RHODES UNIVERSITY
FACULTY OF EDUCATION
RESEARCH PROPOSAL

An investigation of how VITALmaths video clips on mobile phones can be used by student teachers as a visualisation tool in the teaching of Number Sense

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Department: **Education**

Field of Study: **Mathematics Education**

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Abstract

Visualisation is increasingly being recognised as having a significant role in the learning of mathematics especially when students are solving mathematical problems. It is argued that visualisation is a powerful tool for learners to construct mental and physical representations that correctly mirror mathematical relationships and concepts.. To gain a thorough understanding of the scope of visualisation, four Visual Technology for Autonomous Learning of Mathematics (VITALmaths) video clips will be uploaded on mobile phones of each of the four participating student teachers who will be using them in their teaching practice. This is in cognisance of the educational potential offered by mobile phones and their current pervasiveness in the daily lives of both teachers and learners in Zambia. This study seeks to investigate how VITALmaths video clips on mobile phones can be used by student teachers as a visualisation tool in the teaching of Algebra. The videos of the lessons form the core of my analysis. The study will be conducted at a public university near Lusaka, Zambia, and at the four primary schools where the four student teachers will conduct their teaching practice. The study is framed as a case study and is grounded within the interpretive paradigm

Common Statement

This proposed research study is part of the "Visualisation in Namibia and Zambia" (VISNAMZA) project which seeks to research the effective use of visualisation processes in the mathematics classroom in Namibia and Zambia (Schafer, 2015). Research in the VISNAMZA project is currently centred around 5 MEd studies and 1 PhD study. Further, this study falls within the ambit of the VITALmaths project – a collaborative research project between Rhodes University and the University of Applied Sciences of Northwestern Switzerland.

Field of research

Visualisation in mobile technology in mathematics education

Provisional title

An investigation of how VITALmaths video clips on mobile phones can be used by student teachers as a visualisation tool in the teaching of Number Sense

Context of the research

The importance of mathematics is recognized worldwide. It is an essential discipline that needs to be nutured in education to equip students with skills necessary for achieving in higher education career aspiration and personal fulfilment. (Okello, 2010).

The teaching and learning process is increasingly becoming a major challenge in Sub Saharan Africa, and Zambia is no exception (MOE, 2014). MOE (2014) adds that among the major challenges faced by the education sector in Zambia from early childhood to tertiary education are: under qualified teachers, the inclusion of insufficient number of mathematics and science related subjects especially at higher levels, and a lack of appropriate education materials to support the teaching of numeracy and mathematics in schools (p. iii). Kelly (1999) notes that one major contribution to the poor performance by pupils in Zambia in school certificate examinations is the perennial unsatisfactory results in school mathematics examinations. Furthermore, the Educating Our Future, Zambia's National Policy on Education, asserts that a number of challenges faced by many learners in mathematics have their roots anchored in the manner the concepts were introduced at primary school (MOE, 1996).

In an effort to highlight the learning achievement levels among Grade 5 learners at primary school level in Literacy, Numeracy, Life Skills and Zambian Languages, the Ministry of Education (MOE), through its implementing agency, the Examination Council of Zambia (ECZ) launched the National Assessment Survey (NAS) in 1998. In Numeracy, the latest surveys have consistently reported low learning achievement with a mean performance of below 40 percent between 1999 and 2012 (MOE, 2014), as indicated in figure 1 below:

