**UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
SCHOOL OF EDUCATION**

Division of Educational Technology

**A Study Of The Use Of SMS Cell Phone Technology To Support
Teaching And Learning Of Natural Science
With Gr. 7 Learners.**

Surname: Walstra

First Name: Karen Ann

Student Number: 336136

Ethics Protocol: 2010ECE65

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DECLARATION

I declare that this research report is my own, unaided work. It is being submitted to the School of Education for the Degree of Masters of Education in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other university

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Karen Ann Walstra

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Date

ABSTRACT

The purpose of this study was to investigate whether learners from different primary schools would respond to cell phone SMS (short message service) questions related to their schoolwork after school hours. As young people use cell phone technology to socialise, it seemed appropriate to consider integrating this technology within the school-framework, as many schools do not allow the use of cell phones during school. Another aim was to find out whether socio-economic backgrounds or gender groups responded differently to the SMS interaction study. A concurrent triangulation design research method was applied. The study examined how often and what types of answers learners would submit via SMS after school hours. The principal conclusion was that the learners reacted positively to the SMS feedback response sent in reply to an SMS answer and then engaged to a greater degree with the further questions.

CLARIFICATIONS OF TERMS

The following terms are used interchangeably in this report:

- Cell phone, mobile phone, mobile technology
- Texting and SMSing
- Learners, participants and subjects

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1 CHAPTER ONE – INTRODUCTION

1.1 PURPOSE OF THE STUDY

Teachers often wonder whether the children that they teach each day have understood their lessons, or whether they remember or are motivated enough to do their homework. As technology changes and advances it is to the teacher's advantage to use it to enhance and augment the educational experience for their learners in a friendly manner beyond the classroom. The texting feature on a cell phone is an ideal way to address these issues. In light of this, this study investigates whether Grade Seven learners from three different schools would respond to a question, about their Natural Science lessons, sent via SMS (short message service) to their cell phones after school hours.

McGuigan (2003 – 2010) explains that online SMSing or texting is a means of sending text messages from one cell phone to another cell phone at relatively low costs. Feldman (2004 – 2010, online) author of 'Surf Net Parents' agrees that the use of cell phones as a form of communication among pre-teen to eighteen year olds has grown considerably as owning a mobile device has become more easily affordable. Nowadays, young people, from all walks of life are being exposed to or own their own cell phones. This includes previously disadvantaged young people. It therefore seemed appropriate to consider ways of integrating mobile technology into a learning environment. Brown (2008) suggests that as the wireless infrastructure grows rapidly in Africa, m-learning (mobile learning) fulfils students' needs to have access to information from their learning institutions.

This study explores the use of cell phone technology, which children already have easy access to, as an interactive m-learning tool in the primary school situation. Feldman, (2004-2010, online) notes that pre-teen to eighteen year olds use cell phones and especially SMSing or texting as the major form of communication. She emphasized that young people want to use cell phones on their own terms.

Therefore, Grade Seven learners from different socio-economic backgrounds and genders were asked to participate in a project where each time Natural Science was timetabled, over a period of two weeks, after school hours they would receive one

SMS question related to their latest Natural Science lesson. The learners were asked to respond voluntarily via SMS to the SMS questions or statements so that the study could ascertain how many learners would respond and whether the question stimulated engagement and learning of the material during a school day.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

The cell phone industry in South Africa has grown considerably over the last few years. This growth has included people from all walks of life, and all ages. LaFraniere (2005) in the article entitled "Cell Phone Frenzy In Africa" states that Africa is the world's largest growing cell phone market: millions of people in Africa use cell phones daily and have moved easily from writing letters to using SMSing (instant messaging) as a means of communicating. The International Telecommunications Union (ITU) reported that there were 44,510,000 South African mobile customers by the third quarter of 2008 (ITU, 2009, online). This means that with a population of approximately 47 million people, nearly 95% of the South African population could have access to cell phones. Laura@CET's blog (Czerniewicz, 2009) called "The Fuss About Cell Phones" commented that according to a South African advertising industry household survey about cell phone penetration, more than two-thirds of the South African population has access to cell phones. Many South Africans use cell phones in everyday life, and texting or SMSing is a cheaper way of communicating than having a conversation on the phone. The m-learning study by Brown (2005) showed that university students' use of cell phones provides greater flexibility and convenience than online learning, as cell phones are carried by students, which provides greater versatility and mobility than online access at fixed points. The 'Netucation for the Nation' website (Thomas, 2008) article "What does 7.5million MXit users mean to parents?" stated that the worldwide growth for MXit had reached 7.5million users, 6.5million of whom are in South Africa. Futhermore, 33% of the total MXit users are between the age of twelve and eighteen years old. This article confirms that learners are using SMS technology to communicate socially. Since Grade Seven learners who are 12 – 13 years old, fall into the above mentioned age bracket it was deemed appropriate to research their responses in this study.

The learners were selected from three different private schools, two of which are single sex schools with learners from middle to high socio-economic backgrounds; one is a boys' school and the other a girls' school. The third school is a co-educational school where learners are from a lower socio-economic group where most of the learners' parents are domestic workers. The young people participating in the project

needed to have access to a cell phone after school to enable them to respond to the SMS questions that were sent to them. As twelve and thirteen year old learners use cell phones to communicate socially, the study explored whether learners were willing to participate and use cell phones to answer SMS questions related to schoolwork. The study further investigated whether learners could be encouraged to participate further in their school studies if I, the researcher, provided positive feedback to their answers. The study was initiated to see whether interactive technology (cell phones) that was being used for social interaction by young people could have extended use for learning beyond school hours to promote engagement with school work.

1.3 RESEARCH QUESTION

To what extent and in what ways do learners interact and respond to school related questions posed and sent using SMS cell phone technology after the school day?

1.3.1 Sub-Research Questions

Qualitative Sub-Research Questions

- Will questions and activities related to schoolwork sent via SMS; encourage learners from different socio-economic backgrounds to engage in learning, after school hours?
- What types of questions receive better responses?
- Will feedback in response to an SMS answer have an effect on the level of engagement by the learners?
- Will the learners discuss the question/s with other learners or family members before sending an answer?
- How will the learners feel about being involved in the project?
- Can cell phones, using SMSes be used as a teaching engagement / reinforcement tool for primary school learners?

Quantitative Sub-Research Questions

- How many learners will respond to the SMS questions?
- Is there a gender difference in the number of responses to the SMS questions?
- Do the varied socio-economic groups from which the learners come influence the responses (number of or type) to the study?

1.4   ASSUMPTIONS AND LIMITATIONS

This study was based on three main assumptions. Firstly, that the Grade Seven learners would participate voluntarily after school, in their own time, replying to the SMSes honestly and to the best of their ability, in the manner in which they felt comfortable and that there would be no coercion involved. There were no restrictions on the language the learners used. If they used text abbreviations, this would also be acceptable.

The second assumption was that the data and information collected would be accurate and comprehensive. The data relied on feedback from the learners before, during and at the end of the research. It was also influenced by the initial input from teachers and their suggested questions which related to the learners' Natural Science curriculum.

The third assumption was that the learners come from a range of socio-economic backgrounds which would allow the comparisons between different socio-economic groups and also provide a broad base of different children involved in the study.

In the research three main limitations were recognized:
Firstly, the study was confined to a small group of Grade Seven learners from three different schools, and these schools are all private schools. There is therefore no guarantee that these findings can be translated to other schools within the broader educational environment. Even so, these findings could be helpful to teachers who want to explore this area within their own teaching spaces.

The second limitation was related to finances. Since the learners came from a range of socio-economic backgrounds, each learner was given a small amount of money (R10) to cover the costs of the text messages as one did not want a lack of money for SMSes to influence whether they would respond or not. Therefore, there is a possibility that this could have influenced the results. On the other hand, the learners were told that the project was voluntary and so it is hoped that the small monetary compensation did not influence the learners' motivation to respond.

The third limitation is that only one Learning Area (Natural Science) was used for the formulation of the questions and the input in this study, due to time constraints it would have been impossible to incorporate more subjects.

Despite these limitations, it is felt that the design of the study has enabled general inferences to be drawn from the learners' responses. These could be applied to Grade Seven learners in general and offer an additional idea of how teachers could use cell phones to their advantage in the school environment to enhance learning.

1.5 SIGNIFICANCE OF THE STUDY

The significance of the study is that it will provide teachers with information which will give them the confidence to use different technologies, such as cell phones, to encourage their learners to participate and engage in school-related tasks after school. The use of relatively simple technology could be used to encourage learners to take responsibility for their learning and to develop independence. Furthermore the design of the study has addressed teachers' expressed concerns about learners using cell phones during school hours since the design only requires learners to use their cell phones outside of the school environment.

2 CHAPTER TWO – LITERATURE REVIEW

2.1 INTRODUCTION

The South African Education Department White Paper on e-Education (Notice 1922 of 2004) discusses the transformation of learning and teaching through information and communication technologies (ICTs), stating that e-learning requires changes in methodology so that teachers and learners have an electronic means of collaborating and communicating with other teachers or learners and with each other. Therefore researching the use of a portable technology as part of the educational experience seems logical. Some of the technological products or 'digital assets' suggested as underpinning e-Learning in the Gauteng Education Department Circular 71/2008 are the cell phone, i-pod, DVD, television and curriculum software. Makoe (2011) suggests that the use of mobile technology needs to be investigated with regards to providing support for learners and envisages that cell phones could be used to achieve this as they have continuous access to this mobile, easily accessible technology. Studies such as the 'Speak Up National Research Project' (2010) in the USA and the 'Inkanyezi Research Project' (2001 – 4) in the Eastern Cape in South Africa have shown how handheld information and communication devices can be beneficial to education.

Even though young people today use cell phones in their everyday life, many schools, both in South Africa and internationally, do not allow the use of cell phones by learners and students at school. Kolb (2008) agrees with this stance as she suggests that learners are very aware that their teachers dislike their social "toys" (such as cell phones). She describes that many teachers see cell phones as inappropriate tools for classrooms and that several schools have policies to keep cell phones out of schools. The interesting dichotomy of encouraging learners to use technology while schools are discouraging its use prompted this research as it was felt that despite the reservations of some teachers and schools cell phones still hold tremendous potential as a tool to enhance teaching and learning within the constraints of the South African school context.

The impact of using SMS technology meaningfully in a teaching and learning situation was explored due to the fact that studies such as 'Project Tomorrow' (2010)

highlight that teachers do not use technology to their advantage and Kolb (2008) suggests that the manner in which learners use technology is not replicated in the classroom. However Kreutzer (2009) and Brown (2008) demonstrate how mobile technology could be used successfully within the classroom space. A social constructivist perspective was used to explain how texting could be used to develop learning among children, as Vygotsky highlighted that learning takes place in the 'zone of proximal development' and the SMS question and answer interaction could be used as a tool to develop this concept of learning. While Maslow (1943) comments that motivation, including learner motivation, is affected by more than one situation or influence. Anderson and Krathwohl's learning and assessing taxonomy was used to demonstrate the thinking behind the teachers' questions and to explore the level of the thinking the learners were exposed to during the process. By using the SMS feature of the cell phone, authentic learning could be achieved as the learners worked within a real world context of SMSing real answers related to real questions about the lessons they had attended using a technology they were familiar with, as suggested by Cronin (Cronin, 1993, cited by Herrington, *et al.,* 2004), as the learning environment closely resembled a real life experience.

The aim therefore was to investigate whether the use of cell phone technology could have a positive impact on teaching and learning, and whether schools and teachers could be encouraged to use this mobile, interactive technology to enhance their teaching and learning environments.

2.2 REVIEW OF THE LITERATURE

2.2.1 A Constructivist Perspective In Using Interactive Mobile Technology When Teaching And Learning

The Constructivist approach to learning is grounded in the concept that knowledge is constructed by means of the individual's experiences and perceptions of the world (Schuman, 1996, cited by Mergel, 1998, p. 2) and that students actively create and develop their personal and subjective representation of reality (Learning Theories Knowledgebase, 2008). Use of mobile technology outside the classroom environment would allow the learner to reflect on and interact with the information discussed or taught earlier in the day. In light of this, mobile technology can be deemed to support constructive learning. Moreover, it is envisaged that a question sent via SMS which needed to be answered after school hours would also force learners to reflect on what had been taught during the day and would assist in the learning process.

The Soviet psychologist, Lev Vygotsky, presents a philosophy which pertains to the relationship between a learner's educational activity and his / her subsequent development. The Russian term, which Vygotsky uses, is 'obuchenie', roughly translated as 'instruction'. This term incorporates both the teaching and learning processes, thus highlighting Vygotsky's emphasis on the interaction between the environment and the learner (Luckin & du Bouley, 1999). The development of a student's ability relies on the interaction with others (an environment). In this study the interaction occurs via SMS, between the learner and the researcher, thus falling within the framework of social constructivism.

In this project, it is envisaged that an SMS feedback response sent in reply to a learner's SMS answers, would reinforce or assist the learner's learning process, as it implies interaction with a more knowledgeable other within a specific environment. This reinforces Vygotsky's social constructivist theory that learners learn better from interaction with others. He asserts that learning occurs most effectively in an environment where the individual is able to socialise with others thereby developing the tools for writing and speaking within a social and cultural context (Learning Theories Knowledgebase, 2008). After receiving the SMS after school, the individual

learner has the opportunity to network with others, such as family members or peers about the SMS question being asked. According to Vygotsky, learning occurred in the 'zone of proximal development' (ZPD) which is perceived as the gap between a student's ability to complete a task with the assistance of a 'more knowledgeable other' (teacher, adult or peer) and the learner's ability to complete the task independently (Learning Theories Knowledgebase, 2008). As learners engage meaningfully with others their ability, understanding and knowledge is developing. Vygotsky (1978) suggests that students perform at higher intellectual levels when asked to work in collaborative situations rather than individually (Vygotsky, 1978 cited by Gokhale, 1995).

Authentic learning is defined as learning in an environment that is as similar as possible to a real life situation, therefore making the learning relevant and meaningful to everyday situations that learners can associate with and relate to. The SMS interactions could allow the learners to reflect within a real world context and think about the knowledge and skills they are acquiring. Constructivists such as Duffy and Cunningham (cited by Harper & Hedberg, 1997) agree as they suggest that learning should take place within a context, which is relevant to the situation as knowledge is context dependent. It is proposed that learning should be embedded within a realistic context or situation (Cunningham, *et al*., cited by Harper & Hedberg, 1997). Therefore, Cronin suggested that the online learning environments should closely resemble the experiences that learners encounter in real life (Cronin, 1993, cited by Herrington, *et al.*, 2004) to make them authentic. If the teacher uses SMS technology to communicate with the learners, it is relevant, as the learners are already familiar with the technology and they use it extensively in a social context. Therefore a familiar situation is being utilized to engage the learners in a learning environment, which is an authentic educational situation. Moreover, it is envisaged that interactive, authentic learning that allows learners to respond to an SMS question would assist in reinforcing knowledge that had been taught during the school day. When educators are interacting with learners in this manner, they are working within the framework of constructivism, which suggests that learning is an active, dynamic and constructive process. Luckin and du Boulay (1999) saw Vygotsky's ZPD as an essential ingredient in their approach to educational software design, where the learning partner needed to provide activities which were challenging and at the same time provided the

appropriate amount of assistance. In a similar manner the type of the SMS question related to the Natural Science lesson (the learning activity) should fall within the ZPD of the learner to encourage and entice the student to engage with others. Thereby the learner would interact in the SMS question and response process while building and reinforcing his or her knowledge content.

2.2.2   A Perspective On The Impact Of Using SMS Technology In A Teaching And Learning Situation

As teachers, we are often reminded that the children we teach have grown up in the technology rich world of television, DVDs, cell phones and instant messaging. LaFraniere (2005) commented that by 2004 there were 76 800 000 mobile subscribers in Africa. Czerniewicz (2009) agreed that cell phones are widely used by people from all walks of life in Africa. The learners consider information as equally easily accessible via the internet, instant messaging or a cell phone call. In light of their use of technology, Kleiman (2002) considers that current learners view the world as being smaller than people from previous generations.

Young people communicate using SMSes and social chat networks that use SMSing such as MXit. MXit (MXit Lifestyle, 2011) is the abbreviation for "message exchange it" which includes an instant message application that can also be used to send and receive sound clips and images, via the cell phone. Information is sent using GPRS and is therefore a fraction of the cost of regular SMSes and is a very popular method of communication. As another example, Meehan (2011) in her book, Kids and Mobile Phones, tells the story of her daughter's first mobile phone: after two days she asked her mother where all her credit had gone. When Meehan phoned the cell phone company she discovered that her daughter had sent more than 297 texts in the two days. As learners text frequently it made sense to use this form of mobile technology for the project.

Annually, since 2003, the 'Speak Up National Research Project' (2010) in the United States of America has investigated how teachers and learners are using technology. From October 18 to December 18 2009, 'Project Tomorrow' (2010) surveyed 299 677 Grade K to Grade 12 learners, 26 312 parents, 38 642 teachers, 1 987 pre-service

teachers and 3 947 administrators from different socio-economic, racial and cultural groups from 5 757 schools in 1 215 school districts (which included urban and rural areas, 97% public schools and 3% private schools). 'Project Tomorrow' (2010) research found that learners from Grade Six to Grade Eight used a variety of tools to collaborate and communicate about schoolwork, including instant messaging or email, collaborating through social networking or online profiles with their peers, teachers and online tutors. A small percentage of these learners posted blogs or wikis, tweeted or posted a micro-blog, participated in online communities, or worked with learners from other countries and participated in video conferencing. The children in this study fell into the same age bracket as children in part of the 'Project Tomorrow' children and therefore it seemed to make sense to use South African Grade Seven children using simple SMS technology, since not all South African children would have access to a more sophisticated technology, such as smart phones.

The 'Project Tomorrow' (2010) research also highlighted the frustration of learners who felt that there was a lack of use of emerging technologies within their schools. This is reinforced by the findings of Facer, *et al.* (2005) in the UK where cell phones were available for teaching by the teachers, but were given a lower status than other technological teaching aids. Teachers seem to use classroom software, but don't use everyday technologies as easily, so the gap between the way children learn and communicate in schools is very different to the way they communicate out of school where they use texting, online chatting, cell phones, email and other digital technologies (Kolb, 2008). By contrast this study was designed to indicate to teachers how cell phone technology could be beneficial to their teaching rather than a hindrance. If teachers in South Africa can establish whether learners would use their cell phones in a similar way for school work as they do socially outside of school, it may have enormous consequences and impact on teaching methodology and pedagogy. Since the project was conducted with Grade 7 learners, the findings are relevant to that age group of children (pre and early teens). Facer, *et al.* (2005) discuss how the Government of the United Kingdom invested in developing information and technology (ICT) in schools. Their studies found that as handheld devices were easily portable and offered a perfect link between school and home, they did not limit education to the school environment but extended it to the daily lives of those involved, making it authentic learning.

The 'Project Tomorrow' (2010) findings also show that teachers in the USA schools that took part in the survey had concerns about allowing learners to use cell phones at school. The teachers were concerned that learners would be distracted or may use cell phones to cheat in assessments and that learners who did not have cell phones might be unfairly disadvantaged. Anecdotal evidence suggests that this view is similar to that expressed by teachers in South African schools. Many of the teachers in the 'Project Tomorrow' findings did not know how to effectively integrate the technological devices into their teaching and they felt that they needed the curriculum to support the use of mobiles (cell phones). Kolb (2008) suggests that learners are very aware that their teachers dislike their social "toys", such as cell phones.

The Inkanyezi Research Project in the Eastern Cape of South Africa (Leach, *et al.*, 2005) focused on the impact of ICTs (Information and Communication Technologies) on pedagogic practice, learner motivation and achievement using a mobile toolkit (which included a shared laptop and a personal hand-held computer between two teachers). Leach *et al.* (2006) showed that mobile technologies assisted teachers in enhancing their professional knowledge by developing pedagogic practices and subject knowledge; the technologies also enabled teachers to plan and prepare more effectively for their lessons. At the same time, handheld devices enhanced the learning of learners, as they used handheld devices confidently and were observed sharing them to take photographs, record interviews and make notes. This is evidence of the potential use of cell phones as an effective learning tool.

Kreutzer (2009) conducted a cell phone usage pilot study in a low-income area of Cape Town with Grade 11 learners. His findings suggest that the vast majority of urban South Africans in the age bracket of the learners in this study could have access to cell phones, as 97% of his participants did. LaFraniere (2005) illustrates how many rural communities in South Africa and other African countries are benefiting from cell phone use. This indicates that cell phones are widely available in all spheres of South African society. In particular, many learners who do not have access to computers may have access to a cell phone. These observations prompted the idea for this research, as it seemed that it might be beneficial to both learners and teachers if the effectiveness of the use of cell phone technology to encourage learning among students outside of the school day would be studied.

Brown's (2005) mobile-learning (or m-learning) study focused on students from Pretoria University, where he showed how the use of SMS technology had improved the involvement and communication between the university and the distance learning students in rural areas. The SMS communication gave the students access to information without having to travel to a post-office or internet café to receive the information. He suggests that using mobile learning provides students with greater flexibility and convenience than online learning as people carry their cell phones with them, while online systems require that the student has access to a fixed computer. SMSing is clearly more versatile which suits the student better.

At the same time as the number of learners having access to cell phones increases, so too the risk of cell phone security and safety issues increases, schools are aware of the safety risks. Straker, *et al* (2009) highlight the negative potential effects of using computers. A child's personal safety can be compromised when making contact with others via the social networking sites; possible exposure to inappropriate material (e.g. pornography) is a concern, as are issues around a reduction in physical activities and possible musculoskeletal discomfort with the increased use of the technology. These concerns could be related directly to the use of cell phones as well. Atkinson, *et al.* (2009) create an awareness that young people are often surrounded by various types of ICTs: computers, laptops and mobile phones both at school and home, and are thus becoming more susceptible to cyber-bullying, cyber-stalking or other forms of unwanted contact. There is also the possibility of the theft of the cell phone, either at school or on the way to and from school. This means learners need to be taught various aspects of e-safety from an early age. Atkinson *et al.* (2009) suggest that teachers may find themselves having to communicate an e-safety message at school with little support from elsewhere, while at the same time wanting to teach using technology with its enriched virtual environments. By using SMS technology in this study where the cell phones need not be brought to school, the safety issues are addressed taking into consideration each learner's physical safety (perhaps learners carrying phones might become targets for theft) as the participating learners did not have to take the cell phones to school to participate in the activities.

The Gauteng Department of Education (GDE) Circular 71 / 2008 described an "Integrated Learning Environment" as a learning environment where teaching and learning is facilitated through the use of e-Learning methodologies and ICT tools to improve the quality of teaching and learning by ensuring that Learning Area and Subject Outcomes are achieved. This integrated learning environment recommends tools such as Smart Boards, computers, cell phones, DVDs, etc. to enhance the quality of teaching and learning. The focus of the circular was not on ICT skills but on overall curriculum outcomes. Circular 71/2008 encouraged schools to use these 'digital assets' (e.g. cell phones) to support the learning process in all Learning Areas and Subjects. Natural Science was the focus Learning Area in this study. Another comment in Circular 71/2008 stated that learners and educators need to find and invent ways of using technology, and encourage and develop South African citizens to be critical and active lifelong learners. Schrum (Solomon & Schrum, 2007) would agree with this idea, as she suggests that web 2.0 tools could have a profound effect on schools as they could promote creativity, collaboration, communication and may even hone the learners' thinking and organizational skills. It has also been suggested that the SMS feature of cell phones could be used in school for pop quizzes, for opinion polls or to create an awareness of a class discussion. Outside of school, SMS technology could be used for test preparation (Prensky, 2005).

Scornavacca *et al*. (2009) explored the use of a classroom interaction system and the impact of cell phone applications, such as SMS, on university students' learning experience and concluded that the students and instructors benefited from the additional SMS channel of communication in the classroom. The lecturers noted that the students' feedback improved in both quality and quantity by using this communication feature. Students indicated that the system was useful, making classes more interesting and interactive. This research also supports the idea of investigating the effect of SMS technology in schools by learners. The University of Pretoria has been using SMS communication for a distance education programme with rural teachers since 2002, as 99.4% of the students had cell phones at the time their program was initiated. (Keegan, 2005, p. 12)

After reviewing the research on the effect of this type of technology on the learning of university students, Schlosser (2002) has commented that cell phones are central to

the modern workplace and are used prolifically in business and social life. She noted that cell phones were used innovatively, and that individuals generally adapted the technology to suit their lifestyle. This suggests that teachers might be encouraged to view the benefits to learning rather than anticipating that cell phones will be problematic to learning, as most learners have cell phones. Perhaps by allowing learners to use their cell phones at school and to deal with school work after hours, a similar creative culture to that which is found to be taking place in the business environment may occur. If so, this technology can be used to a school's advantage.

While use of cell phones in the work place showed positive spin offs, one area that has not been addressed is whether all learners are technologically literate. The question as to whether all learners are "digital natives" was raised in The Economist (Mar 4, 2010). The article cites various authors who give differing views. Palfrey and Gasser's "Born Digital" (2008) is cited, noting that the young people born since about 1980 do not have to learn about digital integration, as they use technology to express their ideas and views. Prensky (2005) is cited in the article as being in agreement with the idea that students have 'changed radically' and he suggests that the education system needs to change to suit the students. However, other academics such as Vaidhyanathan (University of Virginia, USA), Wesch (Kansas State University, USA) and Bennett (University of Wollongong, Australia) disagree saying that not all students are at the same technological level (The Economist, March 4, 2010). They comment that there is a range and variety of abilities of the users of technology amongst students, and that lecturers and presenters need to take cognisance of this.

2.2.3   Natural Science As The Teaching Subject (Learning Area)

Natural Science is seen by the South African Department of Education as one of the key subjects to be improved in terms of the quality of teaching, learning and assessment. In 2001 the National Strategy for Mathematics, Science and Technology Education (Department of Education, 2001) in General and Further Education and Training (DoE) was established with the strategy and aim to improve access, participation and performance in mathematics, science and technology. The Gauteng Department of Education (January 2010, p. 4) still has a strategy to improve the quality of understanding and the results within schools in mathematics, science and

technology (MST). The GDE's Objective 3 of the MST strategic aims is to improve learner achievement through in-class and supplementary programmes (GDE, Jan 2010, p. 6). With this in mind it was decided to use Natural Science as the subject to be used in this study. Kolb's (2011) science case studies highlight examples of how Science teachers used cell phone technology in their classrooms. For example, Andrew Douch, a science teacher in Australia, explained how he involved his astronomy students in a text messaging project where they had to receive a text message answer to a question, from someone not in the class. Rebekah Randall, a physics teacher in Michigan, encouraged her students to use their cell phones to record their experiences on roller coasters for a physics project.

2.2.4 Effects Of Motivation On Learning: Feedback-SMS

Aleven, *et al.* (2003) stated that students are influenced by motivational factors positively and negatively, stating that 'poor help seeking' often relates to students who are geared towards performance rather than towards learning. Abraham Maslow's Hierarchy of Needs Model, developed during 1943 and 1954 stipulated that each individual person is motivated by needs. These were divided into five categories: biological and physiological needs, safety needs, belonging and love needs, esteem needs and self-actualisation needs. In the 1970s two additional aspects of motivation were added, these were cognitive and aesthetic motivations. These motivations were not added to the Hierarchy of Needs (Chapman, 2010). According to Maslow, needs arrange themselves in pre-potency hierarchies, meaning that one need usually develops because of the satisfaction and gratification of a previous need being met. In addition no need stands alone. Each need is related to the dissatisfaction or satisfaction of other needs or drives affecting the individual person (Maslow, 1943). In addition, Maslow (1943) maintains that an act typically has more than one motivation, such as the atmosphere in the classroom, the student's relationship with the teacher, the student's understanding of the information being taught, the interaction of peers to the SMS research project and the individual's willingness to participate.

The motivation of the learner to participate further in the project could be provided by Vygotsky's 'more knowledgeable other', a learning partner: who could be a teacher, a

peer, a computer tutor (Aleven, *et al*., 2003) or in this instance an SMS feedback response to an SMS answer sent by the student. Kolb (2008) comments that unlike other school tools learners have their cell phones with them continually, so teachers should use the opportunity to find ways of including this technology in their teaching.

McClelland's (1961) needs based motivational model found varying degrees of motivation among individuals, one of which was the need for achievement. Here it is believed that the individual seeks achievement and attainment for realistic but challenging goals (Chapman, 2000-2009). Educators, according to Wiggins (2004), should create assessments that provide better feedback, as he suggests that there is little point to just award precise scores without the feedback to the students. Educators' feedback should not only be important during assessment but in every teaching situation, so that learners know how they are progressing. By sending an SMS feedback response to the learner's SMS answer it is possible for the teacher to engage with the learner and motivate him / her to participate in future learning, both in and outside of the classroom situation. Venables and Haywood's (2003) study using an electronic mailbox where students are able to get electronic feedback against automatic testing, agreed with the idea that feedback provided positive influences: such as the reduction of the amount of late submissions and learners seemed more responsible for their own learning.

