, as fellow students could be encouraged to provide suggestions pertaining to how activities or sections within an existing planned lesson could be adapted to promote learner-centredness. The video recording of students' lessons is another tool that could be utilized to make the discussions even more authentic, but at the same time it also has ethical implications, hence the necessary permission must be obtained before engaging with video recordings.

The recommendations above suggest thus that lecturers could play a key role in promoting learner-centred constructivist practices and as such Ertmer's (2001) '*Responsive instructional design*' approach is suggested as a possible framework that could be used by lecturers to assist students-teachers with their lesson design. This process also takes the needs of the student-teacher into account when the lesson is planned.

## Conclusions

The findings of the research indicate that these four PGCE student-teachers were prepared to implement ICT, even though they were not exposed to ICTs while at high school. However, when they implemented ICT, there was a contradiction between their espoused theory and enacted theory. The participants indicated that they held constructivist beliefs, however, when implementing ICT resources, the data suggest that they implemented PowerPoint and YouTube videos in a teacher-centred manner. The teacher-centredness resulted in spite of being exposed to constructivist principles that were constantly highlighted in their PGCE education modules.

It is highly likely that these students' experiences at university when ICTs were used, had influenced their implementation. The findings indicated that many lecturers used PowerPoint and YouTube during lecture time. It is thus quite probable that these four participants modelled and imitated what they saw during lecturing time when they were in their own school classrooms. Furthermore, it also seems that their twelve-year school experience as '*habitus history*' could have influenced their current practice, as what they have witnessed from their teachers could also have influenced their actions unknowingly.





It is also evident from this research that it is important not to rely solely on quantitative tools when engaging in research related to teacher beliefs and ICT usage, an aspect that was highlighted in the 'Introduction' section. Hence, the above suggests that informal classroom visits and learners' feedback by means of focus group interviews for example, could be valuable data gathering tools to ascertain to which extent the quantitative tools are really portraying the story as it is. The findings from this very small sample seem to validate the above, as the quantitative data and qualitative data were in contradiction pertaining to professed and enacted beliefs. This also then raises the question to what extent reports such as the quantitative 2009 OECD report and other similar surveys are capturing and representing teachers' real beliefs and practice; hence are the professed beliefs and enacted beliefs reported a true reflection of the state of affairs in classrooms?

Lastly, the findings appear to affirm that mismatches between beliefs and practice are not only evident among qualified teachers, but that mismatches are also apparent among student-teachers. It is therefore suggested that the suggestions made in the recommendation section above should be considered to narrow the gap between what is professed and what is practiced. Despite the mismatch currently, it appears that the participating student-teachers are trying to shift more towards learner-centredness, as their eagerness suggest that they are prepared to grow as life-long learners. It is suggested that similar research should be conducted to explore student-teachers and qualified teachers' beliefs qualitatively with a view to ascertain what aspects could lead to possible mismatches as perceived through the eyes of student-teachers and qualified teachers and how it could be ameliorated.

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