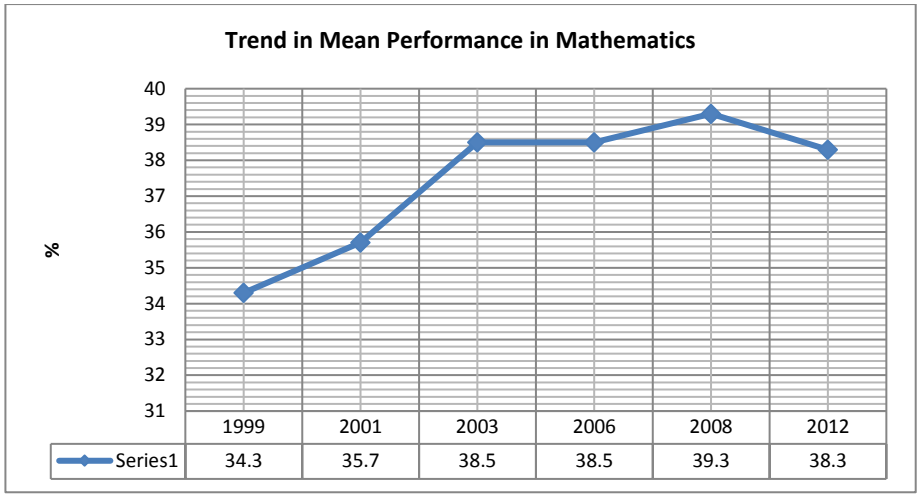

Figure 1: Trends in Grade 5 National Mean Performance in Numeracy over the Survey Years
Source: MOE (2014)

Furthermore, at an international level, Zambia's performance in mathematics as indicated in the Southern and Eastern African Consortium for Monitoring Education Quality (SACMEQ) is of great concern. Zambia was the lowest ranked among 15 countries in the SACMEQ 2011 Mean Reading and Mathematics survey as shown in the figure 2 below.

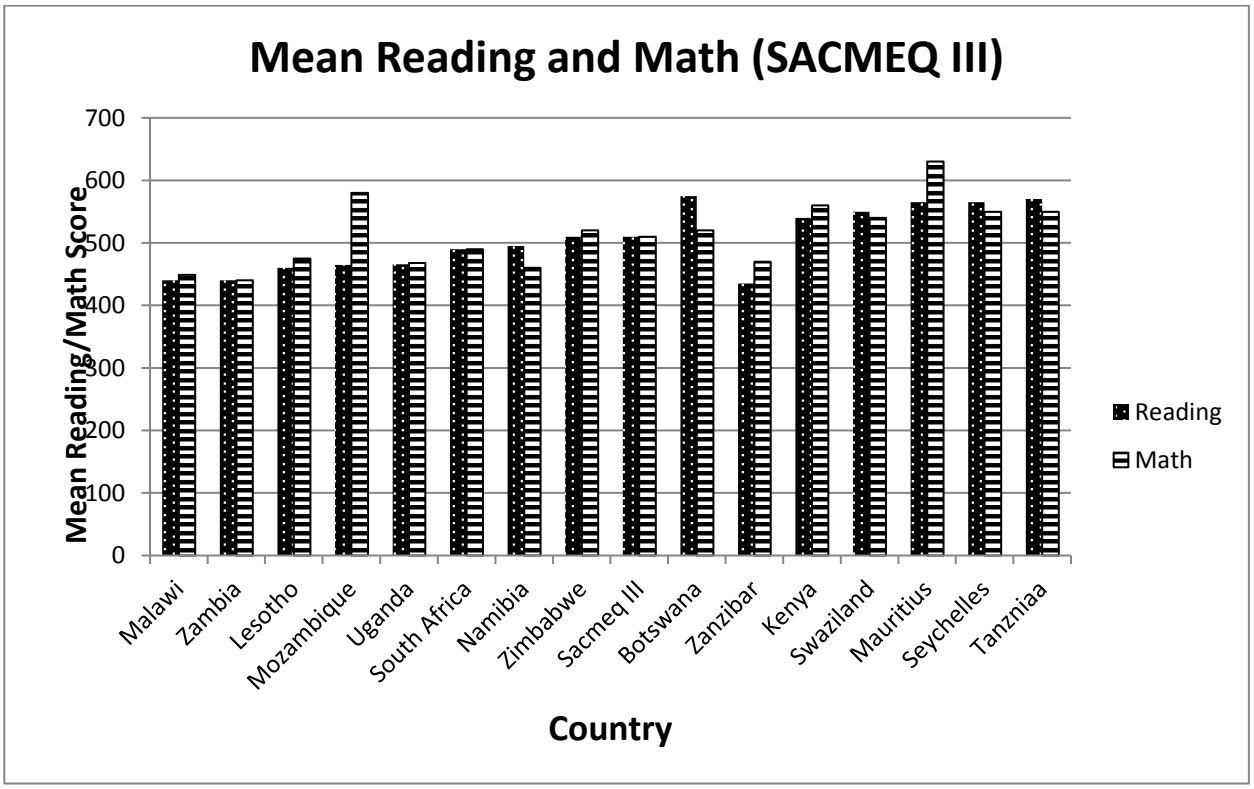

Figure 2: Mean Reading and Mathematics survey (SACMEQ III)