2.2.5 Levels Of Critical Thinking Using Anderson's Taxonomy To Relate To The SMS Questions.

One of the National Curriculum Statements Grade R − 12 principles is for active and critical learning (Department of Basic Education, 2011, p. 6) where an active and critical approach is encouraged rather than an uncritical and rote approach to learning.

Anderson's Taxonomy (Anderson *et al,* 2001) is an adaptation of Benjamin Bloom's Taxonomy. Bloom's Taxonomy (Bloom *et al,* 1956) categorizes questions into different and more complex levels of cognitive, attitudinal and psychomotor domains of thinking. (Bloom, 1956, cited by Mergel, 1998) Bloom's (Bloom & Krathwohl, 1956) six levels within the cognitive domain were identified as knowledge, comprehension, application, analysis, synthesis, and evaluation. Bloom's Taxonomy

(Figure 1, left pyramid) represents the knowledge level as the lowest order thinking and all other levels represent some form of higher order thinking.

Wilson (2006) explains how Anderson, *et al.* in the areas of educational assessment, curriculum and cognitive psychology, altered Bloom's Taxonomy levels' wording, replacing verbs with nouns, namely: remember, understand, apply, analyse, evaluate and create. The Anderson group also compared Bloom's 'synthesis' to their 'create', but they felt that the ability to create is of a higher order thinking ability than to evaluate, and thus placed 'create' at the top of their pyramid (see Figure 1). Anderson's taxonomy is a useful tool to use when planning lessons and teaching. If referred to by the teacher, learners are encouraged to engage and answer questions of different levels of thinking. When formulating questions using critical, cognitive levels of thinking and simultaneously encouraging learners to use mobile technology with which they are familiar and are actively using, teachers can promote collaboration and communication about school related questions which takes place after school between teachers and learners, or between peers and encourages learners' thinking skills and creativity, as suggested by Schrum (Solomon & Schrum, 2007) when using web 2.0 tools.
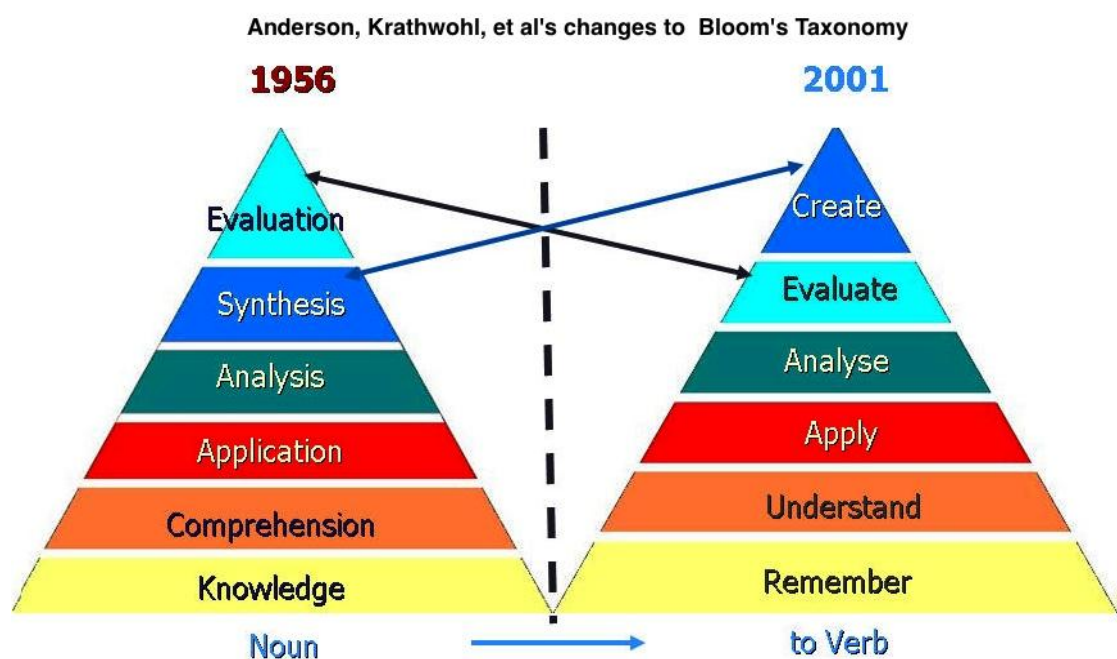
Figure 1: Anderson, *et al***'s Changes To Bloom's Taxonomy (Wilson, 2006)**

2.3   CONCLUSION OF THE LITERATURE REVIEW

The Department of Education of South Africa (2002, May) hopes to instil a love of lifelong learning among all students, encouraging them to become critical thinkers. As teachers we should be embracing changing technology and exploring ways to enhance and enrich our teaching in relation to technological developments around us. Various studies, such as Scornavacca *et al*. (2009), Leach *et al*. (2006) and Keegan (2005) demonstrate that mobile technologies enhance teaching and learning and are beneficial to learners and teachers.

The 2004 White Paper on e-Education (NDE, Notice 1922 of 2004) states that e-learning requires changes in methodology so teachers and learners would be required to collaborate using various technological products. This is still to be affectively achieved within the majority of South African schools. Nielsen writes (Tuesday, June 16, 2009) "The Innovative Educator" blog, the entry entitled 'Ideas for Enhancing Teaching and Learning with Cell Phones Even in Districts that Ban Them', states that there are few documented examples of cell phones being used to enhance teaching and learning, while the GDE Circular 71/2008 states that schools should use digital technologies, such as cell phones, to aid learning and teaching. In light of the research reported in the literature review this study aims to study the effectiveness of incorporating SMS technology in an after school communication between teachers and learners related to the work that had been taught during the school day.

3 CHAPTER THREE – RESEARCH DESIGN AND METHODOLOGY

3.1 OVERVIEW OF THE RESEARCH DESIGN

The project was conducted using a Concurrent Triangulation Design Research Method, which is a mixture of quantitative and qualitative methodologies used simultaneously and the findings were corroborated. This Concurrent Triangulation Design approach was supported by McMillan and Schumacher (2010), who suggested when results of different research methods support each other and they converge reliable research is achieved. Qualitative interviews were conducted with the principals of the schools to understand the demographics of each school and its policies with regards to cell phone usage during schools. The teachers who were involved in the project were also interviewed initially to establish their use of cell phone technology in his / her class and to ascertain his / her viewpoint about using SMS technology related to the lessons after school hours. At the beginning of the process the qualitative and quantitative analysis of the returned 'Background Information' questionnaires allowed deeper insight and a greater understanding into how cell phones and SMS technology influenced or affected the learner's lifestyle. Then the SMS question and responses after the school day, between the researcher and the learners, were conducted and the results were investigated, both qualitatively and quantitatively, to establish the learner's individual engagement in the Natural Science related SMS questions. At the end of the process a 'Review of Research' questionnaire was administered among the participating learners, and the results were collated, analysed (both qualitatively and quantitatively). Finally results from the SMS interactions and the questions were merged and conclusions were drawn for this study.

3.1.1 Phase One: Qualitative Phase - Preliminary Research

This qualitative research began with the review of relevant literature dealing with the opinions and views related to the influence or impact of cell phone usage by different members of society. This is in line with Cresswell's (1998) suggestion that when a researcher uses a qualitative research method, such as interviews, a detailed opinion

should be formulated. This was followed by interviews with the principals and the Natural Science teachers as McMillan and Schumacher (2010) suggest that constructivist findings may reflect 'active' codes that demonstrate the contributors' insights as participants in the research. The purpose of these interviews was to find out about the context and setting of the different schools, the background of the learners at the various schools and how the school and its teachers viewed cell phone usage by learners.

3.1.1.1 *Head of School Unstructured Interview*

An appointment was set-up and an informal discussion or unstructured interview (Woods, 2006) was held with the principal of each school of the three schools, requesting permission to conduct research using their Grade 7 learners. This interview was conducted to determine the school's policy on the use of cell phones, on whether or not Grade Seven learners would be suitable for this study (number of Grade Seven classes and number of learners per class), as well as to gauge the schools' attitude to the use of cell phones at school by the learners. A written request was given to the principal during the discussion (Appendix 2).

The project involved Gr. 7 learners who had their own cell phones or had access to a cell-phone after school hours. It also involved one Gr. 7 Natural Science teacher from each school who was willing to participate in this SMS project over an approximately two week period, with each learner having to reply to a maximum of 10 SMS questions. The principals were informed that the learners would not need to bring the cell-phones to school as part of this project. They were also told that the project was a completely voluntary, even after learners had agreed to participate. The principal agreed upon the detailed information sheets and parent and learner consent letters, and consent from the school was received before the Natural Science teacher, parents or learners were approached about the project and to obtain their consent.

3.1.1.2 *Natural Science Teacher Discussion*

After the school approved the study with written consent, meetings were set up and discussions were held separately with the Natural Science teachers in an informal

environment at each of the three schools in order to explain the purpose of the project and their role in it. (A written request was given to the NS teacher during the discussion (Appendix 3). The teachers were asked to read the information sheet and to sign a consent form. They were told that Natural Science lessons would continue as usual and the SMS question would be sent out after school, for approximately two weeks, each day that Natural Science was taught. The teachers were asked to develop questions which were preferably open-ended. It was decided that the researcher could adapt or convert the questions, without losing the essence of what the teacher was asking, into an SMS question. The Natural Science teachers discussed their methods of teaching and how the research questions would relate to the topics that were being taught. The teacher was thanked for her or his time and the discussion took place in an informal environment.

3.1.1.3   *Learner Discussion and Permission*

A discussion was held separately with each nominated Grade Seven Natural Science class at each school. The project was explained to the learners, using the learner's permission document (Appendix 5) as the basis for the explanation. Learners were asked to volunteer to participate in the SMS project for approximately a two week period related to their NS school work. It was explained that they could respond to a maximum of ten SMSes. The learners were told that their SMS answers would be confidential and their names would not be needed in the process, just honest responses, as the information was to be recorded on a database arranged according to the cell phone number and not the learner's name. The learners were also told that they would not need to bring their cell-phones to school as the SMSes would be sent after school hours and they (the learners) could respond when it suited them. Learners were allowed to raise queries or concerns. Learners were also asked to take home the information document (Appendix 1), the parent consent form (Appendix 4) and the learner's consent form (Appendix 5) to discuss the project with their parents and to get their permission to participate in it. Learners were told that participants would be given a small monetary (R10) contribution so that they wouldn't feel that they were 'using their own airtime". (It was decided this amount was sufficient as SMSes cost less than R1 each, and a maximum of 10 SMSes would be required to be sent from the learners if they wanted to reply to all questions.) Learners who agreed to

participate returned both the parental and learner consent forms to school, in a sealed envelope, before they were allowed to participate in the project.

3.1.2 Phase Two: Participant Background Information Questionnaire

The 'Background Information Questionnaire' (Appendix 6) contained both the qualitative and quantitative question types. This questionnaire was used to ascertain background information was completed by each learner who had been given permission to participate in the research by his or her parents or guardian. The questionnaire was completed at home and returned to school in a sealed envelope.

3.1.2.1 Phase Two A: Qualitative Phase

Learners who agreed to participate in the study completed the 'Background Information Questionnaire' (Appendix 6). The purpose was to find out factual details which were analysed to provide deeper insight and a greater level of understanding into how SMS technology influenced or affected the learner's responses and involvement in the particular Learning Area, Natural Science. Both open and closed questions were used in this questionnaire.

Objectives for this questionnaire for the qualitative research

Once the questionnaires had been completed it was possible to establish:

1. The school the participant goes to to determine which possible socio-economic group he / she belongs to
2. Whether the participant communicates with other people via SMS
3. Which people the participant communicates with more frequently via SMS

3.1.2.2 Phase Two B: Quantitative Phase

Once the questionnaire had been completed by each participating learner, the information could be used to establish the demographics of the learners in relation to school, age and gender, how they use their cell phones to communicate with others (such as SMS or MXit) and with whom they communicate most often (for example parents or peers)

Objectives for this questionnaire for the quantitative research

Once the questionnaires had been completed it was possible to establish:

1. The gender of the participant

2. The participant's age, to confirm that they were of primary school age.

3. The socio-economic groups of each school's participants

4. The participant's cell phone number, to create the CSV data base for communication.

5. The type of cell phone the participant will be using

6. Whether the participant communicates with other people via SMS

7. Which people the participant communicates with more frequently via SMS

8. The most favoured method of technologic communication, such as SMS, MXit.

The data was compiled and portrayed displayed in graphical or table format.

3.1.3   Phase Three: SMS Interaction With Learners

The Natural Science (NS) Teachers and the researcher made a joint decision as to when the SMS questions would be sent in accordance with the school's teaching calendar. The original SMS questions were devised by the NS teacher and related to the NS topic at the time.

Table 1 Co-ed School's SMS Questions

Qu. No.	Question	Response / No response sent to answer of question
1	Why would an astronaut enjoy being weightless?	No response
2	Why is gravity important to us as people?	No response
3	What are the advantages of a material being dense?	No response
4	All materials are influenced to greater or lesser degree by presence of a magnetic field, do you agree?'	Response
5	How are magnetic objects useful to us?	Response
6	What was your favourite section you were taught in Science this year?	Response

Table 2 Boys' School's SMS Questions

Qu. No.	Question	Response / No response sent to answer of question
1	Why is it important to know the high risk behaviours related to HIV / Aids?	No response
2	What is the significance of science in dispelling the myths around HIV / AIDS?	No response
3	Is it fair that Plato is no longer described as a planet?' Note error in qu. should have been 'Pluto'.	No response
4	How have man-made satellites influenced people's perception of the solar system?	Response
5	How has the development of the international space station benefited you directly?	Response
6	What was your favourite section you were taught in Science this year?	Response

Table 3 Girls' School's SMS Questions

Qu. No.	Question	Response / No response sent to answer of question
1	Why is it important to understand the physical properties of materials?	No response
2	List the properties of metals and identify any 3 objects that are made from metals	No response
3	Identify 3 objects at home made from 3 different materials, explain the properties which made them suitable	No response
4	Name 3 metals that are magnetic. How are magnetic metals of benefit to people?	Response
5	Name 3 metals that are found in their pure state.	Response
Add. Qu.	Why are metals separated from the ore?	Response
Last Qu.	What was your favourite section you were taught in Science this year?	Response

The researcher re-designed the questions to fit into an SMS format of no more than 160 characters. The learners knew the SMS came from the researcher as each SMS was signed, "from Mrs. W". Each participating learner's SMS responses for each question were analysed separately, according to whether the question was correct, the grammatical structure of the answer, as well as if text abbreviations were used.

The first three SMS questions were sent out and the responses were collected, counted and analysed. There was no additional communication with the participants (the learners).

The same SMS responses were analysed from a quantitative view point by counting how many participants responded, and whether they responded to all or only to some of the SMSes. This was done to evaluate whether patterns of response were developing.

The second three SMS questions were sent out and the responses were collected. An additional SMS was sent in response to each individual learner's answer, commenting about the answer received, congratulating the learner if it was correct, or providing further information about the answer if it was inappropriate. An additional SMS was also sent to learners in the group who did not respond to the question, requesting them to respond to the next one.

The learners' SMS responses were analysed from a qualitative constructivist design view point by assessing whether each answer was correct, did the learner understand the NS content being questioned, as well as carefully considering the wording of the learners' SMS answers to determine whether the additional SMS responses influenced or affected whether the learners responded to further questions. The learners' SMS responses were once again analysed from a quantitative viewpoint by counting and totalling how many participants responded, and whether the additional SMS reply to the learners' answer influenced or affected whether the learners responded to further questions due to the additional feedback response from the researcher.

3.1.4   Phase Four: Comparative Phase

The quantitative data had been counted and recorded within each school group. The data was then compared across the various groups, namely the three schools, the gender groups and the various socio-economic groups, using nominal measuring scales. This was done to compare how the different groups responded to the various SMS questions.

3.1.5   Phase Five: 'Review of Research' Questionnaire

The learner participants completed the 'Review of Research' questionnaire (Appendix 7) at their own schools after all the SMS interactions were completed. The

information from the questionnaires was transferred onto an MsExcel database before each separate question was interpreted and analysed according to the various responses from different schools', the gender groups and the socio-economic groups.

The first two information statements (gender and school) were to reference the participants into the various groups (schools, gender groups and socio-economic groups) when the data was collated. The first three questions were analysed using a quantitative nominal scale of measurement.

- How did you feel about being involved in the project?
- How did you feel about having to send an SMS answer?
- How did the adults around you affect you involvement in the project?

The fourth question, "Who did you communicate most with about the SMS questions?" was examined using a combination of qualitative and quantitative techniques. The quantitative section of the question was a rank-order question, which used an ordinal scale of measurement with two variables: most often and sometimes. The data was calculated using the MsExcel COUNTIF function to total each variable according to the category. The qualitative aspect of the fourth question was scrutinised to determine who the learners communicated with about the research questions' answers, and whether they used verbal discussions or SMSes to communicate.

The fifth question, "Has this project changed your parents' ideas about cell phones?" and sixth question, "After being involved in this project, if your cell-phone was allowed at your school, how would you use it to help you with schoolwork?" were explored qualitatively. The researcher carefully considered and inspected the individual comments to determine the individual learners' opinions and viewpoints about these two questions. The conclusions and findings were recorded.

3.1.6 Phase Six: Merging of Studies

Merging and comparing the findings of all three aspects of the study: the background information questionnaire, the SMS interactions and the review of the research

questionnaire. The purpose was to merge the two methods of qualitative and quantitative research, to determine common findings and draw inferences and conclusions, thereby completing the triangulation of the study.

Concurrent Triangulation Design Research Method Model

Phase One: Preliminary Research
- Conduct Quantitative and Qualitative Interviews, collect information
- Identify the sample

| **Phase Two: Participants Background Information Questionnaire**
Quantitative Phase
Nominal & Ordinal Measurement Scales
Initial data to create SMS database | **Phase Two: Participants Background Information Questionnaire**
Qualitative Phase
Document studies |

Phase Three: SMS Interaction with Learners
Quantitative Data
- SMS Replies to SMS Questions with no response
- SMS Replies to SMS Questions with feedback response

Phase Three: SMS Interaction with Learners
Qualitative Data
- SMS Replies to SMS Questions with no response
- SMS Replies to SMS Questions with feedback response

nalyse Quantitative Data
- Question Analysis Tool derived from Anderson's Taxonomy
- Descriptive & inferential numerical statistics

Analyse Qualitative Data
- Interviews
- Document studies – questionnaires
- SMS responses

Phase Four: Comparative Phase
SMS responses – schools, gender & socio-economic backgrounds

Phase Five: 'Review of Research' Questionnaire
Quantitative Phase
Nominal & Ordinal Measurement Scales
Initial data to create SMS database

Phase Five: 'Review of Research' Questionnaire
Qualitative Phase
Document studies

Phase Six: Merging of Studies
Quantitative Phase & Qualitative merging and comparing of findings
Common inferences & conclusions

Figure 2: Concurrent Triangulation Design Diagram

3.2 JUSTIFICATION FOR THE RESEARCH DESIGN: MIXED METHOD - CONCURRENT TRIANGULATION DESIGN RESEARCH METHOD

The study explored the idea of teachers using cell phones after school hours to communicate with the learners by sending SMS questions about the content that had been taught in class earlier in the school day. The Concurrent Triangulation Design research method adopted for this study is a mixture of quantitative and qualitative methods used simultaneously so that the findings could be corroborated. The research addressed the extent to which and in what ways a sample of Grade 7 learners interacted and responded to school related questions posed and sent using SMS cell phone technology after the school day. The wide variety of cell phone types and models the learners had access to should be borne in mind in the design of the research study. Since all cell phones can SMS, the study was restricted to SMS communication. The qualitative and quantitative data were collected in parallel, analysed separately, and then compared and merged before drawing final conclusions.

In this study the quantitative descriptive data from the questionnaires and the SMS responses were used to determine whether SMS interactions after school hours between learners and teachers could positively influence learners to engage with learning materials after school from separate schools. The qualitative data such as interviews, observations and questionnaires explored the use of SMS question-answer interactions for participating Grade 7 learners at three separate, independent schools. An analysis of the quantitative and qualitative results allowed for responses to be compared between the different schools, gender and different socio economic groups. This study was designed to indicate to teachers how cell phone technology could be beneficial to enhance and promote learning rather than become a hindrance. In light of this it was valuable to establish whether a sample of Grade 7 learners would respond to SMS questions, and in what manner they would become involved in the study, and what feelings they might have about the project.

Quantitative research tests theories exploring, examining and investigating the relationship between the variables. The variables can be measured on instruments or tools so the data (often numeric data) can be analysed using statistical procedures or

tests (Creswell, 2009). In this situation the quantitative data results enhanced the general comments, views and ideas, while the context was explained better by using the qualitative results.

Both types of data, quantitative and qualitative, were collected at the same time. This created the opportunity for the quantitative data to be triangulated while allowing for the qualitative data's individual responses and reactions to be included and recognised. A mixed method research design was considered particularly suitable for a study of this nature, as both methods played a significant role in clarifying the findings. It was decided to use a Concurrent Triangulation Design Research Method where the mixed methods were used simultaneously to enrich both methods and to enhance the final findings and conclusions. The mixed-method strategy was supported by McMillan and Schumacher (2010) who suggested that when results from different research methods on a single topic support each other and converge, the findings had been mixed or triangulated. In this situation the quantitative data results enhanced general comments, views and ideas, while the context was explained better by using the qualitative results. The qualitative methodology allowed the possibility of gaining insight and a greater level of understanding of how SMS technology had influenced or affected the learner's responses and involvement in a particular subject, namely Natural Science. On the other hand, the quantitative data collection methods allowed measurement scales (McMillan & Schumacher, 2010, p. 150) to distinguish different aspects from each other, such as how many learners responded to the SMS questions or which gender responded to a greater degree. This method also offered possibilities for the quantitative data to be triangulated as well as allowed for data collating individual responses and reactions to be included and recognised.

The reason for collecting both qualitative and quantitative data was to corroborate the results of the two forms of data to bring greater insight into the problem than would be obtained by either type of method separately.

3.3 RESEARCH POPULATION

3.3.1 Schools

The research was conducted at three different schools, using one class of Grade Seven learners from each school. The participating learners had permission from their parents and had access to a cell phone after school hours.

- Single sex girls' primary school
- Single sex boys' primary school
- Co-educational primary school

All three schools were private, urban city schools. The majority of learners from both the single sex schools were from upper and middle socio-economic environments, while the majority of the co-ed school's children were from a lower socio-economic environment.

Reasons for using these schools:

- All three schools are private institutions.
- In the single sex schools the majority of learners have their own cell phones which they are able to use freely within their own family's constraints,
- In the co-ed school the majority of Grade Seven learners have access to the cell phones, with many having their own.

3.3.2 People Involved

3.3.2.1 Principals

Prior to the research a meeting was held with each of the three principals, to discuss the idea of using Grade Seven learners who had access to a cell phone after school hours as well as the Grade Seven Natural Science teachers, in a SMS project over a two week period, with each learner having to reply to a maximum of 10 SMS questions.

The principals were informed that the learners would not need to bring the cell phones to school. They were also told that it was a voluntary project for which learners and their parents would have to give consent before the learners could take part and that the Natural Science teachers would have to agree to participate in the study. The

detailed information sheets and consent letters were given to the principals; learners or parents were informed of the project. All the principals agreed to the project and where interested in seeing the results. They did not participate in the project any further.

3.3.2.2 Participating Natural Science Teachers

One Grade Seven Natural Science teacher was used from each school. Each teacher gave verbal consent after a discussion about the project. The teachers each chose a class that would be approached for involvement in the project. Teachers were asked not to encourage learners to respond to the SMSes but each teacher formulated the SMS question to be sent to the learners, which centred on to the work being taught at the time in class.

3.3.2.3 Learners

One class of Grade Seven learners was chosen by each Natural Science teacher from each school. These children were approached and asked to participate in the SMS project and were then asked to discuss the matter with their parents and have the relevant permission forms completed before being able to participate in the project.

The learners were from three different schools. They did not interact with each other as part of the project. Each school was dealt with individually. Each learner had his or her own cell phone or had access to a cell phone.

3.3.2.4 Parent / Guardian Information

The parents / guardians gave written permission for their children to participate in the project, acknowledging that the learner had access to a cell phone at home and that the phone was not needed at school

3.4 Characteristics, Criteria, Permissions And Sample Identification For Both Qualitative And Quantitative Strands.

Table 4: Key Qualitative Research Characteristics And Quantitative Research Criteria Implemented

Qualitative Characteristic / Quantitative Criteria	Strand Normally Associated With	Description
Natural setting	Qualitative Characteristic	Three actual classes of children were used from three different schools.
Context sensitivity	Qualitative Characteristic	Consider the daily influences within a school situation that may or may not affect when the SMS questions would be sent and the type of question sent relating to what was relevant to the teacher's teaching topic at the time. Close interaction with the various teachers as to day-to-day processes at schools and when it was appropriate to send the SMSes.
Direct data collection	Qualitative Characteristic & Quantitative Criteria	Researcher collected SMS data directly from School Management System 'Pencilbox' Collected and reviewed pre- and post- questionnaires directly.
Inductive data analysis	Qualitative Characteristic	Generalisations are concluded and induced after synthesizing the information was collected.
Participants perspectives	Qualitative Characteristic	Focus on the learners' comments and views expressed in both the questionnaires and in the SMSes were invaluable.
Emergent design	Qualitative Characteristic	This was considered in terms of when the SMSes should be sent in relation to other events or activities taking place at the various schools.
Complex Understanding and Explanation	Qualitative Characteristic	Consider the complex nature of the world, in relation to the way in which the learners answer the questions and considering multiple perspectives.
Ethical Considerations	Quantitative Criteria & Qualitative Characteristic	Focus on what is morally proper / improper when engaging with participants or accessing data. Be Sensitive to beneficence, justice, respect for persons, protecting vulnerable populations (e.g. children), and social betterment.
Informed Consent	Quantitative Criteria & Qualitative Characteristic	Explanation & full disclosure of research to participants, if necessary family members.
Voluntary Participation	Quantitative Criteria & Qualitative Characteristic	Voluntary participation, with withdrawal allowed at any stage of study
Privacy	Quantitative Criteria & Qualitative Characteristic	Privacy includes: the anonymity, confidentiality and secure data storage of participants & data with a research study.
Protection of private property	Quantitative Criteria & Qualitative Characteristic	Protection of the individual's private property, (participant's cell phone). The individual's only used the phones away from school, so this was not seen as an issue with regards to the study.
Sampling	Quantitative Criteria & Qualitative Characteristic	Subject group to be used during study. A convenience sample was used.

(Adapted from McMillan & Schumacher, 2010)

3.4.1   Characteristics And Criteria

3.4.1.1   *Natural Setting*

The natural setting for this study was the three actual classes within three different schools that were used. Two were single sex schools: one a boys' school and the other a girl's school. The majority of learners from these two schools were from middle and upper socio-economic households. The third school was a co-ed school whose children were predominantly from lower socio-economic households.

3.4.1.2   *Context Sensitivity*

The context sensitivity of the project had to take into consideration the individual daily influences within each school, such as learners going on outings, public or school holidays, class or subject tests and assessments within the school. These influences affected whether the Natural Science lesson was taught and therefore whether the SMS question could or could not be sent. Close interaction with the Natural Science teacher from each school was needed, so that the SMS questions related to what had been taught during that day and to determine whether the SMS question could be sent.

3.4.1.3   *Direct Data Collection*

The direct data collection happened throughout the project. The initial data collection began once the learners had been given permission by their parents to participate in the project. Each participant completed a pre-research questionnaire, entitled: Research Using SMS Cell-phone Technology to support Teaching and Learning in Primary Schools - Background Information Questionnaire (Appendix 6). The qualitative type questions included information about the individual learners' details (gender, school and cell phone number) and information about the type of cell phone they would be using. The learners also provided examples of the rules their parents or guardian had given them with regards to cell phone use or guidelines.

Next the data from each SMS response was recorded on the School Management System (SMS) 'Pencilbox' within the bulk SMS response section, under the

researcher's name. The various SMS responses from each individual learner, from each school which could be linked by using the cell phone number were collected from this SMS system.

The final data that was collected were the individual questionnaires the learners completed after the SMS component of the project was complete. (A study of the use of SMS Cell phone Technology to support teaching and learning of Natural Science with Gr. 7 learners 'Review of Research' Questionnaire).

3.4.1.4   *Inductive Data Analysis*

The inductive data analysis took place after the data was collected; the information was synthesized and interrupted retrospectively, after which generalisations were concluded (McMillan & Schumacher, 2010). The various aspects of the data (the two questionnaires and the various responses from the various individuals from each of the schools) were analysed and generalisations were decided upon.