Source: MOE (2014)

The low learning achievements in mathematics in Zambia as reflected above in both NAS and SACMEQ calls for widespread interventions in mathematics education. In an effort to improve learner performance in mathematics, the Ministry of Education undertook a number of measures. One such measure was a revision of the curriculum of student teachers in colleges of education to make it outcome based as opposed to content based (MOE, 2014). This implies that teachers need to place an emphasis on conceptual understanding. According to Kiilpatrick, Swafford and Findell (2011), conceptual understanding is the comprehension of mathematical concepts, operations, and relations. A significant indicator of conceptual understanding is being able to represent mathematical situations in different ways, such as visual diagrams and knowing how different representations can be useful for different purposes (*ibid*, p. 119)

In the curriculum review that is currently being undertaken by the MOE, one of the reasons cited for poor performance in the Zambian mathematics education system is the lack of teaching that promotes conceptual understanding (MOE, 2014). Kalimaposo (2010) is of the view that student teachers in colleges of education are unfortunately not sufficiently exposed to teaching methods that foster conceptual understanding and the construction of knowledge. One way in which conceptual understanding can be enhanced is by integrating appropriate technology in the teaching and learning process. The use, for example of a mobile phone, a device that is pervasive among student teachers in Zambia and has the potential to be used as a visualisation tool could be one of the solutions. There is a growing recognition that visualisation plays a significant role in the learning of mathematics (Thornton, 2001)

Visualisation in Mathematics Education

From a mathematical perspective, different authors have defined visualisation in a number of ways. Arcavi (2003) contends that

> "Visualisation is the ability, the process and the product of creation, interpretation, use of and reflection upon pictures, images, diagrams, in our minds on paper or with technological tools, with the purpose of depicting and communicating information, thinking about and developing previously unknown ideas and advancing understanding", (p.217).

Generally it is agreed that visualisation plays a number of important roles in students' capacity to solve problems. For example, Ho (2010) and Zimmerman and Cunningham (1991) note that visualisation does not equate to just forming a mental image, but rather it is specifically about

visualising a concept or problem rather than an idea. They described visualisation as "the process of producing or using geometrical or graphical representations of mathematical concepts, principles or problems, whether hand drawn or computer generated (Zimmerman and Cunningham, 1991, p.1). Durmus and Karakirik (2006, cited in Hyde 2011) state that mathematicians have long used tools and manipulatives, including computers, in the development of mathematical concepts and relationships using visual representations. Ndafenongo (2011) adds that the overall goal with visualisation is to help learners construct mental representations that correctly mirror mathematical relationships in instructional representation located outside the mind (p. 29).

Guzm'an (2011) adds that:

> Visualisation is therefore extraordinarily useful in the context of the initial processes of mathematics as well as in that of the teaching and learning of mathematics. All this makes very clear the importance of training our own visual ability and to introduce it to those whom we are trying to introduce mathematics to.

To gain a thorough understanding of the scope of visualisation, technologies such as videos and other interactive programmes need to be taken into consideration. This study will endeavour to add to this scope by investigating the potential use of mobile phones as a useful technology in visualising mathematics.

Mobile technology and visualisation in education

Mobile technologies today are pervasive as a medium for communication, and as such the feasibility of mobile technology to alter teaching and learning is overwhelming (Garrison & Anderson, 2003; Prensky, 2005; Kolb, 2008 as cited in Ndafenongo, 2011). Prensky (2006) posits that the 21st century, which is also referred to as the digital age, has brought a number of changes as regards technological devices and the expertise to effectively utilise them. In my experience most learners, who generally are young people, are very much at ease with using digital devices such as computers, video games, mobile phones and internet. This opens many educational opportunities and ultimately implies that teachers should consider realigning their ways of teaching to take advantage of this modern technology. Prensky (2006) recommends that the mobile phone, in conjunction with the computer, is one tool that could be effectively used in schools. Koebler (2011) concurs with Prensky and argues that it is logical to use mobile phones for learning and teaching especially in areas where there is a dearth of the latest technology.

In my view, the potential of using mobile technologies in education is enormous in a country such as Zambia where there is limited access to electricity and landline telephone networks, poor roads, limited or no access to reliable computers and few people with the necessary skills to using computers. In the midst of all these challenges, mobile phone coverage in Zambia is however very widespread compared to access to computers. The penetration rate of internet access is at 23 percent, landlines at 0.7 percent while that of mobile phones is 75 percent (Zambia Telecoms, 2015).

The major thrust of my study is to investigate how VITALmaths video clips uploaded on mobile phones can be used by student teachers as a visualization tool in the teaching of Number Sense. Kukulska-Hume & de los Arcos (2011) are of the view that as mobile phones constitute a good part of daily life there is a good likelihood that they will be utilized for learning at some stage, even if only informally. They added that since "mobile technologies facilitate and encourage self-directed learning, ways should therefore be found to uncover these patterns of informal learning use and attempts made to incorporate them into formal learning by coupling them to learners' demands for mobile access" (p. 76). One way in which mobile phones can be incorporated into formal learning is by utilising them as tools to transport video clips into a classroom and use the video clips as visualisation tools for teaching and learning. Visualization, in particular dynamic visualization, is a very important feature in "teaching for understanding" in mathematics because it aids the teacher by engaging learners in realistic situations (Makina, 2010). The types of video clips that can be used as visualisation tools on mobile phones for my study are those that also promote autonomy in learning. These include the video clips developed and researched by the Visual Technology for Autonomous Learning of Mathematics (VITALmaths) project (www.ru.ac.za/VITALmaths). Ndafenongo (2011) sums up the findings of his research with the VITALmaths clips by stating that:

> The use of VITALmaths video clips as mathematical content, and cell phones as a vehicle of delivery, enhanced active participation and concentration, sped up lessons, encouraged collaboration as well as interaction and hands-on exploration, and promoted both student autonomy as well as teacher enrichment (p. ii)

VITALmaths video clips

The VITALmaths project which produces the said video clips to be used in this study emphasises the importance of autonomous learning (Linneweber-Lammerskitten., & Schafer, 2010). I wish to use the mobile phone as a conduit for an environment where learners navigate,

explore and deliberate with the content of the video clips at their own pace. "VITALmaths is a multilingual collaborative research and development project between the University of Applied Sciences Northwestern Switzerland (FHNW) and Rhodes University in South Africa. VITALmaths short video clips are specifically designed for the autonomous learning of Mathematics," (Linneweber-Lammerskitten, Schafer, & Samson (2010). The short video clips of about one to three minutes long and are produced typically using natural materials with a view to develop different mathematical ideas and processes. Linneweber-Lammerskitten, Schafer, & Samson. (2011) emphasise that "it is envisaged that these video clips can then be used in the preparation of lessons, for personal conceptualization of mathematics concepts and as motivational and explanatory tools, with the emphasis lying on teachers and learners to use them as autonomously and independently as they wish" (p. 356). The database of these video clips can be freely accessed from the website: www.ru.ac.za/VITALmaths.

Though it is envisaged that the VITALmaths project can help in making use of mobile phone technology as the primary distribution platform in the South African context, (Linneweber-Lammerskitten et al., 2011), I strongly feel the idea can also fit in the Zambian context as the two countries share similar challenges in their education systems, especially in under- resourced schools.

Use of mobile technology in teaching

Engaging learners in effective exploration of real life situations using inquiry based processes and active learning is a major challenge for many mathematics teachers (Kiwala, 2014). This is because such an approach requires teachers to consider teaching and learning pedagogies that are not just textual but also those that use other resources such as digital technologies such as tablets, mobile phones and computers. Chazan & Schnepp (2002) affirm that "engaging teachers in tasks within technology enhanced learning environments designed to support inquiry based learning, enabled teachers to rethink and revised their pedagogical, curricular, and subject matter knowledge" (p. 191). One type of technology that is pervasive among learners, student teachers and teachers alike is the mobile phone.

One of the notable qualities of using mobile devices for learning is their anytime-anywhere functionality. This function can, in addition to accessing, gathering and processing information, also help users in harnessing the visualisation potential of these devices. Zaslavsky & Sullivan (2011), add that mobile devices can accord teachers (and student teachers) an opportunity to

socially construct mathematical knowledge. Furthermore, they consider mobile learning to be a significant feature of curriculum change in future classroom settings and sum up by stating that "for these changes to occur, prospective and practising teachers must learn to interact with this novel setting and develop new communicative skills (p. 192).