3.4.1.5   *Participants Perspective*

The participants perspective is important, as the researcher tries to 'reconstruct reality' from the participants point of view (McMillan & Schumacher, 2010). The information used to achieve this perspective was to use and assemble the individual learners' comments and views expressed in both the questionnaires and in the SMS replies submitted.

3.4.1.6   *Emergent Design*

The emergent design developed as the discussions with the teachers took place, and explained the areas of Natural Science they would be teaching, when it would be appropriate to begin sending the SMS questions and what the questions would be. This took into consideration other events or activities taking place at the various schools.

3.4.1.7   *Complex Understanding and Explanation*

The complex understanding and explanation of the research information was considered, as qualitative researchers believe there are not many simple explanations for human behaviour and that the world is complex (McMillan & Schumacher, 2010). With this in mind, the various responses and perspectives were taken into consideration when analysing the learners' answers to the questions and their comments within the questionnaires.

3.4.1.8   Ethical Considerations

Ethics with regards to research, focus on and are concerned with beliefs about what is morally proper or improper when engaged with participants or when accessing data from a moral perspective. The majority of educational research subjects are human beings. It is necessary for the researcher to understand ethical and legal responsibilities when conducting research (McMillan & Schumacher, 2010, p. 117). The individual participants' dignity, privacy and confidentiality were taken into consideration throughout this study. The project and the process of the project were explained verbally and a detailed written explanation (Appendix 1) was given to all who might potentially be involved, including all the Grade 7 learners and their parents who could have been involved in the study. Before the study began consent was acquired from all concerned, namely the schools, the teachers, the participating learners and the learners' parents.

3.4.1.9   Informed Consent – Full Disclosure

Before agreeing to participate the prospective subjects were provided with a detailed, full explanation about the research, including full disclosure of any possible risks related to the research (McMillan & Schumacher, 2010, p. 118). The participants were then able to provide informed consent before the study began. In this SMS interactive study, the participants from selected school groups were asked to participate in the research activity after it was explained to them in detail. The explanation included reminding the learners that sending an SMS has a cost implication, and stating that a small monetary contribution would be given to each consenting participant before the project began. A detailed written explanation of the study was also provided (Appendix 1) to all involved (school, teachers, learners,

learners' parents). Written permission was supplied by the school, the teachers, the participating learners and from the learners' parents before the project began. It was also reiterated to participating learners that even after consenting to participate in the project, they still had the choice of actually taking part and replying to the SMS questions.

3.4.1.10 Voluntary Participation

It was very important that the subjects participate in the study on a voluntary basis, having being informed that they may withdraw from the study at any stage. It was clearly and precisely explained to the participating learners (study subjects) that even though they had agreed to participate in the study and they had been given the small monetary contribution, they still had the voluntary and optional decision of replying to the SMS questions.

3.4.1.11 Privacy

The privacy and anonymity of subjects taking part in a study must always be protected. Access to participants' behaviours, responses and other information is restricted to the researcher. Privacy of the participants (subjects) in a study is ensured by using anonymity, confidentiality and appropriate data storage.

The anonymity denotes that there should be no link between the data and the participants. The identification of the participants should not be able to be identified from the data (McMillan & Schumacher, 2010). The subjects (participants) in this study had their responses linked to a cell phone number only, all questionnaires were completed anonymously, and only the researcher had access to the database where the information was stored, so all responses were anonymous and private. A further extension was the anonymity of the schools involved in the study. There is no record of the schools' names within the recorded data. Neither is there a record of the principals' names nor the teachers involved in the study with the data base or other data materials.

Confidentiality denotes that only the researcher has access to the individuals' data and the participants' names, no-one else which also ensures that data and cannot be linked to individual participants by name. This is achieved by collecting data anonymously, where no names are included on questionnaires or surveys. The confidentiality of the school that took part will be maintained as the names of the schools are not included in the study. Neither the learners' names nor the schools' names were kept on the database with the responses, so all responses were anonymous and linked only to a cell phone number. The learners' and teachers' names were not included in the study in any form that could provide a link to his / her data. The SMS responses were removed from the school management system, 'pencilbox'. No one had access to the information on the database, other than the researcher, so it is completely private. The suggested SMS questions from the teachers were either given to the researcher verbally or via email (the original emails were deleted). The questions were transposed into an SMS form on an MsWord document by the researcher. It did not contain the names of the teachers or of the schools' names.

The storage of the data is very important to the protection of privacy. In this study the questionnaires are locked away and the electronic data is stored on a computer under a locked password to ensure complete privacy.

3.4.1.12 Protection Of Private Property (Cell Phone)

The protection of each individual participant's cell phone was considered. Since the phone was not used at the school and was only ever kept by the participant this was not an issue during the study.

3.4.1.13 Sampling – Convenience Sampling

In convenience or available sampling the participants are selected as they are easily available. In this instance the heads of the three schools used in the study all agreed that the study be conducted within their schools. They were interested in seeing the results regarding SMS technology being used in an educational environment. As the schools are primary schools it was decided to use children from the oldest grade in the school as it was presumed the older children would be more likely to have access to a cell phone than the younger children. The principals of the schools then recommended

classes and teachers, if more than one class existed. Finally the learners in each class had the project explained to them. They then had to discuss the project with their parents, and consent to participate was given (see Figure 3).

Interaction at Each School to Source Subjects
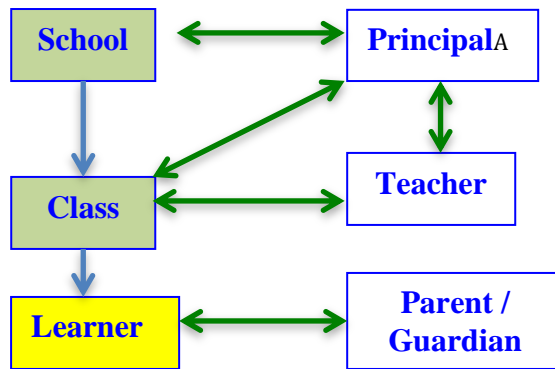
Figure 3: Convenience Sampling Diagram

Therefore the number of children agreeing to participate varied from school to school.

Table 5: Class Sizes

Type of School	Original Class Size: (No. of Learners initially asked to participate in study)	No. of Learners who agreed to participate	Percentage per class of participants
Co-ed school	24	16	67%
Boys' school	27	10	37%
Girls' school	26	11	42%

After the numbers of the subjects (learners) who agreed to participate were tallied, it was decided that sufficient children had provided written permission and agreed to participate so the study was set to continue. It was understood that this convenience sample, even though small, represented lower, middle and higher socio-economic groups, as well as both genders. A total of nineteen boys participated in the study: ten from the boys' school and nine from the co-ed school, and a total of eighteen girls: eleven from the girls' school and seven from the co-ed school.

The primary purpose of the study may not be generalised due to the small sample, but rather than dismissing the findings, they would be limited to the type of subjects in the study (McMillan & Schumacher, 2010, p. 137), that is Grade Seven learners, in

both single sex and co-ed schools from various socio-economic backgrounds who have access to cell phones.

3.5 METHODOLOGY

3.5.1 Qualitative Pre-Study Investigation Method

Before the study, informal discussions or unstructured interviews (Woods, 2006) were conducted with the principals and Natural Science teachers from each of the three schools. The principals and teachers interviews were each approximately half and hour in length each. The purpose of these interviews was to obtain and find out about the context, environment and setting of the different schools, the type of learners at the various schools, how cell phones usage by learners was viewed by the school and its teachers and to develop good consent practices with the participants (Creswell & Plano Clark, 2011). The researcher used techniques like asking for clarity or explanations during the discussions to keep the discussion focused and on track. Notes were recorded after each of the interviews. Commonalities and differences between the various schools were noted.

3.5.1.1 *Principals of Schools - Unstructured Interview Method*

An appointment was set up and an informal discussion or unstructured interview (Woods, 2006) was held with each principal from each of the three schools, requesting that the research be conducted using their Grade 7 learners. An unstructured interview, according to Wood (2006) is the best form of obtaining information if a relaxed, natural atmosphere is created. The researcher or interviewer would have general ideas about the topics to be discussed or a list of points to remind him / her of the points. The interviewer needs to avoid letting the conversation lose focus and become inconsequential.

Techniques used during the discussion to keep it focused:
- ask for explanations, pose alternatives ('if children have cell phones at school what are the consequences?')
- ask for clarification ('What did you mean by . . . . ?')

- search for opinions ('May the research be conducted at your school?' 'Would Grade Seven learners be suitable for this study', 'What is the school's policy on the use of cell phones?')
- ask hypothetical questions (Yes, but what if . . . ?)

The principals were informed that the learners would not need to bring the cell-phones to school as part of this project. They were also told that the project is completely voluntary, and that learners and their parents would have to consent before the learners could participate. The discussion was also used to find out about the school's cell phone policy or attitude to the use of cell phones by learners at school.

Questions that were addressed:
- May the research be conducted at your school?
- What is the school's policy on the use of cell phones?
- Would Grade Seven learners be suitable for this study?
- How many Grade Seven classes are there?
- Would Natural Science be an appropriate subject (learning area) to do the study in, in the school?
- How many Natural Science classes are there in Grade Seven? (if it was agreed to use Grade Seven)
- How many Natural Science Teachers are there for Grade Seven? If more than one, which teacher should be approached to do the research with?
- May the researcher set up a meeting with the Natural Science teacher to discuss the research and to find out if the teacher is willing to be involved?
- May the parents of the children be contacted for permission to participate in the research?
- May a discussion and information session be held with the Grade Seven learners to explain the process?

3.5.1.2 *Natural Science Teacher Discussion*

After the school approved and gave written consent, meetings were set up and informal discussions were held with the Natural Science teachers in all three schools. The project and the teacher's role were explained. The teachers were told that the Natural Science lessons would continue as usual, and that an SMS question related to

the NS lesson or topic would be sent out to each day that Natural Science was taught, after school, for a approximately two weeks. Questions that were discussed:

- How many Natural Science lessons are taught during a school week?
- How long are the lessons? (Minutes per lesson)
- How many children are in the Grade Seven Natural Science to be used?
- Do you use / own a cell phone?
- Do you use your cell phone or a similar technology to communicate with your learners, either during or after school?

The NS teacher was asked to devise possible questions to be used for the SMS focussing on the work being taught, which were preferably open-ended. It was decided that the researcher could adjust the question to fit into the 160 character SMS structure. The Natural Science teachers discussed their methods of teaching and how the research questions would relate to the topics taught. The teacher was thanked for her / his time and for their continued assistance during the project.

3.5.2   Quantitative Methods Used To Analyse The Background Information Questionnaire

Learners' completed the Background Information Questionnaire (Appendix 6). The Quantitative data was analysed and organised using statistical methods, such as descriptive statistics. Descriptive or summary statistics were essential when interpreting the results of qualitative research and are the most fundamental manner of summarising the data. They were used to organise, summarise or reduce large numbers of observations, focusing on 'what is' with regards to the data sample (e.g. what is the school the learner is from?). The information was transferred onto an MsExcel database and then the information was analysed using the following methods.

The first four statements asked the learners to provide their cell phone number, the make of the cell phone, name of school attended and the learner's age.

The cell phone numbers and the school group were placed on an MsExcel database to use when collating further data during the research. The name of the school was not

used on this database; rather the three schools were recorded as co-ed school, girls'
school and boys' school.

The cell phone numbers were also recorded into three CSV. files (one for each
school). These were exported onto the 'pencilbox' SMS management system to be
used to send the bulk SMS questions per school.

- **Age Question**

The ages of the learners were recorded on the database. Their ages were compared to
the Grade 7 norm of being between 11 and 14 years of age, ideally being 12 or 13
years. The number per year group per school was recorded.

The method used was a nominal scale of measurement, with nominal variables.
Categorical Nominal Variables have two or more categories (e.g. do you like school?
Always, most of the time, sometimes, never) and they can only have categories, not
levels (e.g. a Likert scale from 1 to 5)

Quantitative Analysis – Nominal Variables (Categorical Nominal Variable)

- Question: How old are you?
- Nominal Variable: Age
- Categories: Ages between 10 and 15 years (10, 11, 12, 13, 14, 15)

- **How do you mainly use your cell phone to communicate? ☐ Talk ☐SMS
  ☐MXit ☐Other (please state how)**

Quantitative Analysis - Nominal variables (Categorical Nominal Variable) have two
or more categories (e.g. do you like school? Always, most of the time, sometimes,
never) and they can only have categories, not levels (e.g. a Likert scale from 1 to 5)

- Question: How do you mainly use your cell phone to communicate?
- Nominal variable: Method of communication
- Categories: Talk, SMS, MXit, Other

- **Cell Phone Make**

The makes of the cell phones were also recorded on the database. This information was not used in the research, however it could have been analysed using a nominal measurement scale with nominal variables.

- **Tick the relevant box: - Gender: ☐Female ☐ Male**

Quantitative Analysis – Categorical Variables (Categorical Dichotomous Variable) where only two categories may exist.

- Question: Are you female or male?
- Dichotomous variable: Gender
- Categories: Female, Male

The gender of participants per school was totalled and recorded. The information was pictorially portrayed as a bar graph. The information was used further in the study when analysing the SMS responses in relation to gender.

- **Have your parents / guardians given you cell phone rules / guidelines?**

This question had both qualitative and quantitative components; the quantitative aspect will be discussed here.

Have your parents / guardians given you cell phone rules / guidelines? ☐Yes ☐No
If yes, give an example of the type of rule / guideline they gave: (lines spaces left for comments)

Quantitative Analysis – Categorical Variables (Categorical Dichotomous Variable)

- Question: Have your parents / guardians given you cell phone rules / guidelines?
- Dichotomous variable: Yes / No
- Categories: Yes, No

- **Ordinal Scale of Measurement**

Rank-ordering data puts it on an Ordinal Scale. The variable categories can be ranked, such as from highest to lowest. There was also a scaled item, which allowed the participant to provide an opinion, relatively accurately, by using a series of values or

levels that describe the various degrees of something (McMillan & Schumacher, 2010).

The type of scaled item used in this questionnaire was a rank-order, as the participants had to list from most to least the people they communicated with via SMS. For example: Who do you communicate via SMS with the most? In order of frequency: Number the blocks for 1 to 5: (1 is most and 5 is least / never)

☐Parents

☐Other family members

☐Friends

☐People you don't know

☐ Other (please explain) _____

The data was calculated as to how many participates communicated according to each rank order in each category, e.g. parents, friends. The MsExcel COUNTIF function was used to calculate each rank –order in each category.

An example of the formula used: =COUNTIF(A2:A5,"1st")

- Description: Number of cells with "1st" in first column of the table.

- Range of cells to be counted: A2:A5

- Criteria to be counted: "1st"

The quantitative findings from this questionnaire have been used to determine:

- The gender of the participant

- The participant's age, to determine that they were primary school age.

- The school the participant goes to determine which possible socio-economic group he / she belongs to

- The participant's cell phone number, to create the CSV data base for communication

- The type of cell phone the participant would be using

- Whether the participant communicates with other people via SMS

- Which people the participant communicates with more frequently via SMS

- The most favoured method of technological communication, such as SMS, MXit.

3.5.3 Qualitative Methods Used To Analyse The Background Information Questionnaire

The learners completed the Background Information questionnaire (Appendix 6) these were seen as personal documents, which are described as a first-person account of events and experiences. These types of documents are useful sources of data, according to Wood (2006), but should be treated with confidentiality and care. The purpose of analysing these documents was to find out how the factual details of the open-ended questions provided a deeper insight and a greater level of understanding into how SMS technology influenced or affected the learner's responses and helped the researcher understand the participants' opinions about the using SMS technology for school work after school hours.

Questions from the Background information Questionnaire
- **Have your parents / guardians given you cell phone rules / guidelines?**

As mentioned previously this question had both qualitative and quantitative components. The qualitative aspect will be discussed here.

Have your parents / guardians given you cell phone rules / guidelines? ☐Yes ☐No
Qualitative aspect of question: If yes, give an example of the type of rule / guideline they gave: (lines spaces left for comments)

This section of the question is open-ended, and the learners could reply in any manner they desired.

The answers from all the participants were recorded and the information was investigated and analysed to establish whether the parents / guardians provided guidelines for their children for the use of cell phones, and what type of advice (if any) was given to the children by their parents / guardians.

The qualitative findings of this questionnaire have been used to determine:

- The school the participant goes to determine which possible socio-economic group he / she belongs
- The type of people the participant communicates with most via SMS, such as friends or family, and the manner he / she communicates most SMS or social networks.
- The type of guidance (if any) the children were offered by their parents with regards to cell phone rules.

3.5.4 Qualitative Methodology Used To Explore And Explain How The Taxonomy Level For Each SMS Question Was Decided

The Natural Science teachers set questions that could be sent to the learners on the topic being taught SMS questions. These questions were then adjusted and adapted into an SMS format. The essence of the original question was kept as far as possible. The learners knew the question came from the researcher, as each SMS was signed, "from Mrs. W". These SMS questions were equated to one of the levels adapted by Anderson and Krathwohl. The majority of the questions were intended to try to encourage the children to think and reason, or to allow learners to provide their own opinion or idea. Some of the questions were knowledge and recall type questions.

The SMS questions were analysed using the tool below, to decide which level of Anderson's Taxonomy (Anderson, *et al.*, 2001) the question related to. The levels of Application, Analysis, Evaluation and Create will be considered higher order thinking, while the levels of Remember and Understand will be regarded as lower order thinking (see Figure 4). The diagram of Anderson's Revised Taxonomy Levels and Definitions (Figure 4) illustrates the definitions (descriptors) of the levels which were used to determine whether the question belonged to the higher or lower level of thinking, and were related to a particular level.

Anderson's Revised Taxonomy Levels and Definitions
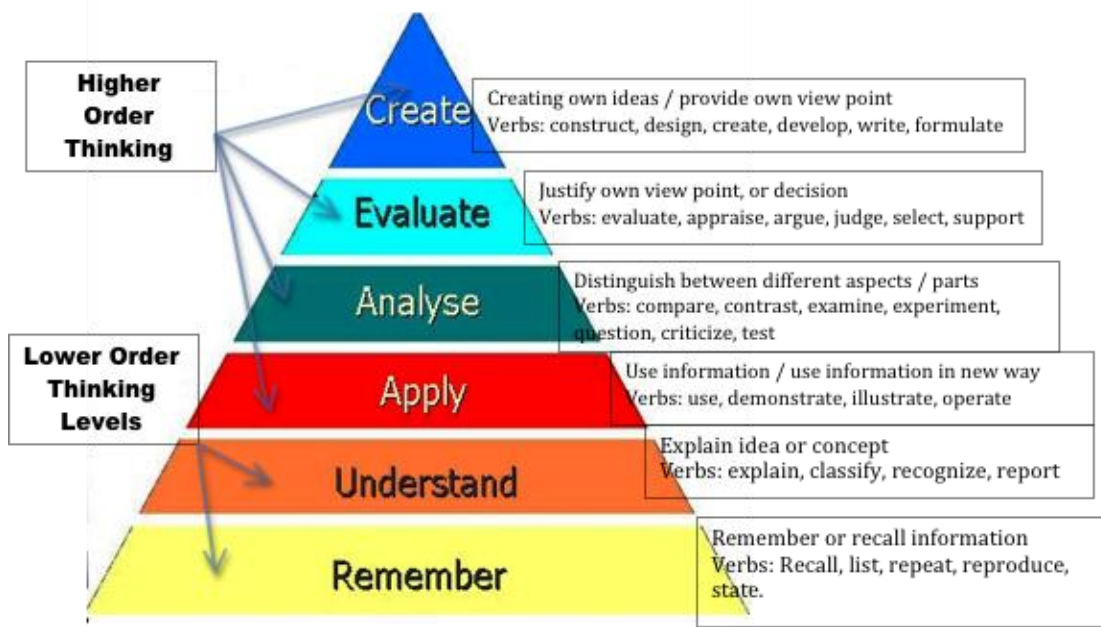
Figure 4: Anderson's Taxonomy And Level Descriptors; Adapted From Sun, Y. M. (2007) And Wilson, L. O. (2006)

Table 6: Level, Descriptor, Level of Thinking And Suggested Verbs For Anderson's Revised Taxonomy

Anderson's Revised Taxonomy			
Level	**Definition / Descriptor**	**Higher / Lower Order of Thinking**	**Suggested related verbs**
Create	Create own ideas and provide own view point	Higher Order	Construct, design, create, develop, write, formulate
Evaluate	Justify own view point or decision	Higher Order	Evaluate, appraise, argue, judge, select, support
Analyse	Distinguish between aspects or parts	Higher Order	Compare, contrast, examine, experiment, question, criticise, test
Apply	Use information in various ways, including new ways	Higher Order	Use, demonstrate, illustrate, operate
Understand	Explain idea or concept	Lower Order	Explain, classify, recognise, report
Remember	Remember or recall information	Lower Order	Recall, list, repeat, reproduce

Each SMS question was analysed separately and a decision was made as to which level of Anderson and Krathwohl's Taxonomy it related to. The analysis of the SMS questions focused on the level of critical thinking expected by the learners. It was established if they were sufficiently open-ended to allow learners to effectively engage with them. This analysis of the questions was conducted before the SMS interaction to determine the range and variety of questions to be asked per school.

3.5.4.1   Analysis Of SMS Questions For The Co-Ed School's Learners.

The first SMS question related to Anderson's Taxonomy Level - 'Evaluate', as the learners had to draw conclusions, make decisions or give their own point of view. The question asked: '*Why would an astronaut enjoy being weightless? Give your own ideas.*' This first SMS question was open-ended and allowed the learners to think creatively and critically.

The second question was considered an 'Analyse' type question where the learner examined the situation, or perhaps compared and contrasted ideas as suggested by Anderson it asked: '*Why is gravity important to us as people? Give your own ideas.*' This question was also open-ended and allowed the learners to apply their knowledge and analyse the situation, thereby providing their own thoughts and ideas.

The Third Question related to Anderson's 'Apply' level, as the learners had to describe information and demonstrate knowledge. It asked '*What are the advantages of a material being dense? Give your own ideas.*' This question was less open-ended. The learners had to know the properties of different materials to apply their knowledge to the various materials and explain what were the advantages of material being dense.

The fourth question was initially interpreted as Anderson's 'Apply' level, as it was thought that the learners had to use information and demonstrate knowledge. However, after reading the responses the learners submitted, the question was re-assessed and linked to the Anderson's 'Analyse' level, as the answers distinguished between materials and the learners needed to compare and contrast the different materials before deciding on an answer. The question stated: '*All materials are influenced to greater or lesser degree by presence of a magnetic field, do you agree?*' This question is open-ended, as the learners had to demonstrate understanding and analyse the information about the different materials and then decide on the answer to be submitted.

The fifth question was linked to Anderson's 'Understand' level as the learners had to explain and / or classify objects. It asked: '*How are magnetic objects useful to us? Give one idea*!' This is a limited question, and less open-ended as the learners had to

provide uses for one type of material, which is showing understanding of the information.

The sixth question was related to Anderson's 'Analyse' level as the learners had to examine the situation, compare and / or contrast ideas before answering the question. The question asked: '*What was your favourite section you were taught in Science this year?*' This question was open-ended, allowing the learners to reflect on and analyse what had been taught and decide which areas interested them the most.

Table 7 Questions For Co-Ed School Learners Related To Anderson's Taxonomy Levels

Questions per level	Anderson's taxonomy levels
0	Create
1	Evaluate
3	Analyse
1	Apply
1	Understand
0	Remember

As shown in Table 7 three questions were set at the analyse level, one each at the evaluate, apply and understand levels, while none were set at the neither create nor remember levels. This gave a good mix of open-ended questions from a variety of taxonomy levels.

3.5.4.2   Analysis of SMS questions for the Boys' School's Learners.

The First Question sent to the Boys' School Learners related to Anderson's level entitled 'Apply'. The learners had to 'use information and demonstrate knowledge' when asked: '*Why is it important to know the high risk behaviours related to HIV / Aids?*' It was an open-ended question allowing the learners to provide their own opinions and thoughts.

Question Two related to Anderson's level of 'Analyse'. The learners had to examine the situation, compare and / or contrast ideas when asked: '*What is the significance of science in dispelling the myths around HIV / AIDS?*' This too was an open-ended question and allowed learners to show an understanding of the topic being taught and to analyse the situation before submitting an answer.

Question Three was also described as being on Anderson's 'Analyse' level. The learners needed to examine the situation, compare and / or contrast ideas, the question asked: '*Is it fair that Plato is no longer described as a planet?*' This was a problem as instead of 'Pluto' (the planet) the word 'Plato' (the Greek God) was used in the question. Most learners ignored the error and responded as if it was 'Pluto' using the correct spelling in their response. What needs to be noted is that careful vigilance to the spelling and accuracy of the initial question needs to be taken. This was an open-ended question, as learners had to understand the background knowledge and then had to analyse the situation in relation to the question, and submit a response.

Question Four was linked to Anderson's 'Evaluate' level. The learners had to argue, select, support and / or appraise an idea or concept when asked: '*How have man-made satellites influenced people's perception of the solar system?*' This too is an open-ended question, allowing the learners to interpret the information and evaluate the content in relation to the question, before submitting an answer.

Question Five was linked to Anderson's Analyse level. The learners had to examine the situation, compare and / or contrast ideas or concepts before answering the question that asked: '*How has the development of the international space station benefited you directly? Give your opinion.*' This is a creative and open-ended question where learners need to analyse the information and knowledge they have acquired, analyse it in relation to the question, before sending an answer.

Question Six was also linked to Anderson's 'Analyse' level, and the learners had to examine the situation / question, compare and / or contrast ideas or concepts before answering the question. The question asked: '*What was your favourite section you were taught in Science this year?*' This question was open-ended, allowing the learners to reflect on and analyse what had been taught and decide which areas interested them the most.

Table 8 Questions For Boys' School's Learners Related To Anderson's Taxonomy Levels

Questions per level	Anderson's taxonomy levels
0	Create
1	Evaluate
4	Analyse
1	Apply
0	Understand
0	Remember

As shown in Table 8 four questions were set at the analyse section, one each at the evaluate and apply levels, while none were set at the create, understand nor remember levels. This gave a mix of open-ended questions from three of taxonomy levels

3.5.4.3 Analysis Of SMS Questions For The Girls' School's Learners.

The first girls' school question was linked to Anderson's 'Analyse' level. The learners had to examine the situation or content and compare and contrast ideas before sending answer when asked '*Why is it important to understand the physical properties of materials?*' It was an open-ended question. The learners needed to analyse the knowledge they had acquired and relate it to the question, before submitting a response.

The second question was linked to two of Anderson's levels: the first part of the question is a knowledge type question and the learners had to remember the information, so it related to the 'Remember' level. The second part of the question required that the learners use the information and demonstrate their knowledge in the answer they submitted, so it related to the 'Apply' level. The question asked: 'List the properties of metals and identify any 3 objects that are made from metals'. The question was partially open-ended as learners could choose the metals they wanted to discuss, had to know the metals' properties and then had to think of objects that were produced from the chosen metals.

The third question was linked to Anderson's 'Analyse' level. The learners had to examine situations or objects, and then compare and contrast ideas to draw a conclusion. The question asked: '*Identify 3 objects at home made from 3 different materials, explain the properties which made them suitable.*' This was a complex

question demanding various thinking processes before the answer was sent. It was partially open-ended and similar to the way the second question was open-ended.

The fourth question was linked to two of Anderson's levels. The first part of the question was a knowledge and recall type question as the learners had to remember the information, so it related to the 'Remember' level. The second part of the question the learners had to use the information and demonstrate their knowledge in the answer they submitted, so it related to the 'Apply' level. It asked: *'Name 3 metals that are magnetic. How are magnetic metals of benefit to people?* The second part of this question is open-ended as the learners could provide their own ideas as to how magnetic metals benefit people.

Fifth Question was linked to Anderson's 'Remember' level. The learners had to recall the knowledge they had acquired when asked: *Name 3 metals that are found in their pure state*. This was a closed question, with correct or incorrect answers only.

An additional question was sent to the girls because of the very poor response to questions 3 and 4. It was linked to Anderson's 'Apply' level and it asked: *Why are metals separated from the ore? Give your own thoughts!* To answer this question the learners had to understand the knowledge taught and had to apply it to existing situations before sending an SMS answer.

The last question (Seventh Question) was linked to Anderson's 'Analyse' level. The learners had to examine the situation, compare and contrast ideas before submitting a response. The question asked: *What was your favourite section you were taught in Science this year?* This question was open-ended, allowing the learners to reflect on and analyse what they had been taught and decide which areas interested them the most.

Table 9 Questions For Girls' School Learners Related To Anderson's Taxonomy Levels

Questions per level	Anderson's taxonomy levels
0	Create
0	Evaluate
3	Analyse
2	Apply
0	Understand
3	Remember

As shown in Table 9 the girls had more than just the six question, as two of the questions related to more than one taxonomy level, and an extra question was asked to try to motivate the learners to be involved. Three of the questions were set at the analyse section, two at the apply and remember levels, while none were set at the neither create, evaluate nor understand levels. This mix was lower down on the taxonomy levels compared to the other two schools and had fewer open-ended questions than the other two schools as well.

3.5.5 Qualitative Method Used To Analyse The Individual Learner's SMS Answers For Each SMS Question

Each SMS answer from each learner was assessed in relation to the Anderson's Taxonomy descriptors (Table 10) as well as evaluated as to whether it was correct or appropriate regarding what the question was asking. An assessment was then made about the quality of the learner's answer, and the information was recorded. (The assessed SMS answers were not quantitatively totalled.) The information for each group of three SMSes per school was summarised in a table. Below is an example of the table and its criteria.

Table 10 Example Of The Summary Of School's Qualitative Results Of The SMS Answers

Qu. No.	Question	Prior determined cognitive level	No. of responses and assessment description
1	Why would an astronaut enjoy being weightless?	Evaluate	4 creative and evaluative ideas 4 evaluative ideas 1 humour and analysed idea 2 correct, but brief

The number of the question and the question's wording were included, as well as the pre-determined cognitive level relating to Anderson's taxonomy. The last column

indicates the numbers of replied responses from the learners, with a summarised assessment description.

3.5.6   Quantitative Methodology Used For The SMS Answers To Determine The Number Of Replies Received

When doing quantitative research numerical (number-based) data is gathered and it should be able to be generalised across groups of people (Sibanda, 2009). The number of responses from each group of participants (school) was totalled. The information was entered onto the database, and the information was calculated using the sum feature in MsExcel. These totals were then converted into percentages, so that the results of the various questions, genders, socio-economic groups could be compared.

The findings were depicted graphically using bar graphs and percentage tables.

3.5.7   Methodology Used For Collecting SMS Responses

The format of each SMS contained a greeting, the number of the SMS, the question and an instruction. For example: *Hello, Here's first NS question: Why is it important to understand the physical properties of materials? Give your thoughts. SMS your answer back! From Mrs W.*

Each school group was sent three SMS questions, the learners were asked to respond. The sent SMSes and the responses were recorded on 'PencilBox'. Figure 5 provides an example of the format in which the data is captured. The top section indicates the cell phone numbers the research was sent to, the date and time the message was sent and when it was delivered.

The system creates its own SMS ID when each SMS is sent, first column on the left. The lower section shows a record of the SMSes received and from which cell phone. A record of the user's name is also included; this is the person who sent the original SMS.
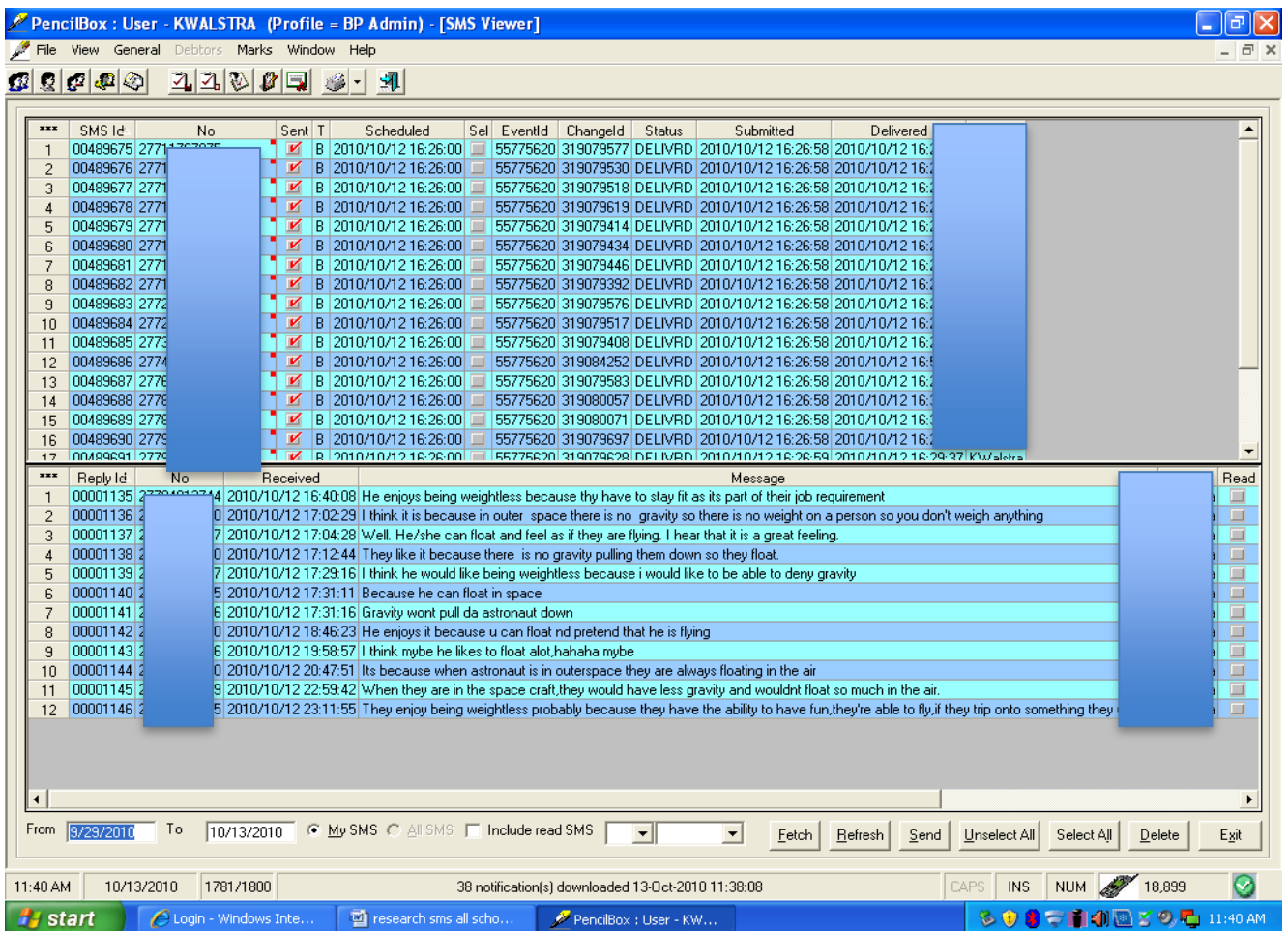
Figure 5: Example Of 'Pencilbox' Layout

The SMS responses from each individual participant was taken off the 'pencilbox' system, and transferred onto an MsExcel database. Number of responses received to each question were analysed to establish which questions triggered more responses.

3.5.8 Quantitative Methodology Used For SMS Answers To Determine The Number Of Replies Received By Each Group.

Each SMS question was analysed separately. The number of responses from each group of participants (school, gender group, socio-economic group) was totalled and compared.

The information on the MsExcel database was calculated and added up using the sum feature in MsExcel. These totals were then converted into percentages, so that the

results of the various questions could be compared for each grouping of participants. The findings were depicted graphically using bar graphs and percentage tables.

3.5.9 Quantitative And Qualitative Methodologies Used To Answer The Sub-Questions About The Effects Of Replying To An SMS Answer.

During the second section of SMS questions, the numbers of SMS answers from participants were calculated using the sum function in MsExcel. The number of responses were analysed according to the various subject groups: school, gender and socio-economic group. These calculated results were converted into percentages.

A comparison was done of the two types of interactions, namely those where no feedback was given to the learners' answers and those where feedback was given to the learners' answers. These results were compared. This information was depicted graphically as well on graphs and percentage tables.

The information was inspected (analysed and compared using the quantitative information) to decide whether SMS interactions between teacher and learners was an effective teaching method or technique when considering Vygotsky's theory of the 'more knowledgeable other' and McClelland's idea of motivational learning.

3.5.10 Quantitative Methodology Used To Analyse The 'Review Of Research' Questionnaire

The learners completed the 'Review of Research' questionnaire (Appendix 7) after all the SMS interactions had been completed. The information was transferred onto an MsExcel database before interpretation took place.

The first two questions were for referencing purposes they were the names of the school and the gender groups. This information needed to place the participant within the various groups when the data was analysed.

The first three questions were analysed using a nominal scale of measurement. All had categorical nominal variables.

Question 1: How did you feel about being involved in the project?

Nominal variable: Opinion about involvement in project

Categories:

- felt happy to be involved, did not mind answering the SMSes
- felt the project invaded in my free time after school, answered most of the questions reluctantly.
- felt the project invaded in my free time after school, answered some of the questions reluctantly.
- felt the project invaded in my free time after school, did not answer the questions.

Question 2: How did you feel about having to send an SMS answer?

Nominal variable: Attitude to answering SMS questions

Categories:

- did not mind answering the SMSes
- did not mind answering the SMSes, but it wasted my money
- minded answering the SMSes, it wasted my time
- minded answering the SMSes, it wasted my money

Question 3: How did the adults around you affect you involvement in the project?

Nominal variable: Asked question, because . . .

Categories:

- I answered the questions, because I wanted to
- I answered the questions, because I my teacher said I must
- I answered the questions, because I my parent/s said I must
- I answered the questions, because I thought I might get into trouble if I did not answer them

Question 4 "Who did you communicate with most about the answers to the questions?"

This question was analysed using a combination of qualitative and quantitative techniques. The quantitative section is explained here.

The quantitative section is a rank-order question which uses an ordinal scale of measurement with two variables: Most often, sometimes

Each variable had to be linked to two of the six categories:

The categories were:

- Parents – discussion at home
- Friends from school – as a discussion
- Friends from school – using cell-phone technology, state how, e.g. MXit, SMS
- Other family members – as a discussion
- Other family members – using cell-phone technology, state how, e.g. MXit, SMS
- Other (please explain)

The data was calculated according to the participants' preferences for communicating with others. The MsExcel COUNTIF function was used to calculate each variable according to the category.

An example of the formula used: =COUNTIF(A2:A5,"most")

- Description: Number of cells with "most" in first column of the table.
- Range of cells to be counted: A2:A5
- Criteria to be counted: "most"

The information was re-calculated into a percentage, per group of subjects. It was graphically portrayed using a pie chart to illustrate the percentages achieved with the various categories.

Question 5: Has this project changed your parents' ideas about cell phones?

Question 5 had both quantitative and quantitative components the quantitative aspect will be discussed here.

Quantitative aspect: Has this project changed your parents' ideas about cell phones? ☐Yes ☐No

Qualitative aspect: If yes, explain how (lines spaces left for comments)

Quantitative Analysis – Categorical Variables (Categorical Dichotomous Variable)

- Question: Has this project changed your parents' ideas about cell phones?
- Dichotomous variable: Yes / No
- Categories: Yes, No

The quantitative analysis of these five questions was converted in percentages to be compared within the various subject groups – individual and across the three schools, gender groups and socio-economic groups. The information was depicted graphically using pie charts.

3.5.11 Qualitative Methodology Used To Analyse The 'Review Of Research' Questionnaire

The data from the questionnaires was recorded on the MsExcel database and the information collected about each question was investigated separately.

Question 4 "Who did you communicate with most about the answers to the questions?"

This question was analysed to discover with whom the learners communicated about the research questions, and whether they used verbal discussions or SMSes in this communication.

Question 5 "Has this project changed your parents' ideas about cell-phones?"

This question was analysed and interrupted to determine whether the study had an impact on the parent's views about cell phones, from the learner's perspective.

Question 6 "After being involved in this project, if cell-phone was allowed at your school, how would you use it to help you with schoolwork?"

This question was analysed and the opinions and thoughts of the learners were recorded illustrating the participants' ideas of how cell phone technology could be used by them in the future at school.

Question 7 "Any other comments or thoughts you wish to share about the project?"

The ideas and comments for this question from the learners were reviewed, analysed and considered when drawing conclusions.

3.5.12 Comparative Methodology And Merged Study Of Findings And Results

The findings from both the qualitative and quantitative methodologies of the three aspects of the study (the two questionnaires and the SMS interactions), were compared and merged to determine common conclusions and to draw inferences thereby completing the triangulation of the study.
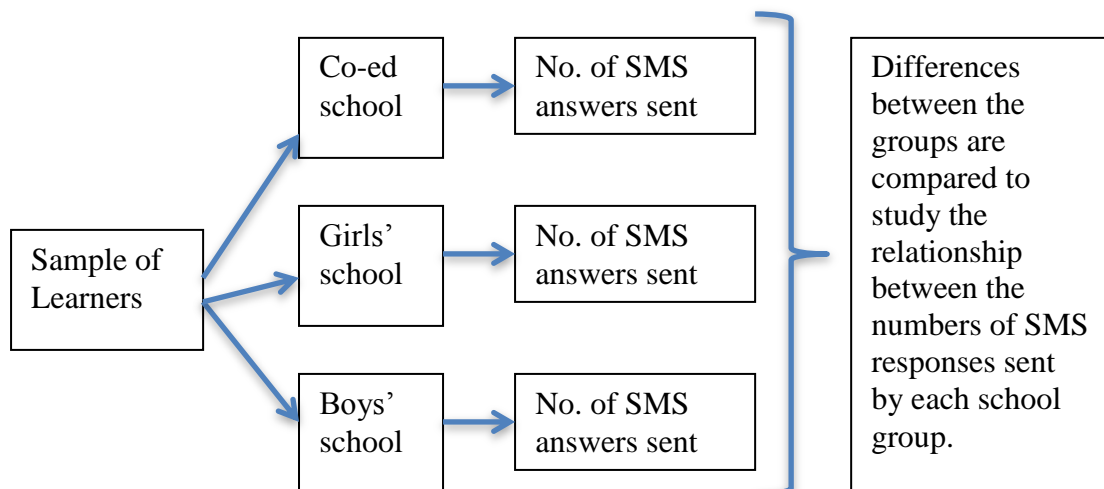
Figure 6 Comparison: Diagram Showing An Example Of A Quantitative Comparison Of Different Groups.

Comparisons were investigated and inferences made with regards to:

- the number of SMS answers sent by participants with initial communication when no feedback replies where sent.
- the number of SMS answers sent by participants when feedback replies where sent.
- the types of responses the various parents gave their children with regards to cell phone rules.
- the various opinions and perceptions across the schools about how the study had influenced (or not influenced) the learners' parents' views on cell phone technology.
- the manner in which learners communicated when using cell phone technology.

The descriptive statistic results were compared so that predictions and inferences could be made by investigating the similarity of the sample (subject group) to the people where the sample came from. The comparisons were explained and inferences were implied. The sum of the merged data was graphically represented using bar graphs and pie charts.

3.6 DATA COLLECTION AND ANALYSIS

3.6.1 Data Collection And Analysis Of Interviews Of Principals And NS Teachers

Interviews were conducted at each of the schools, with the principal and the NS teacher who was to be involved in the study. After the interviews the details were recorded, and the following information about each school was used to establish:

- School's policy / view on learners having access to / using cell phones during school hours.
- The number of NS lessons per week and the duration of those lessons.
- Number of learners per NS class to be used in the study.

This information was used to facilitate the smooth running of the study, as well as to clarify the understanding of cell phone use within the schools.

3.6.2 Data Collection And Analysis Of Background Information Questionnaires

The background information questionnaires (Appendix 6) were completed at home by all the participants in the study and returned to the researcher in a sealed envelope. The researcher collected, collated and transferred the data to an MsExcel database. The cell phone numbers of each participant was saved in school groups on separate CSV files. This information was transferred onto the school management system, 'pencilbox'. A CSV file exports data (learners' cell phone numbers) on an active sheet (MsExcel datasheet) to an MS-DOS-compatible text file ('pencilbox' SMS management system). These datasheets were used to send and receive the SMSes to and from the learners.

The remaining questionnaire answers were either analysed using quantitative descriptive designs, such as the participants ages and gender, or as qualitative strategies which determined how the learners communicated using their cell phones and with whom, and the rules and guidelines their parents gave them about cell phone use.

3.6.3　Data Collection And Analysis Of SMS Answers

A bulk SMS database was created for each school group within the 'School management system' called 'PencilBox'. These separate data lists where saved as CSV files, and were activated separately for each school's SMS questions, as each SMS was sent to the specific group of learners.

The SMSes were sent out to the various schools after discussion with the teachers on dates that suited the school in relation to other school events.

The Natural Science teacher gave the question, and the researcher transferred the question to an SMS, with a limit 160 characters (which included letter, numbers, punctuation marks and spacing) for the whole SMS.

The content of the questions varied from the three different schools. Each school was focusing on different knowledge areas during the research so the questions were quite different from each other. The types of question also varied from school to school, some being more open ended, while others were more knowledge and recall based. An example of an open-ended question may be "*Why would an astronaut enjoy being weightless?*" while a knowledge-based question may be "*List the properties of metals and identify any 3 objects that are made from metals?*"

Schools' First Three SMS Questions (No reply was given to these questions.)
- **Co-Ed School:**

The co-ed school teacher's topic at the time was weightlessness, gravity and the effects of gravity. The three SMS questions sent to the co-ed school participants were the following.

Firstly: *Why would an astronaut enjoy being weightless? Give your own ideas.*

Secondly: *Why is gravity important to us as people? Give your own ideas.*

Thirdly: *What are the advantages of a material being dense? Give your own ideas.*

- **Boys' School:**

The boys' school teacher's questions covered two topics during the research, as there were other school activities within the school which made sending three in one week inappropriate. The first two questions related to the topic of HIV / AIDS and the second topic was about the planets and the solar system.

Question One: *Why is it important to know the high risk behaviours related to HIV / Aids? SMS your answer back!*

Question Two: *What is the significance of science in dispelling the myths around HIV / AIDS? Any thoughts – SMS back!*

When the next question was sent the teacher was now teaching planets and the solar system, so the third question was *'Is it fair that Pluto is no longer described as a planet? Give your opinion – SMS your answer back!'*

- **Girls' School**

The girls' school learners were being taught about the properties of materials.

Their first question was '*Why is it important to understand the physical properties of materials? Give your thoughts.'*

The second question was *'List the properties of metals and identify any 3 objects that are made from metals? SMS your answer back!'*

The third question asked: *'Identify 3 objects at home made from 3 different materials, explain the properties which made them suitable. SMS your answer back!'*

The individual answers to the SMS questions from each school were analysed separately according to school to establish whether the learners' SMS answers were correct or relevant for the question asked. The number of responses from each individual was also totalled, as well as the number of responses per question per school.

School's Second Three SMS Questions, with reply and / or comment

During this section of the study, from the fourth question, each learner was sent a reply to the answer of each question. If a participating learner did not answer the question a comment was sent to the learner asking for him or her to respond to the next question.

- **Co-Ed School Interaction:**

The fourth co-ed school SMS question stated: *All materials are influenced to greater or lesser degree by presence of a magnetic field, do you agree? Explain your idea. SMS back!* Once the learner replied to the SMS one of the following responses as sent. If the answer was correct the reply stated: *"Yes all materials are influenced to greater or lesser degree by presence of a magnetic field depending on the material. Thank you for the reply. Enjoy weekend."* If the answer was incorrect or unclear the reply stated: *"All materials are influenced to greater or lesser degree by presence of a magnetic field depending on the material. Thank you for the reply. Enjoy weekend"*

Fifth co-ed school's SMS question was: *"How are magnetic objects useful to us? Give one idea!"* Those who did respond received an SMS response stating: *"Thank you for the reply!"* The learners who didn't respond got an SMS response stating*: "Hope you get involved with the next question! From Mrs W"*

Sixth Co-ed school's SMS question: *"Hi, Last NS qu: What was your favourite section you were taught in Science this year? SMS back! Thank you for your responses. From Mrs W"* The SMS response to answers was *"Thank you for your honest comments and being involved in the project."*

- **Boys' School Interaction:**

The boys' school fourth question stated: *"How have man-made satellites influenced people's perception of the solar system? Give your opinion"* The SMS response to answers was: *"Thank you for the response to the NS qu. Your comments about satellites were interesting!"*

The boys' school 5th question stated: *"How has the development of the international space station benefited you directly? Give your opinion."* The SMS response to answers was either *"Thank you for the detailed and interesting response about the space station"* or *"Thank you for your reply."* To the boys who didn't respond the following SMS was sent: *"Didn't get an SMS answer from you to the question. Hope you get involved with the next question! From Mrs W"*

The boys' school last SMS question stated: *"What was your favourite section you were taught in Science this year? SMS back!"* The SMS response was *"Thank you for your honest comments and being involved in the project."*

- **Girls' School Interaction:**

Fourth girls' school question: *"Hi, 4th NS qu: Name 3 metals that are magnetic. How are magnetic metals of benefit to people? Give your own thoughts! SMS your answer back! From Mrs W"*. To the girls who didn't respond to the fourth SMS question, a comment was sent stating: *"Didn't get an SMS answer from you to the question. Hope you get involved with the next question! From Mrs W"*. The study was adjusted and it was decided to send an extra SMS question due to the poor response from the girls.

Fifth girls' school question: *"Hi, 5th NS qu: Name 3 metals that are found in their pure state. SMS your answer back! From Mrs W"*. The SMS responses to an answer were individualised depending on the girls' answers, for example: The SMS reply was *'Yes those metals are found in their pure or free state, well done! Thank you for being involved in the project!'* Or to the SMS answer: *'gold, coal, silver'*. The SMS reply was: *'Gold & silver are found in their pure or free state, well done! Coal is not a metal! Thank you for being involved in the project!'* To the girls who didn't respond the fifth SMS question, a response was sent stating: *"Didn't get an SMS answer from you to the question. Hope you get involved with the next question! From Mrs W"*.

Sixth girls' school question: *"Hi, 6th NS qu: Why are metals separated from the ore? Give your own thoughts! SMS your answer back! From Mrs. W"*. The SMS response was *'Thoughtful answers. Thank you for being involved in the project!'* To the girls who didn't respond the sixth SMS question, a response was sent stating: *'Didn't get*

an SMS answer from you to the question. Hope you get involved with the next question! From Mrs W'.

The last SMS question sent to the girls stated: *'What was your favourite section you were taught in Science this year? SMS back! Thank you for your responses. From Mrs W'.* The response was sent to all participating learners, it stated: *'Thank you for participating in this project, from Mrs W'*

Again the learners' answers to the SMS questions were qualitatively and quantitatively analysed per school to establish whether the learners' SMS answers were correct or relevant for the question. The number of responses from each individual was quantitatively totalled, as well as the number of responses per question per school. These totals were compared to the totals of the first group of answers to establish if the SMS replies to the learners' answers had had an effect on the individual's participation in the SMS communication.

3.6.4 Data Collection And Analysis Of ''Review Of Research'' Questionnaires

Each participant was asked by the researcher to complete a review questionnaire (Appendix 7) at his / her school approximately a week after the SMS questions and answer interaction had been completed. The researcher transferred the responses onto an MsExcel database, per school.

Each individual question's data was interpreted and the findings recorded using either quantitative descriptive methods or qualitative methods, or in some instances both methods were used on the question.

Question 1, 2 and 3 were quantitative type questions and each question's variables were totalled using the sum function in MsExcel.

Question 4 was interpreted using a combination of qualitative and quantitative techniques. The quantitative section was a rank-order question which used an ordinal scale of measurement with two variables. The MsExcel COUNTIF function was used

to calculate each variable according to every category. The findings were then re-calculated into percentages and were portrayed as pie charts to illustrate the percentages achieved in the various categories. The qualitative section of the question was examined to determine with who and how the learners communicated about the research questions.

Question 5 had both quantitative and quantitative components; the quantitative aspect was totalled using the Excel sum function, while the qualitative aspect of the question was carefully investigated from the learner's perspective to determine whether the study had an impacted on their parents' views about cell phones.

Question 6 '*After being involved in this project, if cell-phone was allowed at your school, how would you use it to help you with schoolwork?*' and Question 7 '*Any comments or thoughts you wish to share about the project?*' where constructively scrutinised to establish the learner's views and opinions with regards to cell phone technology.

4 CHAPTER FOUR – RESULTS

4.1 RESULTS OF PRINCIPALS AND NATURAL SCIENCE TEACHERS INTERVIEWS

Interviews were conducted at each of the schools with the Principals and NS Teachers. In all three cases the principals' agreed to allow Grade Seven learners to participate in the SMS research on condition that the Natural Science teacher agreed to be involved, and that both the parents of the relevant learners and the learners themselves were informed, before providing consent.

Written consent was received from all three schools, before approaching the NS teachers and Grade 7 learners. All three principals also showed an interest in the results of the research as none of the schools had a policy of allowing learners to the use cell phones doing the school day, due to fears of cell phone theft, damage to cell phones by other learners or possible distraction during lessons if cell phones where allowed. The boys' school principal expressed an interest in possibly allowing willing teachers to explore the notion of using cell phones as part of the learners' educational and learning experience during the school day.

It was agreed by all three schools that Natural Science would be an effective subject to use as the area of learning for the study. The principals' also told the researcher which teacher to contact, to use in the study, and that teacher's Grade 7 NS class was used for the study. The principals stated how many learners were in each class (this was reiterated by the NS teachers). The co-ed school's NS Grade 7 Class had 24 learners, the boys' school's NS Grade 7 Class had 27 learners and the girls' school NS Grade 7 Class had 26 learners. (Refer to Table 3: Class Sizes, to establish how many children took part in the study compared to the original class size.)

All three NS teachers agreed to participate in the study. They all used constructivist methods of teaching, allowing discussion and development of knowledge among their students. The time given to NS in the various schools was very similar. Two schools had four half hour lessons per week of one double lesson and two single lessons. The

other school had three forty-five minute lessons at week. Therefore, each teacher saw their Gr. 7 NS class three times a week, which meant that three SMSes were to be sent out to each school in a week.

All the Gr. 7 NS teachers owned cell phones, but none of the teachers communicated with their learners using SMS technology. The teachers provided a general view of the socio-economic backgrounds of their learners, commenting that the co-ed school's learners were from lower socio-economic backgrounds, while the boys' and girls' schools' learners were from middle to higher income backgrounds.

It should be noted that after the research was completed, the researcher showed the NS teacher the list of learners' names for his / her NS class who had participated in the study. This was done to find out what the overall academic ability was of the participating learners in relation to the other children in the class who did not participate in the study. Each NS teacher said there was a mixed ability group who participated in the study, with the majority of the participating learners being above average ability levels in relation to their whole class.

4.2   RESULTS OF BACKGROUND INFORMATION QUESTIONNAIRE

4.2.1   Number of Participants

There were 37 Grade Seven learners who agreed with their parents to participate in the SMS research project. Co-ed Class: 16 learners of a possible 24 learners; Boys' Class: 10 learners of a possible 27 learners; Girls' Class: 11 learners of a possible 26 learners. (Refer to Table 3: Class Sizes)

4.2.2   Ages of Participants

The learners' ages ranged from 12 years old to 15 years old. The average age of all the participating learners was 13 years old, with one learner being 15 years old. The

table below demonstrates the age range of the participants, with 24 of the 37 participants being 13 years of age.

Table 11 Ages Of Participants

Age in years	No. of Learners participating
11 years	0
12 years	7
13 years	24
14 years	5
15 years	1
16 years	0

4.2.3   Gender: Male And Female Participants

19 males and 18 females volunteered to take part in the study; 11 females from the girls' school, 10 boys from the boys' school, 7 females and 9 males from the co-ed school (Table 12).

Table 12 Gender Analysis

School	Males	Females
Co-ed school Totals	9	7
Single Sex Boys' school Totals	10	0
Single Sex Girls' school Totals	0	11

When looking at the single sex schools, more females volunteered for the project, while in the co-ed school more male learners volunteered for the project (Figure 7).
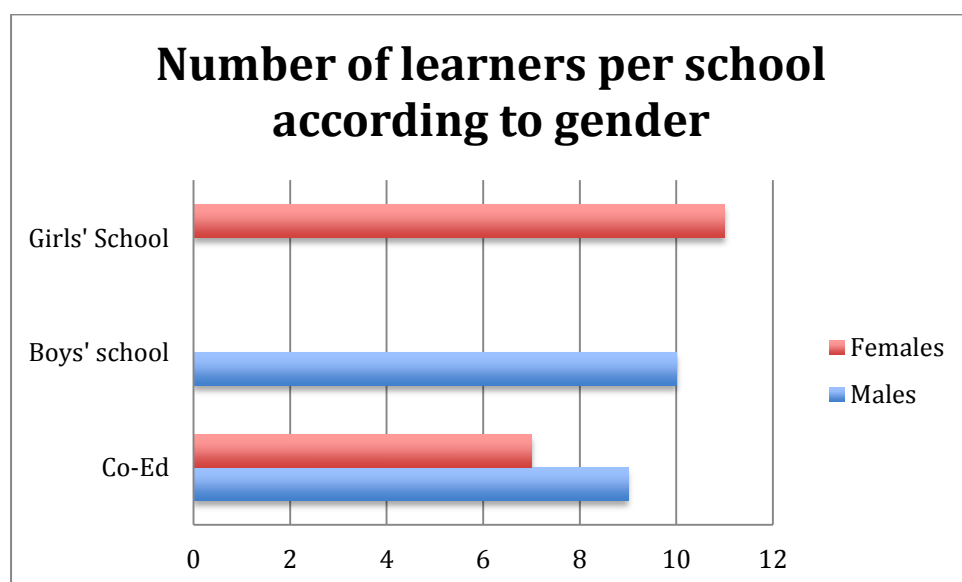
Figure 7: Gender Of The Learners Participating In The Research Project.