Theoretical considerations

One theoretical aspect that is of primary significance to mobile learning is social constructivism. Constructivism is a theory of knowledge that suggests that human beings generate knowledge and meaning from interactions between their experiences and their ideas (Piaget, 1967). These experiences relate to every-day life and various communications and interactions that human beings engage in. The nature of these engagements varies greatly and includes interactions with others on social media using mobile technology devices, for example. Giesen, (2004) reiterates that constructivism is a theory of learning which states that people create their own understanding and knowledge through experiencing things and reflecting on those experiences.
From a constructivist perspective of learning mathematics, learners construct their own mathematical knowledge as opposed to receiving it as a finished product from a textbook or a teacher (Perry, Geoghegan, Howe, & Owens, 1995). By its very nature, mobile technology is a significant feature in most activities of young people, including teachers as they work collaboratively and share information. It is this activeness that develops with mobile technology that is cardinal in adopting mobile learning as a learning environment. Teachers' use of technology to enhance visualisation has the potential to engage learners in active mathematical practices that include experimenting, investigating and problem solving which can add depth to understanding (Goos, 2010).

Sharples (2002) argues for personal learning mediated by mobile technology through asocial constructivist discourse. This should encompass learning supported by both mobile devices such as mobile phones and portable computers (p. 180). It is envisaged that a mobile phone, with its high adoption rate and use among student teachers, can improve classroom dynamics due to its data connectivity that fosters social interaction (as advocated by constructivism) and collaboration (Low & O' Connel, 2006).

Although verbal forms of teaching have dominated teaching methodologies for a considerable period of time, there is evidence that leaners' understanding can be heightened by the inclusion of visual forms of presentations (Mayer & Moreno, 2002). Whitely (2004) notes that with the

introduction of new technologies, the use of visual representations within and outside of mathematical contexts has increased, leading to creating and expressing interesting opportunities to visualise mathematical ideas and constructs. He adds that since people have an inherent ability to interpret visual input, teachers should use available resources that can incorporate mathematical concepts in a visual manner. This will add, as noted by Bruner (1990), to opportunities that construct new knowledge and meaning from real experiences. Ndafenongo (2011), contends that naturally, mobile technology is key in a number of activities in the lives of young people as they work collaboratively and share information (p. 24). He cites examples of activities such as texting, graphics, passing on information and adds that it is such human interaction and the nature of knowledge that develops as learners engage with mobile technology. This is cardinal in adopting a learning environment such as mobile learning. Advocates of mobile learning maintain that the activities employed in mobile learning are inherently aligned with social-constructivist perspective as learners work collaboratively (Hayes, Pathak. Joyce, & Hall. 2005). With these attributes of the mobile phone, and its potential to use it to visualise mathematical concepts, I argue that student teachers should be encouraged to use these devices to teach mathematics. The mathematical domain that is at the heart in this study is Number Sense.

Number Sense

Number sense has been recognised as central to young children's development of mathematics for a number of decades (Australian Education Council, 1990; National Council of Teachers of Mathematics [NCTM], 2000; Sowder, 1988). Different authors have defined number sense in different ways. Bobis (1996) defines number sense as "a well organised conceptual framework of number information that enables a person to understand numbers and number relationships and to solve mathematical problems that are not bound by traditional algorithms" On the other hand, Burton, (1993) and Reys & Yang, (1998) refer to number sense as a person's general understanding of numbers and operations along with the ability to use this understanding in flexible ways to make mathematical judgments and to develop useful strategies for solving complex problems.

According to the Zambian Education Curriculum Framework (MOE, 2014), number sense is an integral part of numeracy. It further explains that Numeracy is the ability to reason and to apply simple numerical concepts usually taught at lower levels and forms a foundation for higher mathematical skills at higher grades (p. 3). Bobis (1996), postulates that without a strong foundation in number sense, it is difficult to carry out even the most basic everyday

mathematical activities She contends that building a strong number sense will greatly help to equip learners to face mathematical challenges in future. Zambia's is poor performance as indicated in both the NAS (2012) and SAQMEC (2011) could be a result of poor foundation in number sense.

Research has indicated that number sense develops gradually and over time resulting from an exploration of numbers, visualizing numbers in a variety of contexts, and relating to numbers in different ways (Burns, 2007). Number sense has a number of important characteristics. These include the ability to reason, thinking flexibly and understanding relationships which are fundamental aspects required from simple arithmetic to complex mathematics (Gersten and Chard, 1999).Kalchman, Moss, and Case (2001) observe that

> The characteristics of good number sense include: a) fluency in estimating and judging magnitude, b) ability to recognize unreasonable results, c) flexibility when mentally computing, [and] d) ability to move among different representations and to use the most appropriate representation (p. 2).

Five components that characterise number sense where identified by the National Council of Teachers (1989) and these are:

- Number meaning
- Number relationships
- Number magnitude
- Operations involving numbers
- Referents for numbers and quantities

In her study that investigated aspects of the relationship between number sense and visualisation, Bobis (1996) observed that many children lacked a good 'sense of number' despite having been exposed to formal mathematics schooling. She noted that this contributed to the recognition by researchers of the importance of studying young children's visual representations of numbers in their attempts to explore their earliest understandings of number concepts. It was further noted that activities that focused on the visual identification of groups of numbers rather than counting one-by-one helped learners develop understanding of part-whole relationships, especially in the decomposition of ten (*ibid*, 1996). She contends that

> Given that many children lack a well-developed number sense after being exposed to traditional teaching it is crucial that alternative methods be explored. While counting is important, it does not allow children to

> develop a rich variety of number relationships. Visualisation at a young age gives children these additional skills (p. 1).

Significance of the study

Despite the pervasiveness of technology, especially the mobile phone, among students and teachers, most of the teaching and learning process in Zambian learning institutions do not incorporate the aspect of technology in the classroom. The mobile phone has a number of features that can be used for educational purposes as earlier alluded to and has the potential to have various materials uploaded, such as videos that can promote learner engagent and learners' construction of knowledge. Furthermore, the mobile phone has the potential to be used as a visualisation tool in the teaching of Mathematics. Despite these attributes, which have the potential to effectively engage learners in the teaching and learning process the mobile phone is rarely or hardly utilised as a teaching tool in the Zambian classroom. I therefore strongly feel that this study, to investigate the use of VITALmaths video clips on mobile phones by student teachers as a viusalisation tool in the teaching of Number Sense, is not only necessary but timely in the Zambian context. The study will not only contribute to the existing literature, but will also provide a platform for stakeholders to discuss and hopefully find solutions to how a mobile phone, from a visualisation perspective, can be utilized in the Zambian classroom.

Research Goal

The overall goal of my study is to investigate student teachers' use of VITALmaths video clips on mobile phones as visualisation tools in teaching number sense

Research Questions

Main Question

How can VITALmaths video clips on mobile phones be used by student teachers as a visualisation tool in the teaching of number sense?

Sub Question

What enabling and constraining factors do student teachers encounter when using mobile phones to teach number sense?

Methodology

Theoretical Orientation

According to Kilpatrick (1998, p. 98), the interpretivist research perspective endeavours to "capture and share the understanding that participants in an educational encounter have of what they are teaching and learning". This gives the researcher an opportunity to gain better insights into the practices of teaching and learning. According to Cohen and Manion, (1994, p.36); Cohen, Manion & Morrison, (2007, p.21), Cohen, Manion and Morrison (2011, p.17) the "central endeavour in the context of the interpretive paradigm is to understand the subjective world of human experience". In this study, I intend to investigate the subjective interpretations and understanding of the experiences of four participating student teachers on their use of VITALmaths video clips on mobile phones in teaching number sense. This study is therefore framed within an interpretive paradigm.

Research Methods

This qualitative case study will be undertaken with four student teachers pursuing a teacher education programme at a public university in Zambia. The study takes place in a rural setting near Lusaka where the researcher is based. Rule & John (2011), state that a case study is a systematic and in-depth study of one particular case in its context (p. 4). Bertram & Christiansen (2014), add that case studies are a style of research that is often used by researchers in the interpretivist paradigm and emphasise that a case study may use a combination of both qualitative and quantitative data. The case in this study is the four student teachers teaching number sense and the unit of analysis is the four student teachers' experiences of how they used the visualisation video clips on mobile phones to teach number sense. This case study builds on the studies undertaken by Ndafenongo (2011) and Hyde (2011) on using VITALmaths video clips in mathematics teaching. To gain a thorough understanding of the participants' experiences, I will use a variety of research instruments to obtain data. These will include observations, interviews, video and audio recordings.