4.2.4   Rules Parents / Guardians Gave The Gr. 7 Learners (Participants) About Use Of Cell Phones

The majority of parents had given their children rules with regards to using their cell phones; 73% of the participating girls' school's parents gave them rules, 75% of the participating co-ed school's parents and 90% of the participating boys' school's parents. These rules varied from the amount of time learners were allowed to spend on their cell phones to who they were not allowed to communicate with when texting.

	Girls' School Participants	Co-ed School Participants	Boys' School Participants
▪ Series1	73%	75%	90%
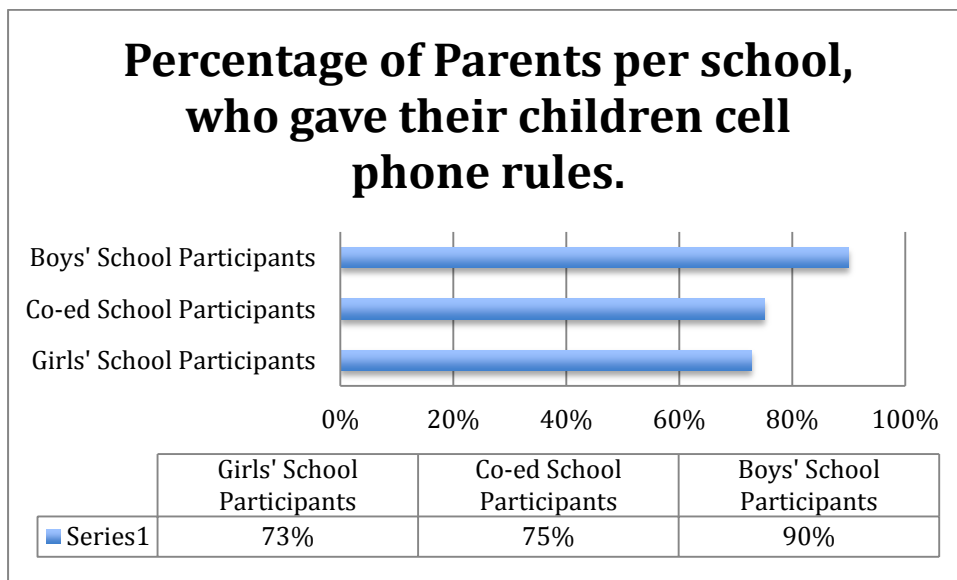
Figure 8: Percentage Of Parents Who Gave Their Children Cell Phone Rules.

Time related cell phone rules:

The majority (65%) of the participating Gr. 7 learners' parents / guardians gave the learners rules for with regards to time restrictions. These included such as cell phones may not be used after 8pm or 9pm, some parents even took the learners phones away for the night. One learner stated that the rule his / her parents gave was that if he / she was on the cell phone too much, it would be taken away and only given back to him / her at the end of the week.

School work related cell phone rules:

A minority (32%) of the participating learners' parents gave their children rules with regards to cell phone use and school. These included rules such as cell phones may not be taken to school, and don't chat and do homework at the same time

Rules related to use and restrictions of internet sites on the cell phone:

A small minority (14%) of the participating learners' parents gave them rules about
internet usage, these included rules such as never go into programs which are for
18 year old or upwards, and don't go onto inappropriate sites.

Rules relayed to restrictions when using MXit or other chat rooms:

Nearly a quarter (24%) of the learners' parents gave them rules about MXit usage and
restrictions, such as never to use MXit for the child's personal safety, not to go
onto MXit after 8:30pm, or don't communicate with strangers on MXit

Rules and conditions related to cell phone costs:

A minority (19%) of the participating learners were given rules related to costs, such
as a specific amount of money was provided by parents each month for cell
phone air time and if that money was used by the learner, he / she had to pay for
more airtime if he / she wanted to use the phone more.

General cell phone etiquette rules:

Almost half (41%) of the participating learners were given general etiquette rules with
regards to using of cell phones and sending of messages. These rules included no
sending of rude messages, not to download inappropriate information, no sending or
accessing of rude or pornographic pictures or web addresses and no communicating
with strangers.

Social warning:

An extremely small minority (3%) of the learners were warned about inviting
strangers onto their social network pages, such as Facebook.

Weather Warning Rule:

Another extremely small minority (3%) of the parents warned their children about not
using their cell phones during rain and storms.

% of the Types of Rules Given

	Time	Etiquette	School work related	MXit / other chat rooms	Cost	Internet usage	Social networks	Weather warnings
■ Series1	65%	41%	32%	24%	19%	14%	3%	3%
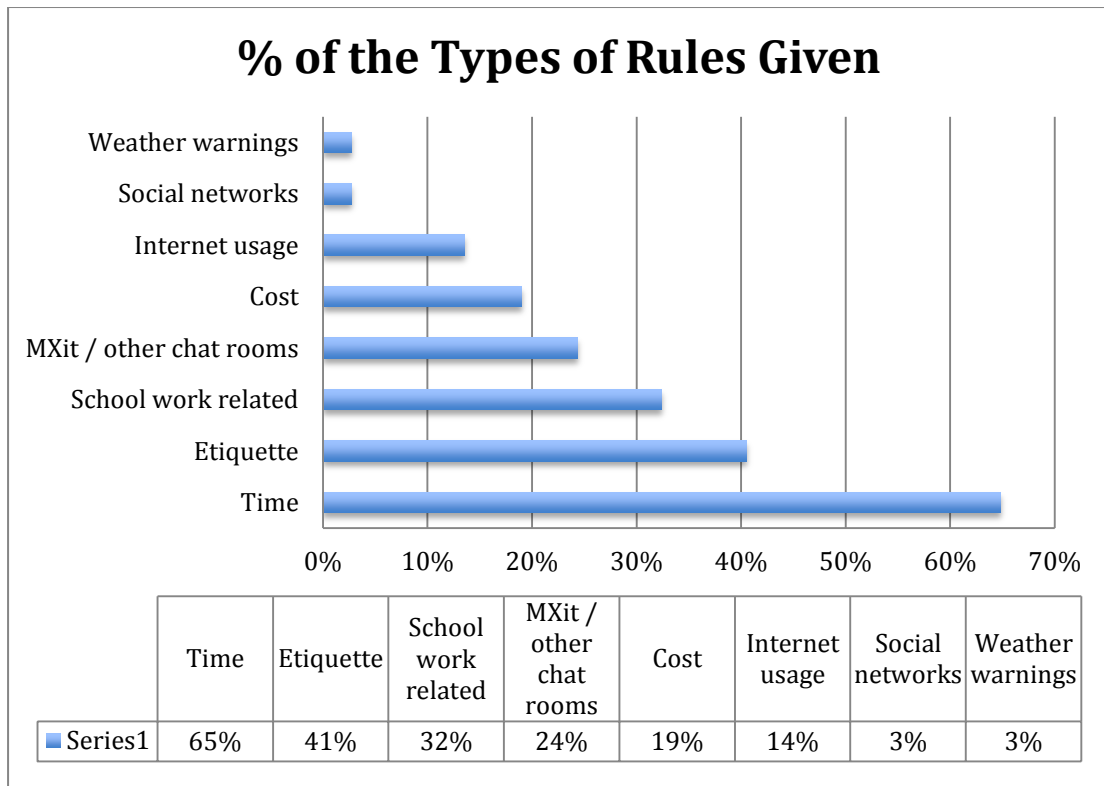
Figure 9: Percentage Of The Type Of Cell Phone Rules Given By The Parents To Their Children.

4.2.5   Preferred SMS Communication Method By Gr. 7 Participants

The preferences of the learners when communicating with other people varied from school to school. Only 5% of all the participating learners' first choice when communicating on their cell phones was speaking. While 46% of the participating learners preferred SMSing and 49% of learners preferred using the social net, MXit, to 'chat' by means of texting. Figure 5 illustrates that in the single sex schools MXit was the most popular form of communication, while in the co-ed school SMSing was used most frequently.

Study Sample's First Choice when communicating on their cell phones
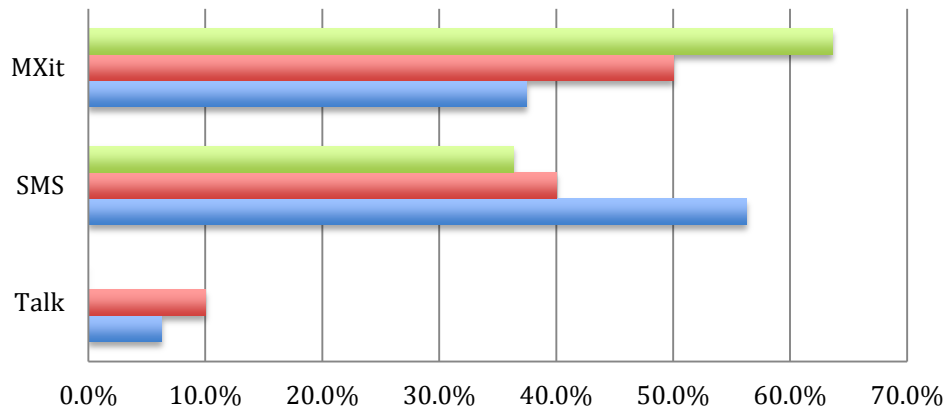
	Talk	SMS	MXit
Girls' School	0.0%	36.4%	63.6%
Boys' School	10.0%	40.0%	50.0%
Co-ed School	6.3%	56.3%	37.5%

Figure 10: First Choice When Communicating On A Cell Phone, According To Each School Group.

4.2.6 People With Whom Gr. 7s Communicate Via SMS

Most favoured people with whom learners communicated
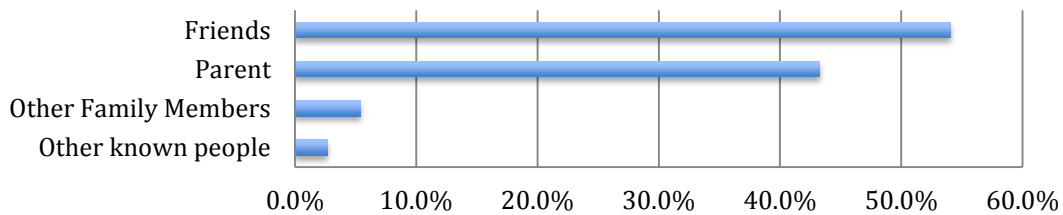
	Other known people	Other Family Members	Parent	Friends
Most favoured	2.7%	5.4%	43.2%	54.1%

Figure 11: Most Favoured People With Whom Learners Communicated By Means Of SMS.

Table 13 People Participants Communicated With Using SMS.

	Parent	Other Family Members	Friends	Other Known People	Unknown People
Most favoured	43,2%	5,4%	54,1%	2,7%	0%
Favoured Second	27,0%	24,3%	21,6%	0,0%	0%
Favoured Third	5,4%	35,1%	8,1%	5,4%	5.4%
Favoured Fourth	2,7%	10,8%	0,0%	21,6%	13,5%
Least / never	5,4%	5,4%	2,7%	16,2%	37,8%

More than half (54%) of the learners communicated mostly via SMS with friends, 43% communicated mostly with parents and 5% communicated mostly with other family members.

The second most popular choice of people the learners communicated with was parents (27%), other family members (24%) and friends (22%)

The third most popular choice of people the learners communicated with was other family members (35%), friends (8%), then parents, 'other' known people (5%).

The fourth most popular choice of people the learners communicated with was 'other' people (21,6%), unknown people (13,5%), other family members (10,8%) then parents (2,7%). People the learners communicated with the least or never were unknown people (37,8%), 'other' people (16,2%), parents and other family members had 5,4% each, and friends had 2,7% of the participants.

More than half the participants (57%) seldom or never communicated with unknown people.

4.3   RESULTS OF LEARNERS' SMS ANSWERS WHEN NO FEEDBACK REPLY WAS SENT TO THEIR RESPONSE.

It should be noted that the SMS replies sent by the learners throughout the study were not edited; the sentence structure and the grammar were left as they submitted them.

4.3.1 Results Of Co-Ed School's Learners' SMS Answers

4.3.1.1 Qualitative Results of Co-ed School's Learners' SMS Answers

The first SMS question was '*Why would an astronaut enjoy being weightless? Give your own ideas.*' The decided 'Anderson's Taxonomy Level' for this question was 'Evaluate', as the learners had to draw conclusions, made decisions or gave their own points of view.

Some of the learners' answers had creative and evaluative ideas, such as:

- *They enjoy being weightless probably because they have the ability to have fun, they're able to fly, if they trip onto something they won't fall, so there won't be any pain*

- *Well. He/she can float and feel as if they are flying. I hear that it is a great feeling.*

- *When they are in the space craft, they would have less gravity and wouldn't float so much in the air.*

- *He enjoys it because u can float and pretend that he is flying*

While other SMS answers evaluated the question, such as:

- *I think it is because in outerspace there is no gravity so there is no weight on a person so you don't weigh anything*

- *They like it because there is no gravity pulling them down so they float.*

- *I think he would like being weightless because i would like to be able to deny gravity*

- *Its because when astronaut is in outerspace they are always floating in the air*

Other learners' SMS answers briefly addressed the question, such as:

- *Because he can float in space*

- *Gravity wont pull da astronaut down*

Some learners' answers included humour in the response, such as:

- *I think mybe he likes to float alot, hahaha mybe*

This SMS answer did not answer the question.

- *He enjoys being weightless because thy have to stay fit as its part of their job requirement*

The second question stated: *'Why is gravity important to us as people? Give your own ideas.'*

This SMS question could be considered an 'Analyse' type question where the learner examined the situation, or perhaps compared and contrasted ideas as suggested by Anderson. The following acceptable answers were received, namely:

- *To kep us down to earth*
- *It's because gravity pulls us down weather we are in the air, in water or standing on the ground and without gravity everyone would be floating in the air.*
- *It keeps us on the earth's surface otherwise we would be floating in the air*
- *Gravity is the force that pulls us 2 the ground. if its not there, we could fall into outer space and die.*
- *Gravity is important to us because without it we would fly away from earth into space*
- *Gravity pulls objects down tosses the centre of the earth. Therefore if the earth had no gravity humans would face a huge metamorphosis: such as loss in weight which will allow then to float into space and basically die because us (humans) need oxygen. Plants will die due to know air.*

There are numerous spelling and grammatical errors in these SMS answers from the various learners. When reading the answers these could be ignored, and the words should be read phonetically to understand what the learner was saying. For example the word *'know'* in the last SMS answer above, should have been *'no'*.

Misinterpretation of the SMS question also happened, as with this Co-ed Learner's SMS answer: *'Its important to us human's because the gravity of someone's behaviour or speech is the very serious way in which they behave or speak to us.'* From a taxonomy analysis point of view, the learner did analyse the question and provided a thoughtful response.

The Third Question stated: *'What are the advantages of a material being dense? Give your own ideas.'* It was rated on Anderson's Taxonomy as an 'Apply' level, which was described as 'using information and demonstrating knowledge.' There were fewer SMS answers to this question than to the first two questions (Refer to Table

14). Two of the responses; '*they can float*' and '*so it cannot move*'; were brief and neither were completely correct as neither specified the type of material being referred to. While another two responses were more explanatory and expressed ideas more clearly, they stated:

- *They are able 2 stay on the ground firmly or in water eg. A submarine*
- *With clothing material, it is important to have Different densitys for different types of weather.*

The difficulty of the question may have resulted in fewer learners answering this question.

Table 14 Summary Of Co-Ed School's Qualitative Results Of First Three SMS Answers

Qu. No.	Question	Prior determined cognitive level	No. of responses (?/16) and assessment description (
1	Why would an astronaut enjoy being weightless?	Evaluate	4 creative and evaluative ideas 4 evaluative ideas 1 humour and analysed idea 2 correct, but brief
2	Why is gravity important to us as people?	Analyse	6 examined situation, or compared & contrasted ideas 1 misinterpretation of question, but it was analysed.
3	What are the advantages of a material being dense?	Apply	2 explanatory & expressed ideas 2 brief and not correct

4.3.1.2 Quantitative Results Of The Number Of SMS Answers Submitted By The Co-Ed School Learners When No Reply Was Sent.

The first question had a 75% response rate from the sixteen learners, the second question 63% and the third question only had a 31% response rate.

There was a progressive decline, with the fewest number of replies being received in answer to the third question (refer to Figure 12).

% of Answers from Co-Ed School to SMS Questions with no feedback
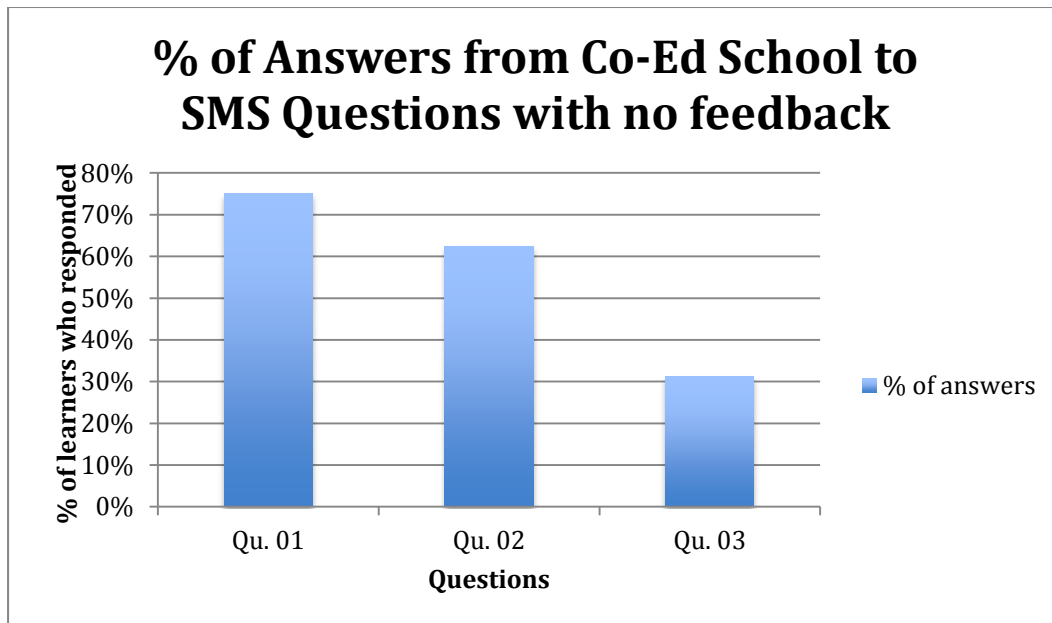
Figure 12: Co-Ed School's No. Of Answers To The First Three SMS Questions

4.3.1.3 Qualitative Results Of Co-Ed School Learners' SMS Answers When Replies Were Sent.

From Question Four to the end of the project a feedback or response SMS was sent in reply to the answer of the question, and an SMS response of encouragement was sent to the learners who had not responded to the question.

The fourth question asked: '*All materials are influenced to greater or lesser degree by presence of a magnetic field, do you agree?*' Initially this question was related to on Anderson's 'Apply' level of the taxonomy, where the learners use information and demonstrate knowledge. However, after reading the responses the learners submitted, the question was re-evaluated and linked to the Anderson's 'Analyse' level, as the answers distinguished between materials and the learners needed to compare and contrast the different materials before deciding on an answer.

The majority of the answers to this question were affirmative and agreed with the statement, some in more detail than others, such as:

- *Yes i agree it depends on what it is*
- *Yes, it is obvious now that there are magnetic forces that attract and repel each other.*
- *Yes, because magnet can be attracted to anything which is a metal*

- *Yes, different materials have different charges for example wool and silk will react differently to magnetic fields.*
- *I do agree. The earths magnetic field has everything to do with mans very existence.*

The feedback response to these answers was: *"Yes all materials are influenced to greater or lesser degree by presence of a magnetic field depending on the material. Thank you for the reply. Enjoy weekend."*

However the negative statement *'No, not all of them are able 2 be magnetised'* was incorrect and the response to this answer was, *"All materials are influenced to greater or lesser degree by presence of a magnetic field depending on the material. Thank you for the reply. Enjoy weekend"*.

The fifth question stated: *'How are magnetic objects useful to us? Give one idea!'* It was linked to Anderson's level called 'Understand', and the learners had to explain and or classify objects. To those learners who responded with an answer showing an understanding of the question by explaining where or how magnets could be used, they received a feedback response stating: *'Thank you for the reply, it was an interesting thought! From Mrs W'.* Such answers were:

- *They useful because u can put a magnet in u draw everytng dat is metal wl touch the magnet*
- *They help create a magnetic field*
- *It useful on castors & office door.*
- *They hold on to things.*
- *For example, wen u tie a necklace at the back can be quite dificult and take time, with magnets its easy and very fast.*
- *They are useful in terms of transport for example there is a magnetic train which travels at a very high speed*
- *Magnetic objects helps us lift up things that are very difficult to lift for eg when i drop a set of pins on the ground i could early just use a magnet to pick then up instead of getting hurt*

The learner who answered with only a 'question mark' (*?*) received an individual feedback response stating '*Give one idea of how magnetic objects are useful to you. From Mrs W.*' This learner did not respond to that individual question.

The learners that didn't respond to the SMS question received an SMS response stating: '*Hope you get involved with the next question! From Mrs W*'

The sixth question stated: '*What was your favourite section you were taught in Science this year?*' It was related to Anderson's 'Analyse' level, and the learners had to examine the situation, compare and / or contrast ideas before answering the question. The answers to this question are interesting in that learners are noting their favourite topics taught in Natural Science during the year. They would have had to have thought about the entire year's work and then made a decision. Their answers were:

- *Energy & forces*
- *My favourite section was matter and materials was the best!*
- *What i enjoyed most was learning about energ and change.*
- *It was when we were doing matter and material.*
- *the lesson on the ph water sample*
- *I really liked matter and materials, wen we got 2 learn about chemicals & elements. Enjoyed taking part!*
- *The importance of gravity*

One learner explained his / her ideas and gave a more personal viewpoint as well.

- *To be truthful, everything. I am always amazed by science and i love making spaceships and studying chemicals and i guess thats one of the reasons that i'v chosen to study Astrophysics and maybe one day i'l be as great as Isaac Newton and ect*

The SMS response to all the SMS answers was '*Thank you for your honest comments and being involved in the project.*' These learners' responses could assist the teacher when planning for the next year, as they provide a feel for the topics, which the learners really enjoyed.

Table 15 Summary Of Co-Ed School's Qualitative Results Of 2nd Three SMS Answers

Qu. No.	Question	Prior determined cognitive level	No. of responses (?/16) and assessment description
4	All materials are influenced to greater or lesser degree by presence of a magnetic field, do you agree?'	Apply	5 agreed, some more detailed than others 1 answer was incorrect 1 replied with a ?
5	How are magnetic objects useful to us?	Understand	7 showed understanding with an explanation
6	What was your favourite section you were taught in Science this year?	Analyse	2 topics only 4 topic & some detail 1 topic & detailed explanation 1deatiled explanation & personal views

Overall the responses to the questions with feedback from the co-ed school learners demonstrated that the learners had thought about their responses. None of the co-ed school learners responded directly to the 'feedback' statement with an additional response or reply. The co-ed school learners regularly included explanations to their answers, which added clarity.

4.3.1.4   Quantitative Results Of Co-Ed School Learners' SMS Answers When Replies Were Sent.
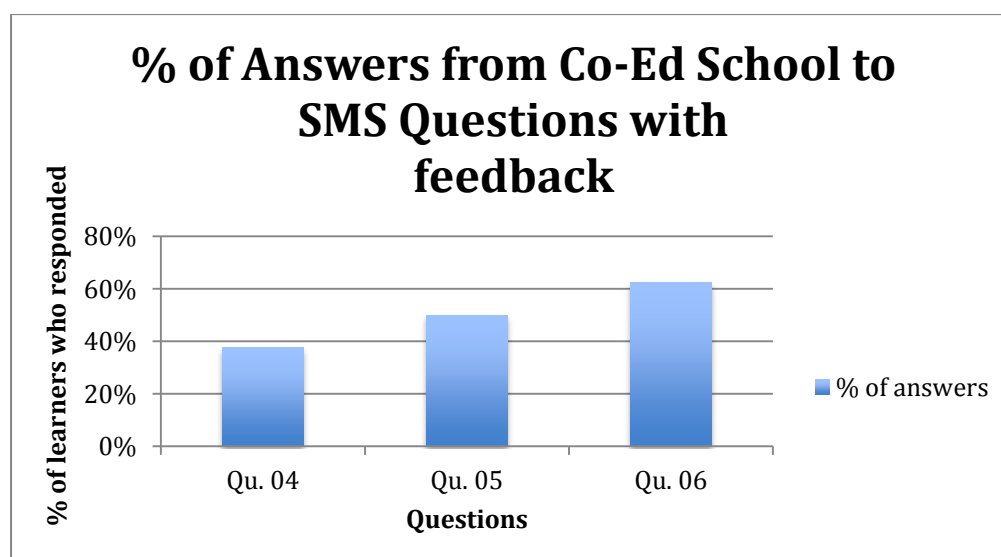
Figure 13: Percentage Of Answers From Co-Ed School Learners To SMS Questions When Feedback Was Sent.

Question 4 had a 37.5% reply rate from the sixteen learners who agreed to participate in the project, Question 5 had a 50% reply rate and Question 6 had a 62.3% reply rate.

4.3.2   Results of Boys' School's Learners' SMS Answers

4.3.2.1   *Qualitative Results Of Boys' School Learners' SMS Answers When No Reply Was Sent.*

Question One stated: '*Why is it important to know the high risk behaviours related to HIV / Aids?*' It was related to Anderson's level entitled 'Apply' and the learners had to 'use information and demonstrate knowledge.' The majority of the answers to this question showed that some thought had gone into the replies, for example:

- *It is important to know how HIV/aids because it could affect your whole life, if you are not educated about the behaviours that could cause you to pick up HIV and Aids then you mite loose your life very early*

- *It is important to know these risks because HIV n aids cannot be cured.*

- *It is important to know the different behaviour's incase one day you need to help someone. You need to know this so you what is happening so that you can help him with what medication he needs to take.*

- *So that the chances of us being effected are far less*

- *You need to no because how u react to HIV and Aid and u have to behave like a normal person*

One answer was very brief and application not demonstrated, such as '*So you don't get aids*'. Two replies didn't quite answer the question, even though the answer related to the topic of HIV and AIDS, such as:

- *If you dnt wear protection you cn get aids and it weakens ur cells nd infection is envatable*

- *So you don't get HIV/AIDS and how to protect yourself.*

Question Two stated: '*What is the significance of science in dispelling the myths around HIV / AIDS?*' It was related to Anderson's level of 'Analyse'. The learners had to examine the situation, compare and / or contrast ideas. One of the learners replied by sending a question mark *(?)* on its own. As there was no feedback during

this section of the project, this learner did not receive any response to his request for clarity. This did not seem to hinder his involvement in the project as he responded to the other questions, whereas another learner responded '*I haven't yesterdays question*' and a response was not sent to him either, and he did not respond to another question. A third learner responded '*Out of airtime*'; this was noted but not responded to either.

The answers of learners who did respond with an answer to the question also varied in accuracy and quality. Two responses answered the question indirectly, namely:
So people do not take medicine that does not work and may damage you more.
Science has proven that HIV/aids is spread through certain body fluids.
While only one answer answered the question directly, namely:
To understand the facts behind contracting the disease and how it affects the body
The learners seemed to have difficulty in understanding the question, and therefore their replies were not completely accurate.

Question Three asked: '*Is it fair that Plato is no longer described as a planet?*' Anderson's level of 'Analyse' was decided upon, the learners needed to examine the situation, compare and / or contrast ideas before answering the question. There was a problem with the question as it had a typing error. Instead of '*Pluto*' the word '*Plato*' was sent to the learners. In this section of the research no response was being sent in response to SMS answers or comments. So it was decided not to resend the question, but rather just observe how the learners responded to the error in the question. Most ignored the error and responded as if it was '*Pluto*' using the correct spelling in their response if they used the word, such as:

- Yes. Pluto does not have all the characteristics of a planet.
- Yes it is fair, because a planet has three basic properties and Pluto only has 2
- Yes it is fair because it does not meet up to the standards to become a planet
- Yes it does not fit the criteria to be classified as a planet.

One learner did note the error and questioned the question with a wise statement, namely: '*Is it Pluto because Plato was a mathemation*', however this was not responded to due the project being in the non-feedback section. This learner did reply to questions after this.