Sampling and Participants

The study will be conducted at the teacher training institution where the student teachers and I are based, and at four primary schools where the student teachers will conduct their teaching practice. The sample involves four student teachers. The selection of the participating students will be purposive sampling According to Cohen et al., (2011), purposive sampling, is choosing specific cases that are best suited to the needs of the researcher. Bertram and Christiansen (2014)

acknowledge this by recognising that purposive sampling occurs when a researcher makes specific choices about which people to include in the research sample (p. 206). I purposefully selected the four participants on the basis that they are students at the institution where I teach, have expressed interest in this study, and have volunteered to take part in the project. The participants are also in possession of a mobile phone which has the capacity for the VITALmaths video clips to be uploaded on.

Research design

The study is divided into six phases.

Phase 1: Training/Awareness

In the first phase, I intend to teach the importance of visualisation in mathematics to my class of 50 student teachers. This is a new inclusion in my curriculum. I then wish to conduct an awareness workshop with the same class on using mobile phones with VITALmaths video clips. Integral in the content of this workshop is the importance of how mobile phones can be used to harness visualisation opportunities in the teaching process of number sense.

Phase 2: Selection and planning Workshop

Phase two consists of selecting four student teachers who will participate in this study. I will ask for four volunteers in the workshop in Phase 1. If there are more than four volunteers I will consider placing the volunteers into groups of two or three. Selected VITALmaths video clips will be uploaded on the mobile phones of the participating student teachers. They will then be invited to participate in a planning workshop where we will design lessons that incorporate the video clips. We will specifically plan a lesson that each of the participants will pilot with a grade 7 class during his/her teaching practice.

Phase 3: Pilot and planning

This phase will be done in three stages.

i. Each student teacher will pilot a micro-lesson with a Grade 7 class and this will be video-taped for reflection and planning purposes. The aim of this lesson is to familiarise the learners with using a video clip on a mobile phone and to afford the student teacher the opportunity to use the mobile phone as a teaching tool.
ii. A reflection on the lesson with the participating students will be done.
iii. Each student teacher will then upload the selected VITALmaths video clips for the main part of the project onto the mobile phone of each learner.

After the piloting stage, the four student teachers (or groups of student teachers) will then each plan 3 lessons to be implemented in Phase 4.

Phase 4 Implementation of the lessons

In this phase, each of the student teachers (or groups of student teachers) will teach their three lessons to classes in their respective schools on a topic on number sense incorporating the VITALmaths video clips uploaded on their phones as well as on the mobile phones of the learners. Sufficient mobile phones have been sourced to be used by those learners who do not possess one. Each of the lessons will be video recorded.

Phase 5: Interviews

After the teaching intervention, one individual interview with each of the participating student teachers will be conducted and audio-taped. After the individual interviews, a focus group interview with all the participants will be done – this will also be audio-taped.

Phase 6: Analysis

In this phase, I intend to analyse the data collected from the individual and focus group interviews. The emerging themes that will be key in the analysis will be the teachers' experiences of the role that mobile phones can play in using visualisation when teaching number sense.

Techniques/Tools

To collect data, I will use observations and interviews.

Interviews and observations

According to Bertram and Christiansen (2014) an interview is a conversation between the researcher and the respondent in which the researcher is the one who sets the agenda and asks the questions (p. 80). They add that in a structured and focussed conversation where the researcher has particular information he wants to elicit from the respondent and designs questions to be asked prior to the interview (ibid, p. 80). I will conduct individual interviews with each of the participating student teachers. In the interviews I wish to tease out with the student teachers the role that the VITALmaths video clips played as a visualisation tool to teach their lessons on number sense. In the interviews, the students and I will analyse each of their video-taped lessons and identify the roles that the mobile phones played in each of their lessons The video of each of the lessons will thus be used as a stimuls-recall tool to elicit information

from the participants on their experiences of using the VITALmaths video clips on their mobile phones. Video stimulated recall and reflection (VSRR), also referred to as stimulated recall interview, is a research method where a researcher uses video to stimulate participants' memory of, and new perspectives on a familiar video recorded event. The focus includes why the participant chose to act in a certain manner (NCRM, 2015). Each interview session will be audio-taped and then transcribed.

Thereafter I will conduct a focus group interview with all of the participants. The objective of this interview is to explore the enabling and constraining factors of using mobile phones to teach number sense.

According to Cohen et al., (2011), the distinct feature of observation as a research process is that it accords the researcher an opportunity to gather 'live' data in naturally occurring social settings (p. 456). They add that in this method the researcher can look directly at what is taking place in *situ* as opposed to reliance on second hand accounts.

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Data Analysis

Qualitative data in most cases consists of textual and visual data as is the case in this study. Urquhart (2013) asserts that data analysis involves connecting identified categories and should start immediately data becomes available. Bertram and Christiansen (2014) emphasise that the first step in data analysis is to reduce the data to enable the researcher to search and identify patterns or themes that emerge (p. 119). In searching for themes, the researcher attempts to understand the complex relationships between different aspects of peoples' situations, mental processes, beliefs and actions (Mc Millan & Schumacher, 1993, p. 495).

As my research is divided into phases, I will analyse my data immediately after each phase up to the last. Interviews and observations that will be conducted in this study will be audiotaped and videotaped respectively. They will then be transcribed and analysed to investigate the participants' experiences of the role that mobile phones can play in using visualisation when teaching algebra. In my analysis, I will organise excerpts from the transcripts into groups of emerging themes. The emerging themes that will be key in the analysis will be the teachers' experiences of the role that mobile phones can play in using visualisation when teaching number sense.

Validity

I will ensure that the instruments used to evaluate the research data will be valid and precise by piloting the process before carrying out the actual project. This will ensure that the information collected from the study is not biased or factually flawed. For an instrument to have high validity, it must be applicable to a diverse group of people and a wide array of natural environments.

Since there is a policy against use of mobile phones in government schools in Zambia, I will get special permission from relevant authorities to use the mobile phones in the respective schools where the student teachers will be practising.

Ethics

Refer to the last page of this proposal.

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RU FACULTY OF EDUCATION: ETHICAL APPROVAL APPLICATION

GENERAL PARTICULARS

M Ed	M Ed		PhD	Other:
(Half Thesis)	(Full Thesis)	√		Please specify

TITLE OF RESEARCH: An investigation of how VITALmaths video clips on mobile phones can be used by student teachers as a visualisation tool in the teaching of number sense

DEPARTMENT/INSTITUTE: Education Department

Date: December 2015

RESEARCHER: Lemmy Kangwa

SUPERVISOR: Professor Marc Schafer

Respect and dignity

I will communicate to the participants what the research is all about without withholding any information pertaining to their participation or that could influence their choice to take part in the project. I will also make it explicitly clear to them that they have the right to withdraw their participation at any time. Their anonymity will be guaranteed.

All the collected data will be kept confidential and will only be shared with my supervisor. In the final write up of the thesis pseudonyms will be used.

Transparency and honesty

I will ask for written consent from the Vice Chancellor of Chalimbana University and the four head teachers where the four participants will be doing their teaching practice for permission to allow them to take part in the project. I will also make it clear to the participants that their participation is voluntary.

I will carry out member checking of the interview transcripts to ensure that what I recorded is a true reflection of the information given by the participants.

Accountability and responsibility

Since all the four participants are students at the institution where I am a tutor, I will ensure that power relations are reduced as much as possible by encouraging them to give their honest opinion without fear of any repercussions. I will assure them that their participation in this study will in no way have any compromised impact on their participation in my class.

Integrity and academic professionalism

Throughout my research I will uphold the professional and academic standards and integrity demanded by Rhodes University by adhering to the laid down rules and standards of the

institution. My findings will be based on authentic data that I collected. My analysis will be based on my empirical work and not on my own assumptions and opinions.

Signature (Researcher)	Signature (Supervisor)
L. Kangwa	Marc Schafer
Date: 14 October 2015	Date: 14 October 2015
Place: NIED Okahandja	Place: NIED Okahandja