Table 16 Summary Of Boys' School's Qualitative Results Of 1st Three SMS Answers

Qu. No.	Question	Prior determined cognitive level	No. of responses (?/10) and assessment description
1	Why is it important to know the high risk behaviours related to HIV / Aids?	Apply	5 detailed, thoughtful replies 1 brief, not applied 2 related to topic, didn't answer qu.
2	What is the significance of science in dispelling the myths around HIV / AIDS?	Analyse	1 detailed, accurate 7 correct 2 detailed, did answer qu. 1 ? 2 responses not related to qu. at all
3	Is it fair that Plato is no longer described as a planet?' Note error in qu. should have been 'pluto'.	Analyse	4 ignored error, correct & detailed explanations 1 noted error, responding Plato mathematician

What needs to be noted was that the majority of the learners were vigilant in the accuracy of their spelling in these initial questions.

4.3.2.2   Quantitative Results Of Boys' School Learners' SMS Answers When No Reply Was Sent
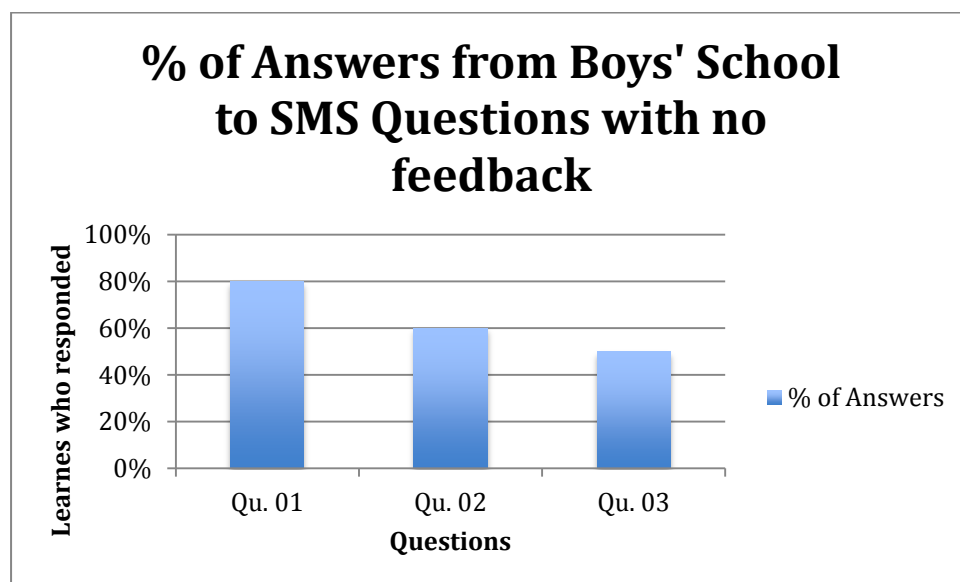
Figure 14: Percentage Of Answers From Boys' School Learners To SMS Questions When No Feedback Was Sent.

There was an 80% response rate to the first question, then a 60% response rate to the second question, while only 50% of the learners responded to the third question.

4.3.2.3   Qualitative Results Of Boys' School Learners' SMS Answers When Replies Were Sent

Question Four asked: '*How have man-made satellites influenced people's perception of the solar system?*' It was linked to Anderson's 'Evaluate' level, and the learners

had to argue, select, support and / or appraise an idea or concept. Three of the replies were relevant and informative, stating:

- *They have expanded our knowledge of the universe. We are now able to view other solar system's and galexys and it has given us greater insight into how the universe began.*

- *They give us information on what's goin on in the solar system. And information about the planets*

- *Satellites tell us what is happening in space*

These SMS answers were sent feedback stating: *Thank you for the response to the NS qu. Your comments about satellites were interesting!*

One learner sent a message stating '*Out of airtime*', and feedback he received was '*Hi, if you could send this SMS you could answer the question. From Mrs W*'

To the boys who didn't respond to the question the following SMS was sent: '*Didn't get an SMS answer from you to the question. Hope you get involved with the next question! From Mrs W*'

Question Five asked: '*How has the development of the international space station benefited you directly? Give your opinion.*' It was linked to Anderson's Analyse level, and the learners had to examine the situation, compare and / or contrast ideas or concepts before answering the question.

The following SMS answer received was interesting and relatively accurate:

- *They have expanded our knowledge of the universe.* (He sent a similar answer to question four)

- *It has benefited us directly, because this new technology will teach us more about the solar system and how it works it is for our own benefit.*

The answer below needed some clarity, as it did not explain how the international space station helped with his NS project, but the second half of the question was fairly acceptable. His answer was:

- *It helped me with my ns project and given me a better understanding of outer space*

The SMS response to these answers was '*Thank you for the detailed and interesting response about the space station*'

The SMS response to the answer '*I don't think that the space station has benefited me at all*' was '*Thank you for your reply*'

The same learner as in Question Five who said '*Out of airtime*' sent the message stating '*Sorry out of airtime*' and this time the feedback he received was '*If you could reply "out of airtime", you should have just answered a question. You now wasted money by saying "out of airtime".*' For Question Six he responded with a relevant answer.

The boys who didn't respond the question were sent the following SMS: '*Didn't get an SMS answer from you to the question. Hope you get involved with the next question! From Mrs W*' One of the boys replied '*OK*' to this SMS and answered question seven.

Question Six asked: '*What was your favourite section you were taught in Science this year?*' it was also linked to Anderson's 'Analyse' level, and the learners had to examine the situation / question, compare and / or contrast ideas or concepts before answering the question.

Most answers were just the topic, such as:

- *The HIV and aids section*
- *HIV/Aids*
- *Forces and motion.*
- *Properties of matter*

Some expressed a more detailed point of view, such as:

- *The best section for me this year was acids, alkalis and indicators*
- *My favorite part in Science was when we did the science experiment for which was the best stomach salt, I really enjoyed that exercise to see what happens in your stomach*

The SMS response to all these answers was '*Thank you for your honest comments and being involved in the project.*'

Table 17 Summary Of Boys' School's Qualitative Results Of 2nd Three SMS Answers

Qu. No.	Question	Prior determined cognitive level	No. of responses (?/11) and assessment description
4	How have man-made satellites influenced people's perception of the solar system?	Evaluate	2 correct, relevant & informative 1 not related to qu
5	How has the development of the international space station benefited you directly?	Analyse	2 partially answered qu., detailed, interesting, relatively accurate 1 partially answered & personal comment 1 sorry out of airtime
6	What was your favourite section you were taught in Science this year?	Analyse	4 topic only 2 topic & details

4.3.2.4 *Quantitative Results Of Boys' School Learners' SMS Answers When Replies Were Sent*
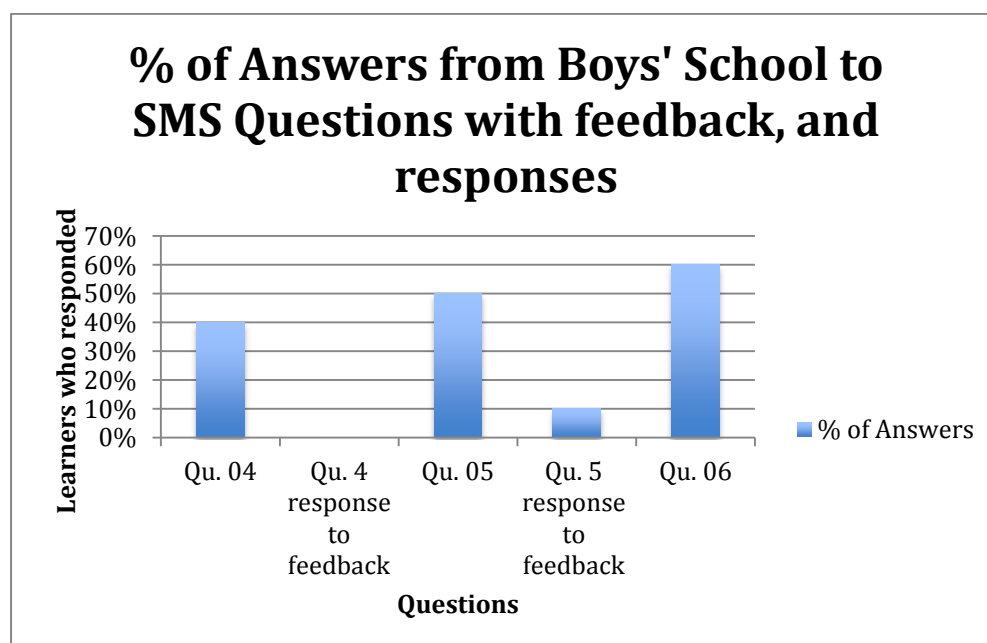
Figure 15: Percentage Of Answers From Boys' School Learners To SMS Questions With Feedback And Feedback Responses.

Question 4 began with a 40% response rate from the ten participating boys' school learners, Question 5 increased to a 50% response rate, and question 6 increased to 60%. With 10% of the learners replying affirmatively to the researcher's SMS comment for Question 5 to participate in the study in the future.

4.3.3 Results Of Girls' School Learners' SMS Answers To The Pre-Determined SMS Questions

4.3.3.1 Qualitative Results Of Girls' School Learners' SMS Answers To Questions With 'No Feedback' Response To Answers

The first question asked '*Why is it important to understand the physical properties of materials?*' It was linked to Anderson's 'Analyse' level. The learners had to examine the situation or content, compare and contrast ideas before sending answer. The majority of the answers expressed a relevant and analysed response such as:

- *Because certain properties cant be used for certain things. Eg: You can't use glass to make clothing.*
- *So that you are able to understand the structural properties of the material.*
- *It is important to know the physical properties of materials so that we can use the material to its full value*
- *If you know the physical properties you will use the materials in the correct way. Eg - you cannot use highly flammable materials in a firemans suit. A E*
- *So that we can see if it would Be suitable for the item we were to build it with.*

One learner didn't answer the question appropriately, namely '*So you know more about the world*'

The second question stated: '*List the properties of metals and identify any 3 objects that are made from metals*' This question was linked to two of Anderson's levels; the first part of the question is a knowledge type question and the learners had to remember the information, so it relates to the 'Remember' level, while the second part of the question the learners had to use the information and demonstrate their knowledge in the answer they submitted, so it related to the 'Apply' level.

The majority of the learners answered the question accurately; some contain more detailed statements than others, such as

- *Properties of metal; strong, malleable, ductile, conducts heat, bendable, shiny. Made out of metal: tap, knife, key.*

- *Iron, stainless steel & chrome. Iron- can rust, hard, scratches things, conducts heat. Stainless steel- doesnt rust, conducts heat, strong. Chrome- conducts heat, strong, doesnt rust.*
- *Nails, spoons, tins. - malleable and magnetic*
- *Iron, stainless steel & chrome. Iron- can rust, hard, scratches things, conducts heat. Stainless steel- doesnt rust, conducts heat, strong. Chrome- conducts heat, strong, doesnt rust.*
- *Metals r strong,shiny,malleable,conduct heat & electricity. Tin, knife &wire*
- *Kitchen sink - zinc, strong, conducts heat. Knives and forks - stain less steel, strong, malleable. Jewellery - gold, silver, malleable.*

One answer listed metals, namely: '*Steel, iron and chromium*' and did not answer the question at all. While another answer listed possible properties such as: '*Strong, conduct heat, bendable, conduct electricity, ductile*' but didn't apply the knowledge further.

The third question stated: '*Identify 3 objects at home made from 3 different materials, explain the properties which made them suitable.*' This question was linked to Anderson's 'Analyse' level, and the learners had to examine situations or objects, and then compare and contrast ideas to draw a conclusion.

Only two learners responded to this question, both the answers identified the objects and provided the properties of the dominant material. The answers were:
- *Security gate: made with strong metal to keep people from breaking through it. 2. Couch: made with fabric covering. Used to protect couch from damage 3. Wall covering: covered with plaster to protect the wall from damage and to make the wall look good.*
- *Bookshelf-strong enough 2 hold books, Granite Table-brittle but hard, Glass Window-hard &brittle, shatter proof*

The learners showed an understanding for the question, as both the answers were relevant and accurate.

Table 18 Summary Of Girls' School's Qualitative Results Of 1st Three SMS Answers

Qu. No.	Question	Prior determined cognitive level	No. of responses (?/11) and assessment description
1	Why is it important to understand the physical properties of materials?	Analyse	5 detailed, relevant, analysed 1 not answered correctly
2	List the properties of metals and identify any 3 objects that are made from metals	Apply	6 correct, accurate application, detailed 1 listed properties, didn't apply 1 correct
3	Identify 3 objects at home made from 3 different materials, explain the properties which made them suitable	Analyse	2 detailed, correct & accurate,

4.3.3.2 *Quantitative Results Of Girls' School Learners' SMS Answers When No Replies Were Sent.*
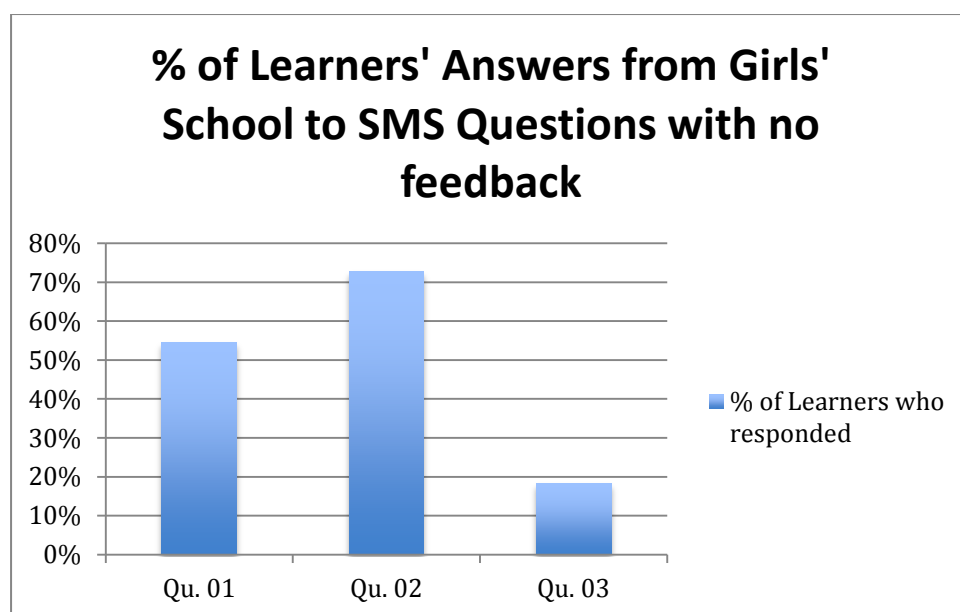
Figure 16: Percentage Of Answers From Girls' School Learners To The First Group Of SMS Questions.

The girls' school response to the first question was only 55 %. However, there was an increase to the second question with a 73% response rate. The third question then had a very large drop off in the number of responses with only an 18% response.

4.3.3.3 Qualitative Results Of Girls' School Learners' SMS Answers When Replies Were Sent.

The fourth question stated: *'Name 3 metals that are magnetic. How are magnetic metals of benefit to people?'* This question was linked to two of Anderson's levels; the first part of the question is a knowledge and recall type question as the learners had to remember the information, so it relates to the 'Remember' level. The second part of the question the learners had to use the information and demonstrate their knowledge in the answer they submitted, so it related to the 'Apply' level. There was only one answer submitted, which accurately answered both sections of the question:

- *Iron, steel & nickel. Magnets are in t.v's, doorbells, computers & speakers.*

To the girls who didn't respond to the fourth SMS question, a response was sent stating: *'Didn't get an SMS answer from you to the question. Hope you get involved with the next question! From Mrs W'*

Fifth Question: *Name 3 metals that are found in their pure state.* Anderson: Remember level, as the learners had to recall knowledge they had acquired

- *Platinum, gold & silver.*
- *Copper, gold, platinum*
- *Silver, gold and platinum.*
- *Gold, silver and steel.*
- *Gold coal silver*
- *Gold silver and iron*

The SMS response to an answer was individualised depending on what the girl's answer was, for example: The SMS reply was *'Yes those metals are found in their pure or free state, well done! Thank you for being involved in the project!* Or to the SMS answer: *'gold, coal, silver'.* The SMS reply was: *'Gold & silver are found in their pure or free state, well done! Coal is not a metal! Thank you for being involved in the project!'*

To the girls who didn't respond the fifth SMS question, a response was sent stating:

> *'Didn't get an SMS answer from you to the question. Hope you get involved with the next question! From Mrs W'*

Two SMS responses were sent in reply to the researcher's SMS comment requesting participation, namely:

- *I answered all the questions except 2 because I didn't understand it.*
- *Hi Mrs W I did not get any of the other questions except number 1, thanks a*

An additional question was sent to the girls due to the very poor response to question Question3 and Question 4: *Hi, 6th NS qu: Why are metals separated from the ore? Give your own thoughts! SMS your answer back! From Mrs W*

The response *'Thoughtful answers. Thank you for being involved in the project!'* was sent to the learners who answers were correct, see below:

- *To get the metal out of the rock.*
- *To make them more valuable*
- *They r sep so that u can have thd pure metal*
- *to take the pure metal.*

The other response was: *'Thank you for answering! Discuss the question and your answer with your teacher'* to these answers:

- *Because their ore contains metal oxides*
- *To make the metal magnetic a e*
- *I think it is something to do with the oxide in the rock.*

Seventh Question: *What was your favourite section you were taught in Science this year?*

Anderson: Analyse – examine situation, compare and contrast ideas.

The responses were:

- *Metals.*
- *I liked properties of matter section*
- *My fav sec was learning about metals.*

- *Vertebrates and in-vertebrates*

- *Properties of materials*

- *The biology section on animals.*

- *Force was the best*

Table 19 Summary Of Girls' School's Qualitative Results Of 2nd Three SMS Answers & Extra 1

Qu. No.	Question	Prior determined cognitive level	No. of responses and assessment description
4	Name 3 metals that are magnetic. How are magnetic metals of benefit to people?	Remember & Apply	1 Correct, accurately answered both sections
5	Name 3 metals that are found in their pure state.	Remember	6 correct 1 two of three answers correct
Add. Qu.	Why are metals separated from the ore?	Analyse	4 accurate & correct 3 incorrect
Last qu.	What was your favourite section you were taught in Science this year?	Analyse	7 topics

The following response was sent to all participating learners, it stated: *'Thank you for participating in this project, from Mrs W'*

4.3.3.4   Quantitative Results To Determine Which Type Of Questions Encouraged The Most SMS Answers From The Girls' School Learners.

The number of learners' responses and replies to the SMS questions was maintained in both question 6 and 7. This reinforced the concept that the feedback SMS had a positive effect on the interactions between the researcher and the learner.
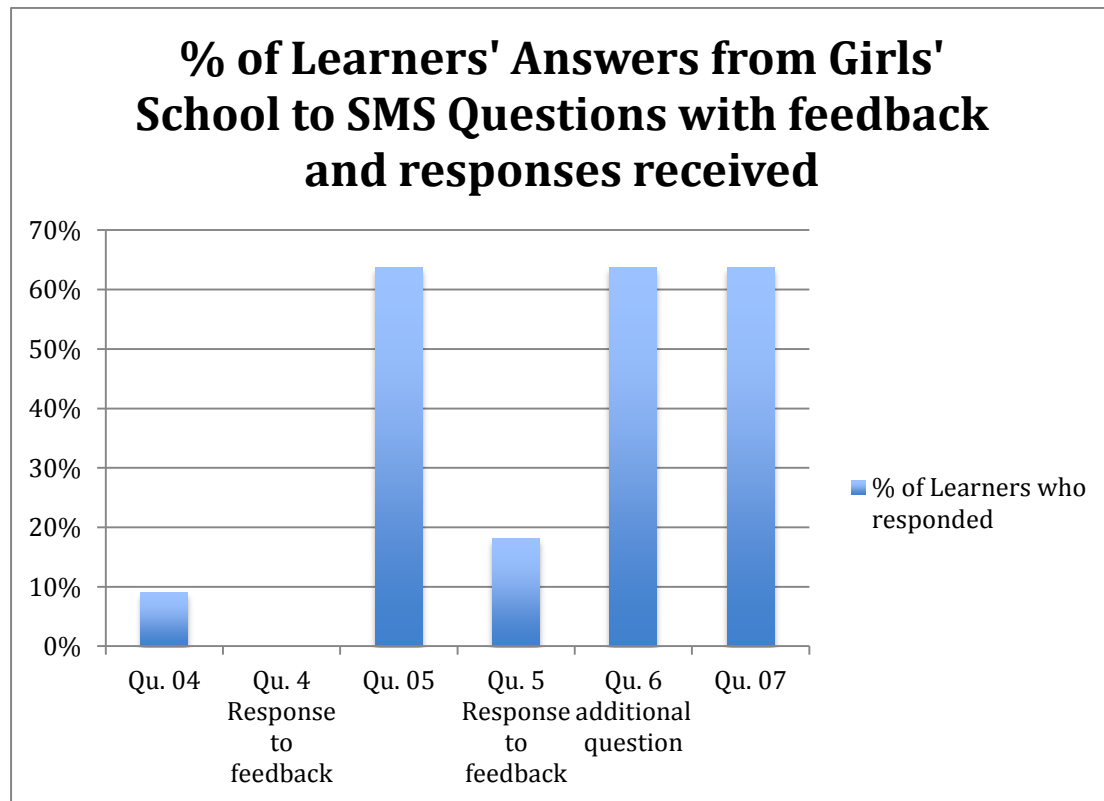
Figure 17: Percentage Of Answers From Girls' School Learners To SMS Questions With Feedback And Feedback Responses.

Of all questions, in all schools, the girls' school response to Question 4 elicited the poorest response with only a 9% response rate. The researcher's SMS feedback reply to question 4 seemed to have a positive effect on the participating girls from the girls' school as the response to question 5 increased to a 64% participation rate. This percentage remained the same for the additional question 6 and for question 7, demonstrating the positive effect the feedback reply to answers had on a number of the participants. Further to this, 18% of the learners sent an additional SMS response to the researcher's feedback response to Question 5 which requested further involvement in the SMS project by these participants.

4.3.4 Comparative Results Of The Three Schools To The SMS Questions

The question with the most responses from the co-ed school learners was Question 1, it was an 'evaluate' type question, at 75%.

The question with the most responses from the boys' school learners was Question 1, it was an 'apply' type question, at 80%.

The question with the most responses from the girls' school learners was Question 2, it was an 'apply' type question, at 73%. (Table 20, the shaded percentage illustrates the greatest number of responses from each class)

Table 20 Comparison Of The 3 Schools' Participants Reply Percentages

Qu. No. & whether response was sent	Co-Ed	Girls' School	Boys' School
1st (no SMS response)	75%	55%	80%
2nd (no SMS response)	63%	73%	60%
3rd (no SMS response)	31%	18%	50%
4th (1st SMS response sent after qu.)	37.5%	9%	40%
5th (SMS response)	50%	18%	50%
Add. Qu (SMS response)	n/a	64%	n/a
6th / last question (SMS response)	62.3%	64%	60%

Therefore the question which had the highest percentage of responses (80%) was Question 1 from the boys' school learners, where learners had to demonstrate and apply knowledge by recalling and listing the importance of knowing the high risk behaviours related to HIV / Aids.

It should be noted that there was the drop-off in SMS answers to Questions Three and Four by all three schools. The co-ed school answers dropped to 31% for Question Three and then increased slightly to 37.5% for Question Four; the boys' school answers dropped to 50% for Question Three and then to 40% for Question Four; while the girls' school answers was the largest drop to 18% for Question Three and only 9% for Question Four.

However all three schools' results and responses increased when feedback was given, after Question Four, so the results for Question Five and Question Six were as follows:

- the co-ed school answers increased to 50% for Question 5, and 62.3% for Question 6
- the boys' school answers increased to 50% for Question five and 50% for Question 6
- the girls' school answers increased to 64% and remained there for both Question 5 and 6.

It is interesting to note that there was never a 100% response to any of the questions from any of the three schools involved in the project.

4.3.5 Comparative Quantitative Results Of The Three Schools' Individuals' Responses To The SMS Questions

Three learners from the co-ed school and three learners from the girls' school did not respond at all to any of the SMS questions.

The tables below (Figures 18, 19 & 20) indicate the number of responses from each school per individual to all the SMS questions.
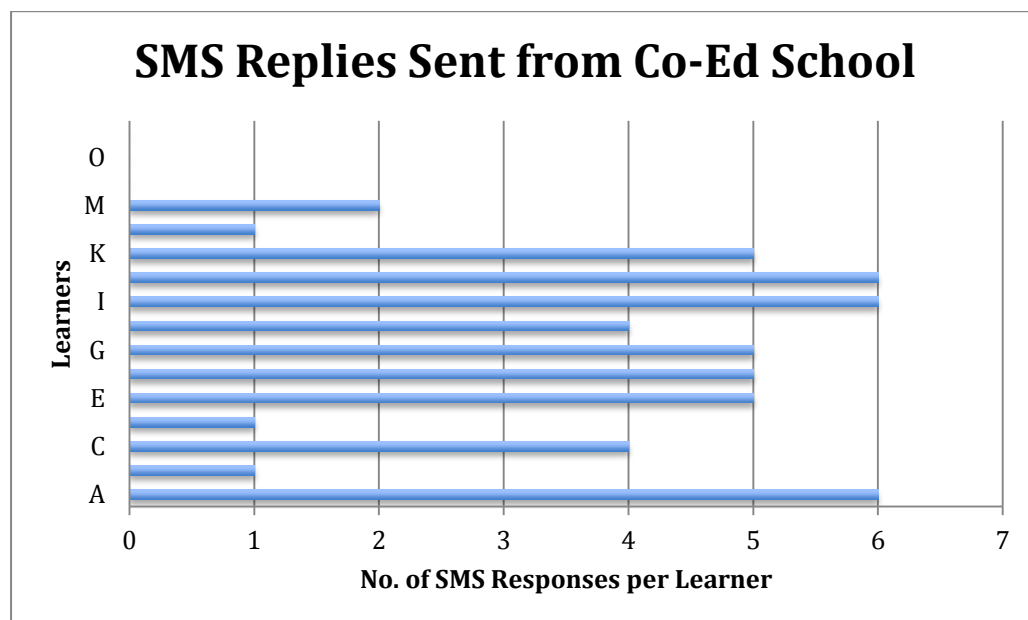
Figure 18: Individual Responses Sent From The Co-Ed Learners

Of the possible sixteen participants from the co-ed school, three learners did not respond to any of the questions. Three learners responded to all six of the SMS questions. Another three of the active participants only responded to one question, while the majority of learners responded four or more times to the SMS questions.
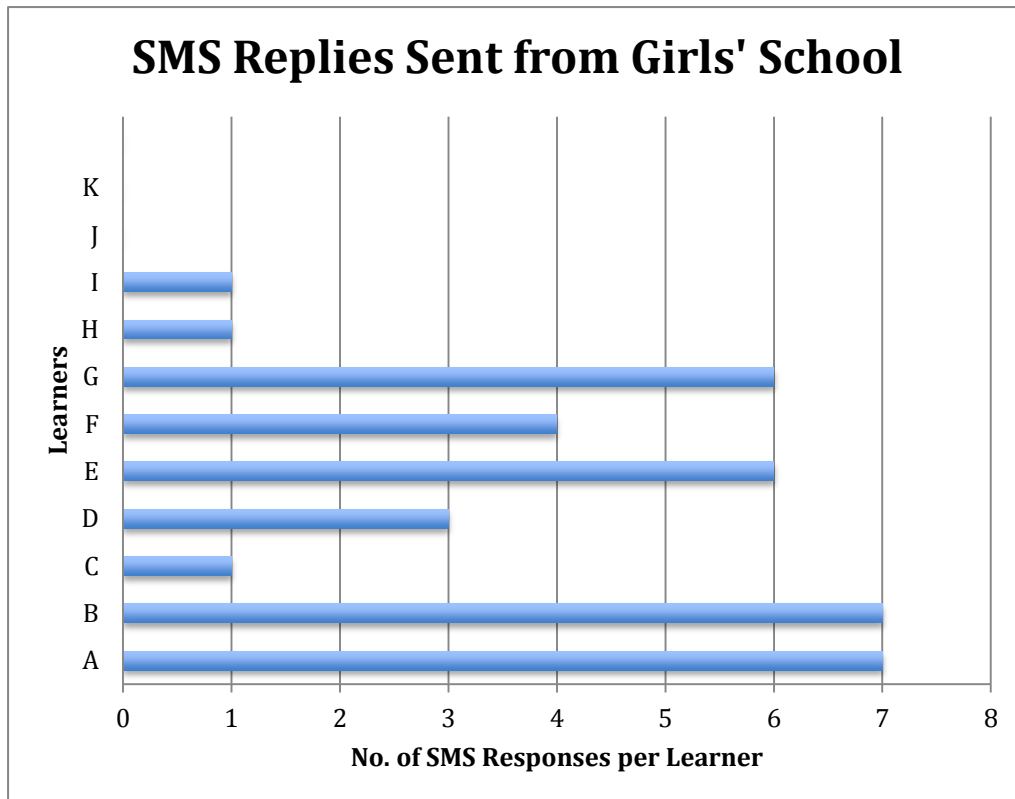
Figure 19: Individual Responses Sent From The Girls' School Learners

Of the eleven girls' school learners who agreed to participate, two learners didn't send any responses and three learners sent only one response. The remaining six learners' overall responses varied from three to seven responses. Two girls replied to all seven SMS questions sent to them.

SMS Replies Sent from Boys' School
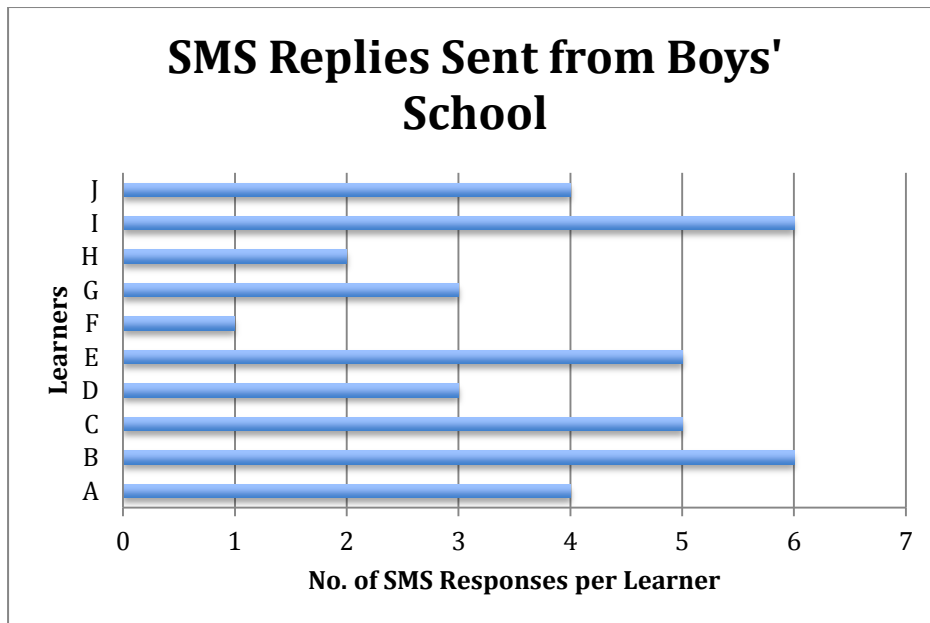
Figure 20: Individual Responses Sent From The Boys' School Learners

All the boys from the boys' school responded to some or all of the SMS questions. One learner responded to only one SMS question, while the other boys all responded in varying numbers. Two of the boys responded to all six of the SMS questions sent to them.

Therefore the combined percentages of the SMS answers submitted by all participants were as follows (see Table 21):

Table 21 Combined Percentages Of SMS Answers Submitted By All Participants

% answers replied to	100%	83%	67%	50%	33%	17%	0%
% of participants who responded to the % of answers	19%	22%	14%	8%	5%	19%	14%

4.3.6 Comparative Qualitative Results Of The Schools' Individuals' Responses To The SMS Questions

The number of answers to each question from the various schools differed from question to question.

The co-ed school and the boys' school sent the most replies to the first question with out feedback to the response, while the girls' school participants sent the most replies answers to the second question.

It could be noted that the majority of learners used very few of SMS abbreviations. In most instances full words were used, although there were spelling and punctuation errors.

Overall, the responses to the questions with feedback from the co-ed learners demonstrated that they had thought about their responses. They regularly included explanations to their responses, which added clarity.

4.4 RESULTS SHOWING ADDITIONAL LEARNER SMSES TO THE RESEARCHER'S SMS COMMENT / REPLY

4.4.1 Quantitative Results To Researcher's SMS 'Feedback Response / Comment' To The Learners.

Table 22: Responses By Learners To Feedback From All Three Schools.

Number of direct responses to the 'Feedback SMS' per related question	Co-ed school Learners	Girls' school Learners	Boys' school Learners
Qu. 4	0	0	0
Qu. 5	0	2	1
Additional Qu. GP	n/a	0	n/a
Final Qu.	0	0	0

As noted in Table 5; only 3 learners responded directly to the SMS reply (feedback statements). However, when looking at the graph below (Figure 21) it is clear to see that the number of learners' answer responses increased when the feedback was introduced.
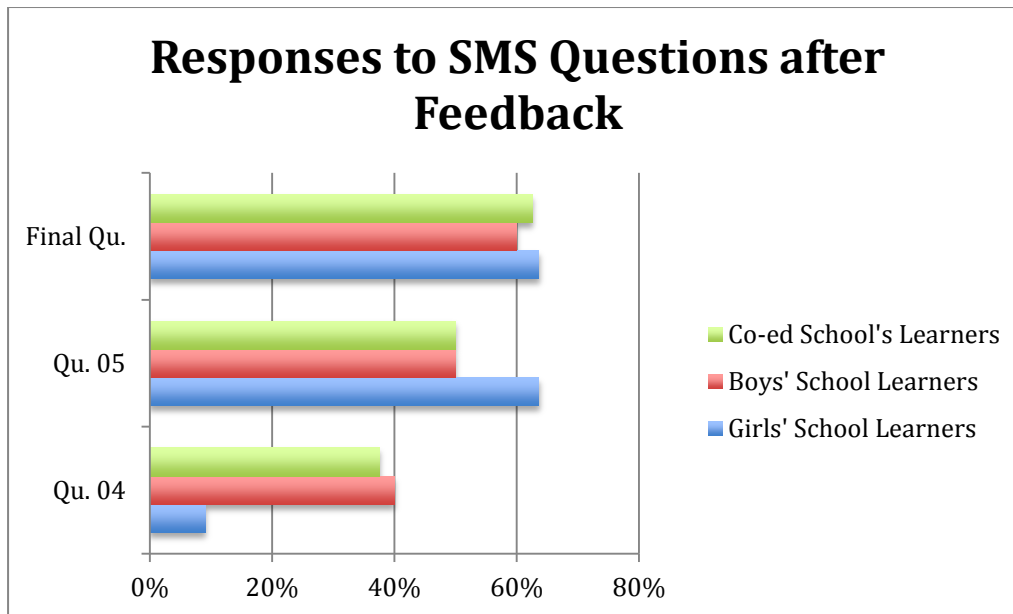
Figure 21: Comparative Results Of The Responses By Learners To SMS Questions After Feedback Was Given To Answers.

4.4.2 Qualitative Results To Researcher's SMS 'Feedback Response / Comment' To Learners.

None of the co-ed school learners responded directly to the feedback SMS. However, the number of learners participating and answering questions continued to increase after each question that had an SMS feedback statement, see Figure 21. Only one of the boys from the boys' school responded directly to the statement stating that he hadn't been responding to answers and hoped he would respond to the next question. His response was '*ok*' and he did answer the next SMS question.

4.5 COMPARATIVE RESULTS OF THE THREE SCHOOLS' INDIVIDUALS' RESPONSES TO THE SMS QUESTIONS.

4.5.1 Merged Quantitative Results Of Individual Responses Depending On The Gender Of The Learners

The girl participants responded in a similar pattern to each other, with the girls' school learners responding more to Question 2, Question 5 and the Final Question, while they also responded the least to Question 4 of all the schools.
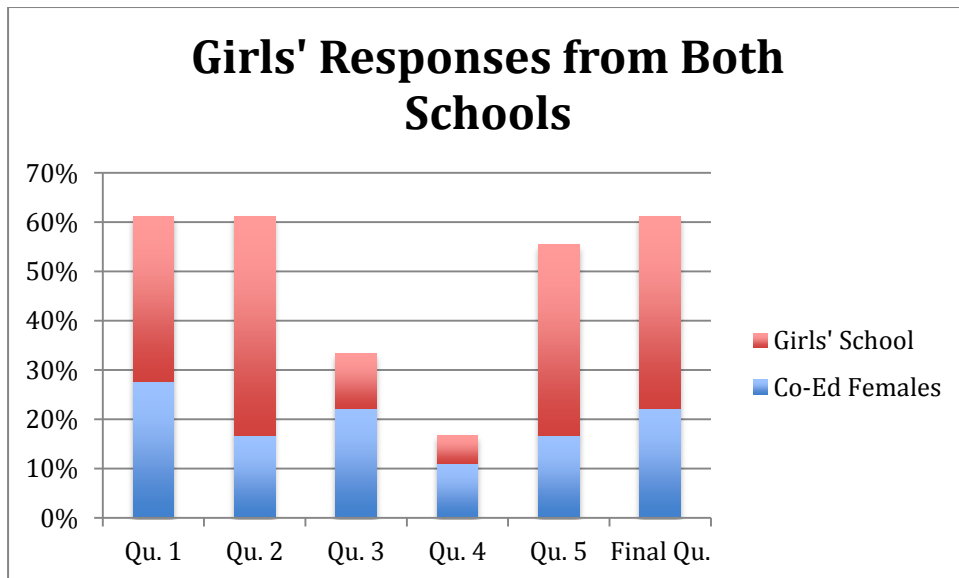
Figure 22: Merged Results Of Girls' Responses From Both Schools: Co-Ed And Girls' Schools

The boy participants also responded in a similar pattern to each other. The boys' school learners responded by 40% more than the co-ed boys to Question 1. However, the number of co-ed boys' responses increased in Question 2 to 26% and this remained consistent in Questions 2, 3, 4 and 5, but dropped slightly in the final question. Meanwhile the boys' school participants' responses dropped in Questions 2, 3 and 4 and then increased in Question 5 and remained consistent in Question 6.
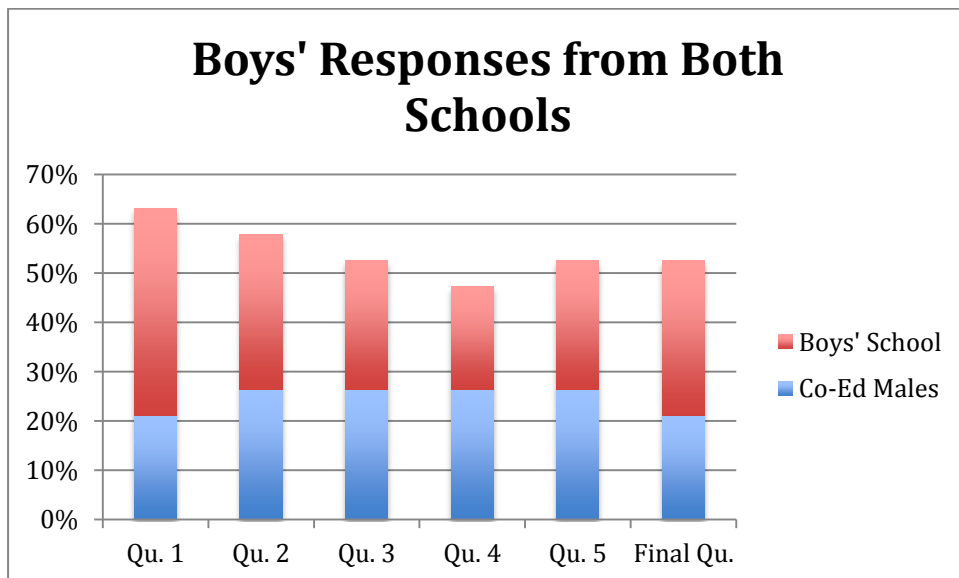
Figure 23: Merged Results Of Boys' Responses From Both Schools: Co-Ed And Boys' Schools

The gender groups were created by dividing the participants into two groups: the male group, boys from the co-ed school and boys from the boys' school, and the female

group: girls from the co-ed school and girls from the girls' school. 49% of the participants were girls, and 51% were boys.

When comparing the responses from the total gender groups' replies (see Figure 24), more boys responded to Questions 1 and 2, their replies dropped slightly in Questions 3 and 4, but they then responded to more questions in Question 5 and the Final Question. The girls sent more responses than the boys to Questions 2, 5 and the Final Question.
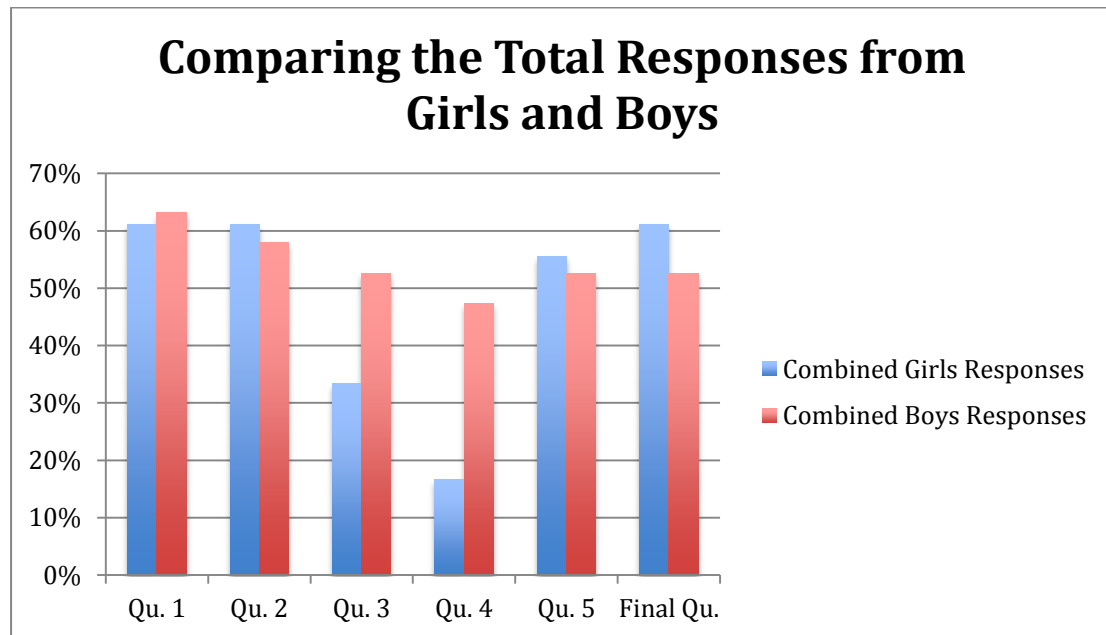
Figure 24: Comparing Totals From All Girl And Boy Participants

Table 23: Comparing Totals From All Girl And Boy Participants

SMS question	Female Responses	Male Responses
Qu. 1	61%	63%
Qu. 2	61%	58%
Qu. 3	33%	53%
Qu. 4	17%	47%
Qu. 5	56%	53%
Final Qu.	61%	53%

When the gender groups' replies to the SMS questions were calculated it was found that for Question One 61% of the females and 63% of the males replied; Question Two 61% of the females and 58% of the males replied; Question Three 33% of the females and 53% of the males replied; Question Four 17% of the females and 47% of

the males replied; Question Five 56% of the females and 53% of the males replied and for the Final Question 61% of the females and 53% of the males replied.

Overall the girls replied to 48% of the SMS questions asked, while the boys replied to 54% of the questions asked.

4.6   RESULTS OF COMPARATIVE SMS REPLIES FOR TWO SOCIO-ECONOMIC GROUPINGS.

4.6.1   Quantitative And Qualitative Comparison Of Socio-Economic Influences

It is interesting to note that the largest number of learners offering to participate in the project were from the school with the lower socio-economic backgrounds.

On the whole the co-ed school learners were from lower socio-economic background, while the learners from the girls' and boys' schools were from middle and upper socio-economic groups. Sixteen learners of a possible twenty-four learners from the co-ed school class of Grade 7s volunteered to participate in the project, while ten of a possible twenty-seven learners from the boys' school Grade 7 Class; and eleven of a possible twenty-six learners from the girls' school Grade 7 Class volunteered to be involved.

Table 24: Comparing Totals From Socio-Economic Groups

Socio-Economic group	Percentage of agreed participants	Percentage of actual active participants
Lower Socio-Economic group	67%	54%
Higher Socio-Economic group	40%	34%

Therefore, 67% of the lower socio-economic school's class volunteered to participate in the project (see Table 24), but three of those learners did not reply to any of the SMS questions. Therefore, the actual number of active participants from the co-ed school in the project was 54% of the original class, while among the wealthier learners only 40% of the two classes from the two different schools agreed to participate in the project, and only an actual 34% were active participants during the research.

No. of Responses in relation to Socio-Economic Group
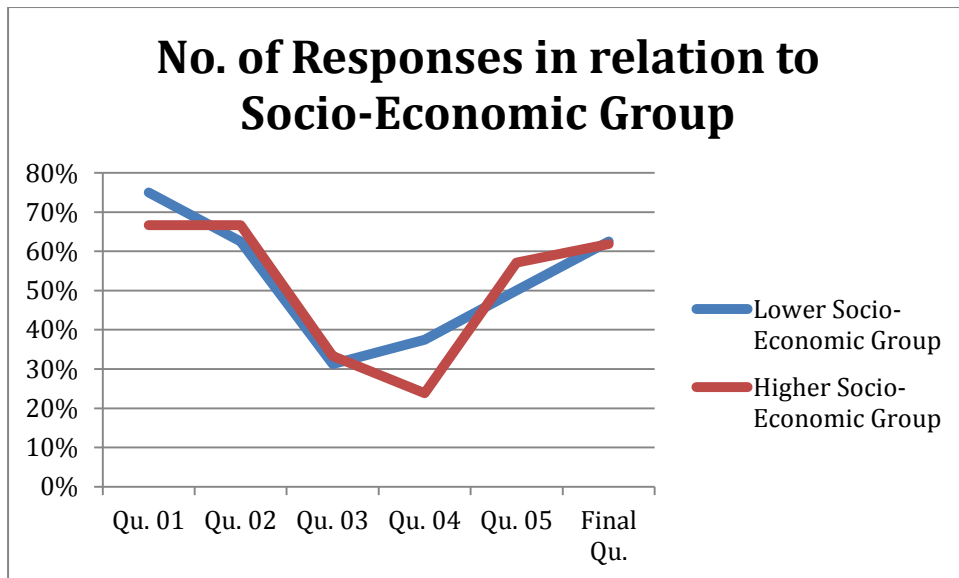
Figure 25: Merged No. Of SMS Answers From Two Socio-Economic Groupings

Looking at the responses of the active participants, the lower socio-economic group of learners responded to more of the SMS questions on the whole compared to learners from the high socio-economic bracket (Figure 25).

Table 25 Socio-Economic Groups and Percentages of Results to SMS Questions

SMS question	Lower Socio-Economic Group	Higher Socio-Economic Group
Qu. 01	75%	67%
Qu. 02	63%	67%
Qu. 03	31%	33%
Qu. 04	38%	24%
Qu. 05	50%	57%
Final Qu.	63%	62%

4.7 RESULTS OF 'REVIEW OF RESEARCH' QUESTIONNAIRES BY ALL THE STUDY PARTICIPANTS

4.7.1 Merged Results Of All Participants Views Of Their Involvement In The Study

Two questions were asked in the 'Review of Research' Questionnaire in order to evaluate the learners' feelings and attitude to being involved in the project. These were:

- 'How did you feel about being involved in this project?'
- 'How did you feel about having to send an SMS answer?'

The results of these survey questions are shown graphically in the pie charts (Figure 26) below.
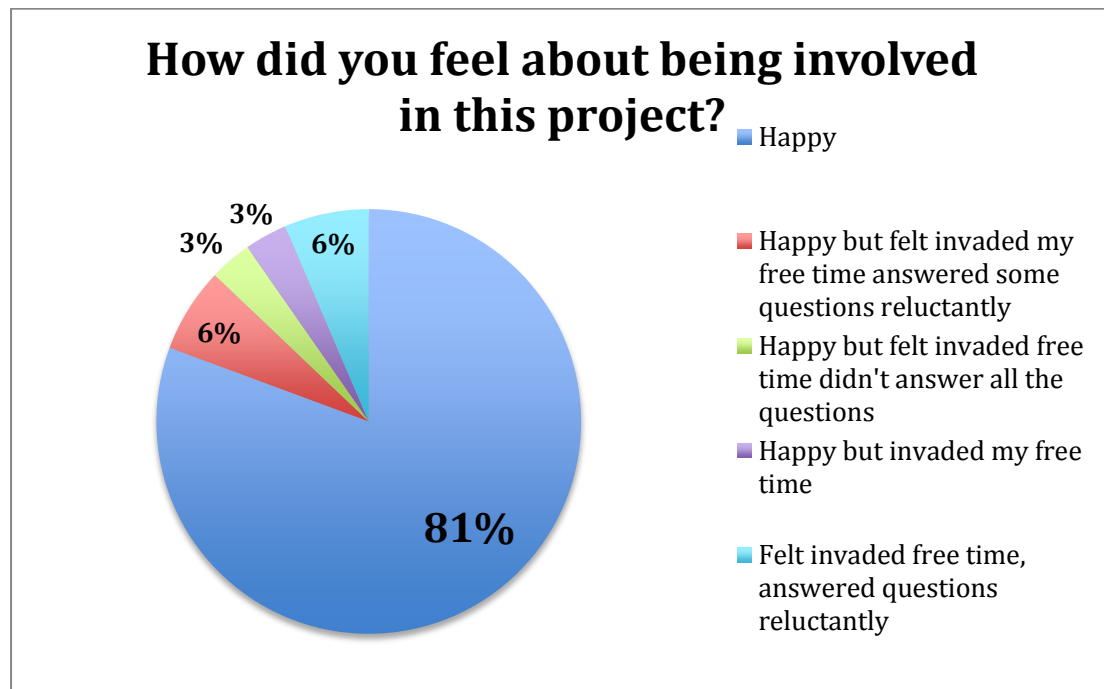
Figure 26: Merged Results: 'Review Of Research' Questionnaire - How All Participants Felt About Being Involved In Project?

It is evident that an overwhelming majority (81%) of the learners were happy to be involved in the project. A minority (12%) were happy to be involved but felt that the project did invade their free time, while only a small minority (6%) felt the project invaded their free time and they participated reluctantly.
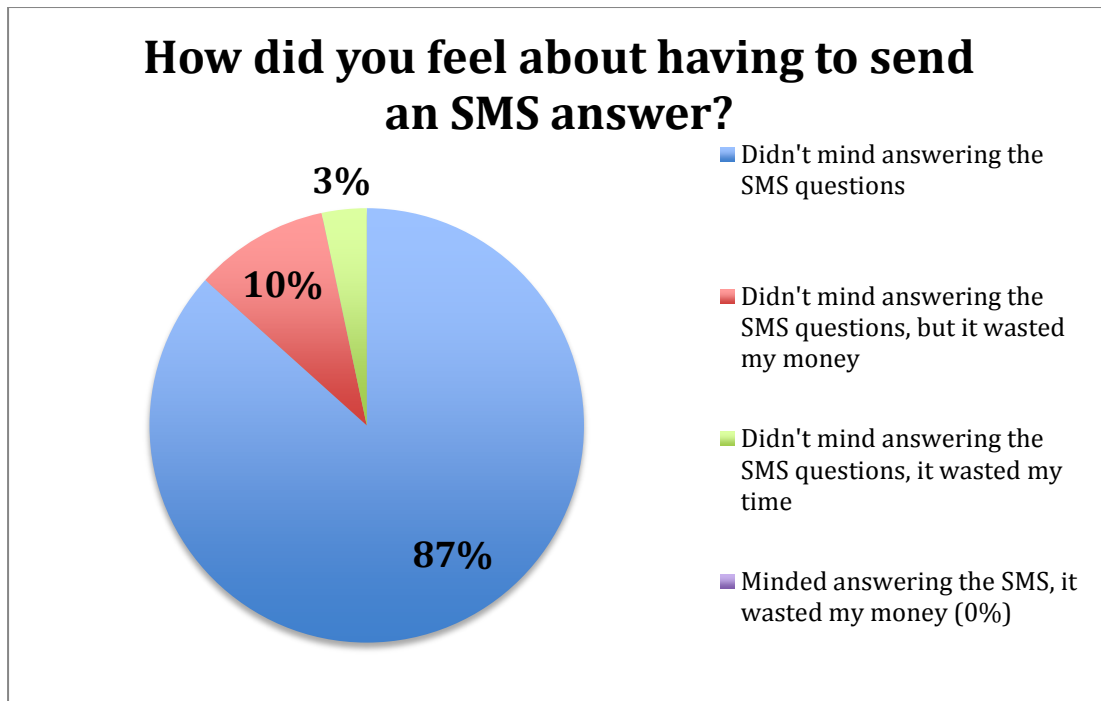
Figure 27: Merged Results Of 'Review Of Research' Questionnaire - How All Participants Felt About Having To Send SMS Answers?

A large majority (87%) of the participating learners said they didn't mind answering the SMS questions, 10% didn't mind but thought it wasted money, while 3% said they didn't mind but felt it wasted time. None of the participants minded answering the SMS questions.

In the question about whether the learners participated freely and voluntarily without fear or outside pressure, the majority of the learners stated that they had participated without fear or pressure from others. As shown in Figure 24, the vast majority of the participants (91%) stated that they had answered the questions because they wanted to, while a small minority (3%) said they answered because their parents said they must. Another 3% answered the SMS questions because their teacher said they must. Only 3% answered because they thought they would get into trouble if they didn't.
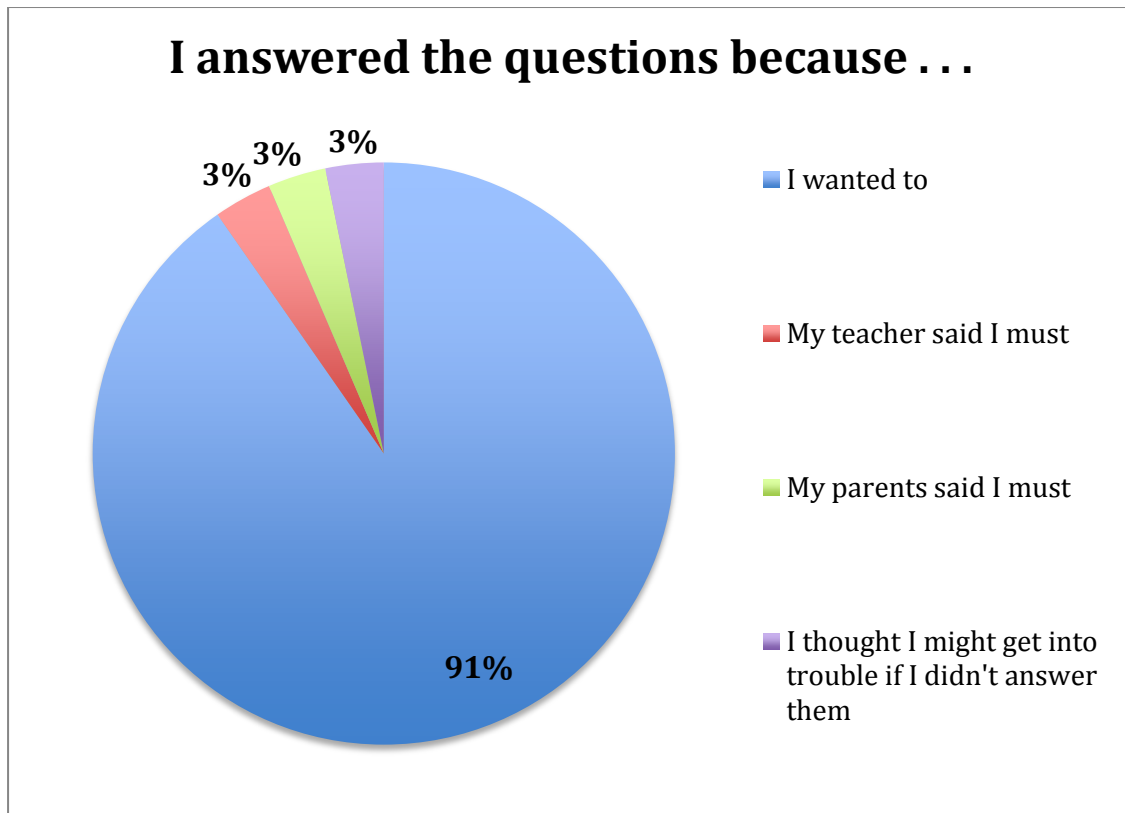
Figure 28: Merged Results Of All The Participants' Views / Reasons For Answering The SMS Questions In The 'Review Of Research' Questionnaire

4.7.2 Merged Results Of How Participants Communicated With Others About The Project Questions

Which other people did learners consult or discuss answers with before sending responses (such as family members or peers) and how did they communicate with them, verbally or using technology? The majority of learners corresponded with others before responding to a SMS question. Only 10% of the learners did not interact with others before sending a response. Of the vast majority (90%) of participants who did interact with others; 13% used five methods of communication, 30% used three methods of communication, 20% used two methods of communication and 27% used one method of communication (refer to Figure 29).
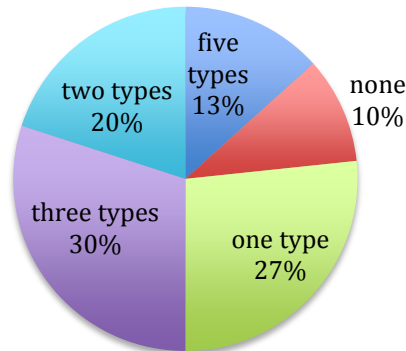
Figure 29: Merged Results: 'Review Of Research' Questionnaire - All Participants Comments About Overall Communications With Others About The SMS Questions.

The way in which learners communicated with others was probed and it was established that these included verbally interacting with their parents, other family members and friends. They also communicated using texting or sending SMSes, via MXit, and one stated that Facebook was also used.
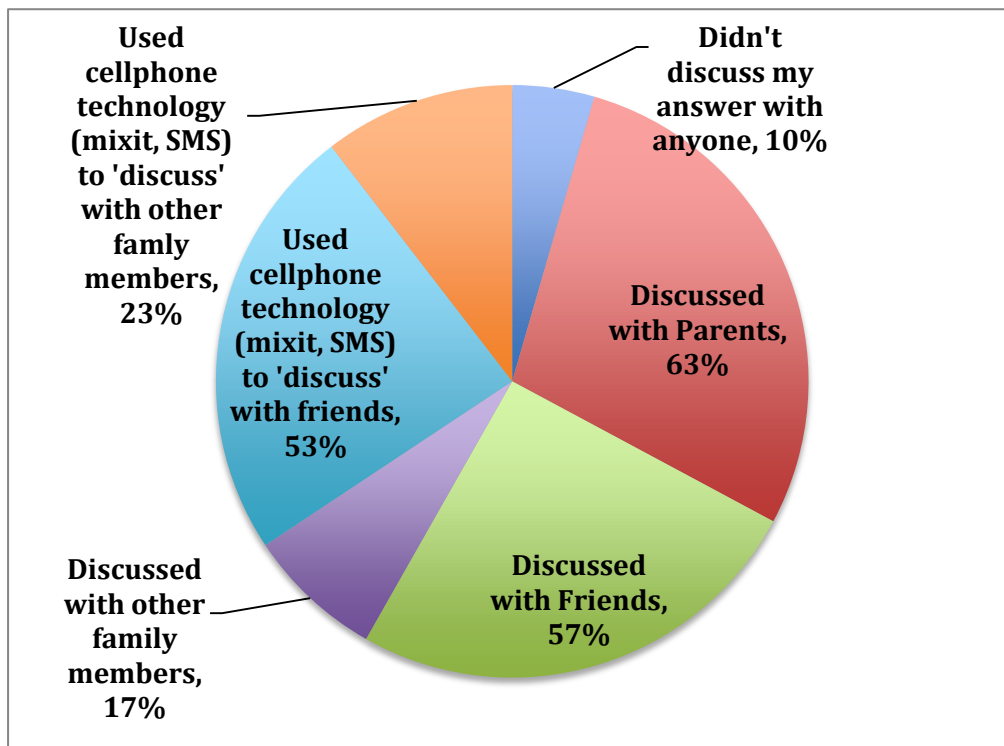
Figure 30: Merged Results: 'Review Of Research' Questionnaire - All Participants Comments About Methods Used Communications With Others About The SMS Questions.

In Figure 30 it is shown that 10% of the learners just answered the questions and did not discuss their answers with anyone. For the rest of the participants, responses varied as to who they discussed their answers with before sending a reply. 63% verbally discussed the answers with their parents, 57% discussed the answers with their school friends and 17% discussed them with other family members. However, 53% of the participants communicated about possible answers via a cell phone technology such as MXit or texting, and 23% communicated in a similar way with other family members before sending a response. One of the participants mentioned using Facebook as a means to discussing the answer.

4.7.3   Merged Results Of Parents' / Guardians' Perceptions From The Participants' View Points About Using Cell Phones After The Research Project Was Completed
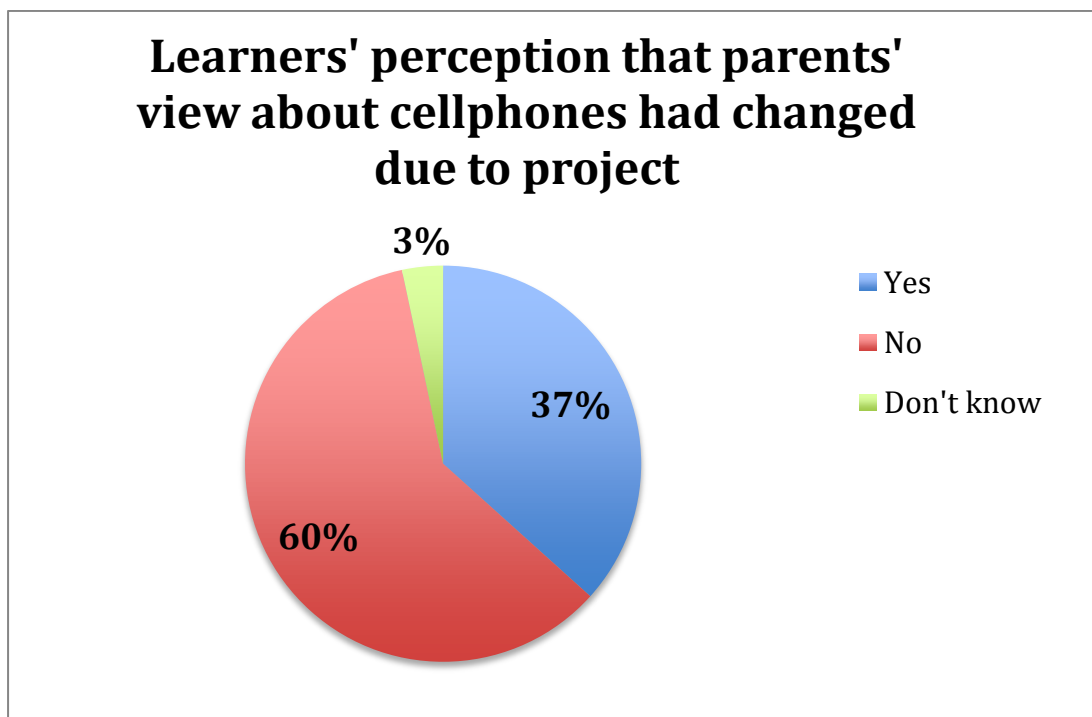
Figure 31: Merged 'Review Of Research' Questionnaire All Participants Perceptions Of Parents' Views About Cell Phone Use, After The Project.

More than half (60%) of the learners felt that their parents' view about the use of cell phones had not changed as a result of the project. One learner responded that his / her parents were not involved in the project so their views were not influenced. However, 37% felt that their parents' views had changed, citing reasons such as: cell phones

could be used by learners for educational purposes; cell phones could be used to encourage learners to answer questions. Some parents viewed cell phones as having both positive and negative uses for learners. Some changed their ideas once they saw how cell phones could be used for educational purposes to assist learners with their studies. One learner suggested that his / her parents didn't mind their child sending text messages since this project began.

4.7.4 Merged Results Of Participating Learners And How They Would Use Of Cell Phones For Educational Purposes After Completion Of The Project

The learners were asked how they would use their cell phones differently after this project. They stated that they would use their cell phones' calculator, use the internet (e.g. Google or web-based dictionary) to check, research or investigate information for schoolwork and to record homework. One learner suggested that teachers could SMS the homework to the learners; another suggested that a school could send questions and then expect answers just as was done during this project. A few suggested that learners could 'discuss' questions posed via texting. Another learner suggested that texting was a helpful and easy way of expressing one's own opinions which would be useful for school. Another learner suggested using it as a peer-learning tool where learners teach and learn from each other.

5 CHAPTER FIVE – DISCUSSION

This project's main research question asked to what extent and in what ways do learners interact and respond to school related questions posed and sent using SMS cell phone technology after the school day. To answer this, Grade 7 learners were sent SMS questions related to the school work which had been taught earlier in the day, to establish how learners would participate and respond. Only one aspect of cell phone use, that of texting, was investigated in this project using three South African private primary schools as the context. Educational technologists, such as Bosco and Bakia (2004), as well as Spector, *et al* (2008), requested the use of more qualitative research methods as results from this type of cell phone research could influence training and school processes. This was relevant in this research because of the increase of computer-based interactive technologies in education and industry (Savenye & Robinson, 2001). Bosco and Bakia (2004) requested that research for ICT in education could be used as a resource for the development of policies and practices of the use of ICTs in educational environments, such as schools. Spector, *et al.* (2008) suggests that educational research with regards to ICTs should not only contribute to evidence-based uses of technology, but should incorporate such studies into multidisciplinary research programmes.

The use of cell phones in society today is widespread, with Africa seen as the world's largest growing cell phone market (LaFraniere, 2005). Children of all ages use cell phones and other digital technologies to send text messages, MXit, chat on line, and send emails, but most of these technological experiences are not encouraged by schools or teachers (Kolb, 2008). In line with these published studies the vast majority (95%) of the learners in this study preferred communicating using texting, which included ordinary SMSing and text 'chatting' on MXit rather than actually speaking to their peers. Many of the learners preferred communicating electronically with their friends (84%), parents (76%) and other family members (65%) by using SMSing.

Therefore it appears that cell phones have changed the way society communicates. This is supported by Kreutzer (2009) who established that in his study of a group of Grade 11 Cape Town learners, the vast majority of whom actively used cell phones. Thus Leach *et al.* (2006), Kolb (2008), Kreutzer (2009) and Scornavacca *et al.* (2009) studies as well as my results suggest that we, as teachers, need to be prepared at times

to alter the way in which we engage with our learners at school in this modern, technological age. The results of this SMS question and SMS reply project may encourage teachers to use cell phone technology to reinforce their in-class teaching or as part of a supplementary teaching programme. It should be noted that even though Natural Science was the Learning Area focused on in this study, the process of using mobile technology to enrich teaching and learning could be related to any other subject.

Learners were encouraged to participate in the project voluntarily this was demonstrated within each of the schools. The number of individual responses from each participant to the various SMS questions varied greatly from individual to individual. It is interesting to note that all the participants from the boys' school answered at least one question, while from the co-ed school 19% of the learners who volunteered did not respond to any of the SMS questions and 18% of the volunteered participants from the girls' school didn't reply to any SMS questions. By allowing the learners to participate on a voluntary basis, even with such a small sample it still demonstrated that the majority of learners actively participated in more than 50% of the SMS questions. Thus reinforcing that this type of SMS communication could be used effectively by a teacher to encourage learning after school hours.

It was interesting to note that the first question sent out received the highest number of responses from two of the schools, the co-ed school had a 75% reply rate and the boys' school had an 80% reply rate. The co-ed school's question was linked to the 'Evaluate' level on Anderson's Taxonomy, and was a question that encouraged creative thought and asked the learners to express their own opinions ("Why would an astronaut enjoy being weightless?"). This may have been part of the reason for the large number of responses as the question was open-ended and allowed for self-expression. The question may have also triggered the learners' imaginations. The boys' school question was linked to the 'Analyse' level on Anderson's Taxonomy and was a partially open-ended question where the learners could also express their own thoughts about '*Why is it important to know the high risk behaviours related to HIV / Aids?*' Another factor that may have influenced the large number of replies was that it was the beginning of the project and therefore the learners may have been excited about being involved in this process and therefore wanted to respond to the question.

This conclusion is supported by the observation that the number of participant SMS replies dropped subsequently before SMS feedback responses were sent to the learners.

The question with the highest number of responses from the participants at the girls' school was their second question to which 73% of the girls replied. The question was: *Hello, Here's 2nd NS question: List the properties of metals and identify any 3 objects that are made from metals? SMS your answer back! From Mrs W.* The question was partially open-ended and related to two aspects of the taxonomy table: 'remember' and 'apply'. This question may have received so many responses as the first part of the question, list the properties, was easy. Generally, the types of SMS questions that received a greater SMS answer from the participating learners encouraged individual ideas and creative thought among the participants.

During the second part of the study an individual, personal, positive SMS feedback reply was sent to each participant once his / her SMS answer was received. Even learners who did not respond to the SMS question were sent a positive SMS reminder as an attempt to encourage them to participate and answer future questions. The SMS feedback reply to a learner's SMS answer had a positive effect on the level of learners' engagement in the project. When the feedback replies were first sent in response to an individual learner's SMS answer, many of the learners were encouraged and the number of SMS answers for subsequent questions increased. The girls' school's responses increased from a 9% to 64%; the boys' school's responses increased from 40% to 60%; the co-ed school's responses increased from 38% to 62%. With increased learner interaction to the SMS questions when SMS feedback replies were sent, indicated that the SMS replies to the learners' SMS answers encouraged them to participate more actively. This personal feedback Wiggins (2004) agrees with as he suggests that teachers should provide guidance and personal feedback to learners. While Aleven *et al.* (2003) would agree that the increased response rate had a positive influence and motivation on the participating learners.

Vygotsky's 'obuchenie' (teaching and learning instruction process) and the theory of Constructivism would be reinforced by the concept of including after school SMS interactions between teachers and learners to substantiate what had been taught during

the school morning, as it created an additional opportunity for the child to construct knowledge and to think critically and creatively after the school day. Moreover, the SMS communication meant that learners were forced to engage with material taught during the day rather than forgetting about it until the next time they had the subject at school. In a similar way, SMS interaction could be used to remind learners of pending homework. Other studies have found that an electronic mailbox had a positive effect on students who received electronic feedback when doing an electronic test (Venables & Haywood, 2003). In this respect SMS technology could serve a similar purpose.

Results have suggested that if feedback had been used from the beginning of the project the number of responses from the learners may have remained high instead of dropping after the initial question when presumably the novelty had worn off. Therefore, if a school decided to use this type of technology to encourage learners using SMS questions in a manner similar to what was done in this study, it would be recommended that feedback should be sent from the beginning of an interactive SMS programme and that SMS reactions or responses to the learners' SMS answers or non-responses should be sent throughout the programme to motivate the learners, to prolong their interest and enthusiasm, and to encourage them to become activate participants. However, if the SMSes were just to be used for information to inform learners about an activity or event, where no reply is expected from the learners then feedback responses would not be necessary. Both scenarios would be advantageous to learners and to teachers who could use information obtained from the learners to inform their lesson planning and curriculum planning. They would also become aware of misconceptions held by their learners and could address these before they became embedded.

The vast majority of participants (90%) engaged in various forms of communication with others during the study when seeking an answer to the SMS questions, which included other learners or family members before sending an answer. The majority of participating learners discussed the questions with a variety of people including family members, parents and peers. The participants used a variety of methods of communication when discussing the SMS questions such as verbal discussions with parents, friends and other family members or they used cell phone technology for example MXit and SMSing, to 'discuss' the questions with friends or other family

members. It could therefore be deduced that if SMS-interactive-question-technology was used in a school context that the majority of learners would communicate information with their parents and other family members in one form or another. This could result in family members taking more of an interest in their education and could keep channels open for communication about other issues.

In light of the findings of this study, a suggestion to schools could be that when learners register at school the cell phone details of parents or guardians, and those of the learners' cell phone numbers could be included on the school information forms. The school could then text questions and other information to both parents (guardians) and scholars. These text messages could have the added benefit of informing parents about the messages being sent to the children from the school and the parents (guardians) could be made aware of the content of the messages. In terms of school work, if an SMS question were to be sent to both scholars and parents, the learner's answer to the question could be from his / her own cell phone or from his / her parent's (guardian's) cell phone which may further increase parent / guardian involvement.

The project included participants from a range of socio-economic backgrounds i.e. from the lower to the upper socio-economic sectors. Therefore, the participant sample was divided into two general socio-economic groups, the lower-socio economic group and the higher (middle to upper) socio-economic group and the responses and willingness to participate in the study were compared between the two groups.

There was a difference in the number of learners from the different socio-economic groups who volunteered to participate in the study: 67% of the original lower socio-economic group that was approached to participate in the study agreed to do so, while only 40% of the original middle and upper socio-economic group agreed to participate. Perhaps the participants from the lower economic group place more value on getting the extra practice about their school work, or the middle and upper class participants felt they already had additional educational resources at home, such as computers connected to the internet or attended individual lessons, and therefore saw participating in the study as a nuisance.

The number of SMS answers from the different socio-economic groups varied from question to question. To begin with, the 75% learners from the lower socio-economic group replied to the first question, while 67% of the learners from the higher socio-economic group did so. This means that not only did a higher number of learners from the lower income group agree to participate, but that more of those actually responded. The lowest percentage of replies from the lower socio-economic group of learners was 31%, while the lowest percentage from the higher socio-economic group of learners was 24%. The participation of both groups increased when feedback was sent to their SMS answers, the lower socio-economic group of learners' answers increased to 63%, while the higher socio-economic group of learners' answers increased to 62%. This indicates that the learners from different socio-economic backgrounds were positively influenced by the SMS feedback replies which were sent to them. By including learners from different socio-economic backgrounds in the project, it could be assumed that learners of similar ages, schools and socio-economic backgrounds as those of the participants would probably engage in SMS questions / answers or similar SMS activities related to schoolwork which means that the study has relevance in a number of South African schools.

There was a gender specific difference in the number of responses to the SMS questions. The girls replied to 48% and the boys replied to 54% of the total possible number of SMS questions they could have answered. However, both genders indicated their willingness to participate and showed involvement and commitment to the project. This suggests that the concept of the study would be viable in both single sex and co-ed schools.

The attitude and feelings of the majority of the learners (81%) involved in the project was that they were happy to be involved and willingly answered the questions. On the other hand a few (12%) were happy to participate but felt their free time was being invaded and they therefore did not answer all the questions. Only a small minority (6%) said they answered the questions reluctantly. These results could perhaps be used as indicative of how school learners would participate in texting answers to questions and how they would feel about receiving information related to the subjects they are taught. The teachers were asked not to encourage the learners to respond to the questions during this study; however, in a real school scenario the teacher would

discuss the answers with the learners and could generate further enthusiasm. These SMS answers could also be seen as the homework for that subject for the day, which may reduce the irritation felt by some learners, especially if longer homework was not given. Learners' texting answers could also save time; some learners spend hours writing down answers to questions that could easily be texted to the teacher. A texted answer has an additional advantage in that learners are required to think about how to structure information into a set number of characters, which means that they need to synthesize information into an appropriate format.

With regards to the attitude of the learners to sending the actual SMS answers, the vast majority (87%) asserted that they did not mind texting the answer 10% felt that sending the messages wasted their money, and only a small minority (3%) felt that sending the messages wasted their time. The overwhelming consensus (91%) was that the participants participated in this project because they wanted to, without pressure from others. The learners may have been motivated by various reasons to respond or not respond to the SMS question as Maslow (1943) suggests that an act has typically more than one motivation. Therefore an individual's 'act' of replying to an SMS question could have been motivated or influenced by varying, personal circumstances: such as the classroom situation or atmosphere, the student's relationship with the teacher, the student's understanding of NS information being taught, the interaction or reaction of peers to the SMS research project, and finally the individual's willingness to participate or family involvement. Whatever the learner's reason or motivation for participating in the study, the overall reaction was that it had a positive motivational impact in the majority of participants.

As technological inventions advance and change, it seems possible that technology could encourage learners to interact with teachers in a more open way, as was demonstrated by some of the learners' SMS answers. Learners were not shy to inform the researcher that some questions had not been received, or that a question was not answered when it was not understood. If teachers were to follow up these responses with their learners during class time (which was not included in this study) as well as using texting as a means of communication after school, the relationship between the learner and the teacher could be further reinforced.

Schrum (Solomon & Schrum, 2007) suggests that Web 2.0 tools, among other things, could promote collaboration and communication. If teachers use a variety of technologies including texting, the skills suggested by Schrum (2007) would enhance learning for the learners and would relate to the technological world they are familiar with, where they feel comfortable using technologies to interact with others. Cell phones allow the learners to use a variety of tools with easy access and could be a great tool for learning, as is suggested by the West Virginia Department of Education (online, n.d.) which includes text messaging, taking photos, capturing video, calculating, and accessing the Internet. By using cell phone technology as part of teaching the teacher would benefit because the learners would be using a technology which they use outside the classroom anyway, and this may spike a greater interest in what is being taught in the class. It may also make learners feel that a teacher has taken a greater interest in entering the world with which they are most familiar rather than sticking to the paper and pencil technology that has existed in schools for almost the past century. Learners live in a multi-tasking social world, so by integrating part of that into their educational life the teacher would relate better to his / her learners. The school or classroom social environment plays an important role in the involvement of the learner (Sousa, (Ed). 2010). Teachers need to be aware of this and interact accordingly with learners in a positive and considerate manner.

As learners are inspired to use technology, they may be more driven to participate in classroom content if they are able to develop knowledge for their cell phones (Kolb, 2008). Since this small sample of learners in this study stated that they were happy to be involved in the project, it is felt that this enthusiasm by the learners should be used to the benefit of learning by the teacher. This study could be extended to investigate

how learners could develop lesson content and knowledge with the teacher using a cell phone technology. The answers to the final SMS question requesting learners to stipulate which section they enjoyed most would be useful to the teachers in planning for the next year, as they provided a feel for the topics which the learners really enjoyed. This demonstrated another use for SMSes in the school environment which could allow the learners to give an honest opinion in a safe space or environment. Encouraging the learners to be involved and to participate more interactively in a mode with which they are comfortable and familiar should make learning fun and different from the tedium of a normal school day.

Nevertheless, texting should not be seen as a replacement for face-to-face learning, but rather as a tool to reinforce and enhance the learning taking place. Using cell phones to SMS could be used to promote engagement and should be seen as a reinforcement tool for primary school learners. As teachers we should strive to counteract what Kolb's (2008) refers to as the 'digital disconnect' between how children use technology in and out of school, and begin bringing technology, especially mobile technology, into our teaching. In this respect, this pilot project could be adapted as an idea to show teachers how to begin to use technology in their teaching spaces, without too much of a 'threat' or 'fear' from the teacher's view point.

It could be concluded from this study that since this project was conducted with Grade 7 Primary School learners who voluntarily and willingly answered the SMS questions and due to the fact that the majority of participants were happily involved in the project, the success of this type of activity could be successfully replicated in other similar school situations. The idea could possibly be extended into the Intermediate Phase (Grade 4 – 6) section of the primary school.

This idea is supported by Brown (2008) who suggested that cell phones could be used for m-learning (mobile learning) activities in a variety of ways. He suggests the use of SMS type questions or statements about the work being taught or a reminder about a homework task or project, assessments using multiple choice questions or quizzes (using blue-tooth to beam an answer, with or without wireless connections in the classroom), feedback on assignments or tasks, as well as messages to motivate or instruct the learners. In today's society teachers should be interacting with their

learners using technologies that the learners are using. In this respect therefore cell phones and m-learning should be used. This would make the learning experience authentic and realistic to the learner's 'world'. The technology can be used in the teaching environment much more than just for SMSes. Teachers could extend its use to also allow learners to record their homework as an audio clip or to take a photograph of the homework written on the board. Teachers could set projects where learners use their phones to take photographs, create and record a video clip, or research information on the web using a mobile internet connection. The possibilities are endless and they depend on the motivation or desire of the teacher to promote the use of this mobile technology within the subjects he / she teaches.

In the final analysis, it is evident from the positive results shown in this project, which used a small sample of learners, that the methodology used here could be adapted to assist schools and teachers in achieving the Gauteng Department of Education (GDE) Circular 71 / 2008 goal of creating an "Integrated Learning Environment". The results of the project could assist teachers in the achieving some of Circular 71/2008's goals by using a 'digital asset' (e.g. cell phones) to support the learning process in all Learning Areas or subjects. While only Natural Science is used in this study, the findings may be able to be extended to other Learning Areas. The conclusions drawn from this study could provide teachers with the confidence to use different technologies (such as cell phones) in their teaching environments, to encourage learners to participate and engage in school related tasks after school, using SMSes, and at the same time to encourage learners to take responsibility for their learning and to develop learner independence. Another aspect of Circular 71/2008 which was supported by this study, was where learners and educators were requested to find and invent ways of using technology to develop South African citizens as critical and active lifelong learners. If teachers sent SMS questions and / or information to learners, the learners would engage in learning by using a technology with which they are familiar and comfortable thereby encouraging the learners to take responsibility for their learning and to develop independence. This notion would be supported by Kolb (2011) who states that lessons are more appealing when learners can learn using the same tools at school that they use at home, in this instance the cell phone.

The design of the study also addressed the safety concerns of schools about learners using cell phones during school hours as the learners were not required to use the cell phones at school. Rather, the questions were sent after school hours. Therefore the learners who participated in the project did not need their own cell phone, but only needed access to a cell phone after school. The messages could be sent to any cell phone number to which the child had access. This meant that fears of theft of cell phones at school or that some children may be excluded if they did not have a cell phone were reduced. This same concept could be applied to all schools that, for similar reasons did not want the cell phones to be brought to school, yet within the constraints suggested by this study, the advantages of the technology could still be used to encourage learners to engage in learning by using technology that they enjoyed and felt comfortable using.

As the learners only responded to one SMS question per day, musculoskeletal discomfort did not apply, as it could result in the shoulders and hands of learners with over use of texting or working on the computer by. With regards to cyber-bulling or cyber-stalking learners only sent and received SMSes in a controlled environment; they were not on the internet and were only corresponding with the researcher. The learners were not exposed to any online risk from 'outsiders' who could have misused the technology. Teachers may find themselves having to communicate about e-safety at school, as expressed by Atkinson *et al.* (2009). In this study the majority of participants (58%) seldom or never communicated with people they did not know. As teachers we need to make the young people we teach aware of internet and social network dangers, including 'chat rooms' on web-based mobile technology programmes such as MXit. In this study 64% of the girls' school's participants, 50% of the boys' school's participants and 37% of the co-ed school's participants favoured MXit as a method of communication, while according to the participants only 24% of all their parents provided rules related to chat rooms, including MXit and a very small minority of parents (3%) gave their children rules about social networking sites. A meaningful suggestion was proposed by Kritzinger and Padayachee (2010) to include e-safety in the South African Life Orientation curriculum, by adjusting that Curriculum the possible e-safety concerns could be addressed within the school day. This would be beneficial to schools, teachers, parents and learners. E-safety needs to

be seriously considered by the teacher and should be included when using ICTs to teach, including cell phones.

This study addressed the research question which asked to what extent and in what ways do learners interact and respond to school related questions posed and sent using SMS cell phone technology after the school day. As discussed previously, the vast majority of learners were happy to be involved in the project and willingly answered the questions. Even though the sample was small, it is not unreasonable to assume that this project could be transferred to a larger community, as the use of cell phones could benefit schools by encouraging learners to engage with the subject matter being taught and provide information to learners, thereby motivating them to lifelong learning.

In this regard, it is suggested that cell phone messages and texting could be an effective and motivating method for teachers to communicate with learners outside of the school environment. Ling (2004) agrees as he suggests that mobile telephones (cell phones) are ideal for this purpose as they are more accessible than personal computers (PC) and do not have the various components that need to be assembled before being used. Teachers could formulate text message questions related to a topic being taught in a subject. Learners could be encouraged verbally during the lessons by teachers to respond to the 'after school' SMS questions. Learners' text answers could be recorded and the learners could then be sent a response about the answers they submit electronically to teachers. This response could be used to entice and encourage learners to engage in further text message questions or discussions. This is supported by Brown (2008) who advocates that m-learning provides flexibility for learning styles and lifestyles, and is also a supportive mode of education. By using a variety of communication strategies (SMS questions, information and reminders) the interest and involvement of learners may be sustained throughout the school year.

In the USA 'Project Tomorrow' survey (2010) of Grade K (kinder-garden) to Grade 12 learners suggested, amongst other things, that they would use their cell phones for personal and individual learning interaction by communicating with classmates and teachers. The learners participating in this study also had many and varied ideas of using their cell phones for learning, including using it as a peer-learning tool, or as a

discussion tool for posed questions where their own opinions could be freely expressed.

It is recommended that further cell phone studies should include in-depth longitudinal studies which are complex in nature taking into account the various aspects of education technology and the impact it is having on schools: such as utilizing the different cell phone features within every day classroom situations in a variety of subjects (e.g. camera, voice recording, internet access). These recommended studies should include modules which address personal safety and appropriate use of cell phones and other technologies. The idea of in-depth research about various aspects of educational technology is supported by other educational technologists such as Spector, *et al.* (2008) who claims that most technology research is focused on a limited sample, as this study has done.

Geary (2008) in his article 'Supporting Cell Phone Use in the Classroom' agrees that as educators we need to use cell phones as part of our teaching, as learners need to practice these 21st century skills of collaboration, communication and innovation. After analysing and reviewing the positive comments and opinions expressed by the majority of this study's participants and reflecting on how technology is changing around us, it seems advisable that teachers should begin to quickly adapt and change the way they teach to include different technologies, beginning with technologies they feel comfortable and familiar with, such as cell phones. This would be supported by Brown (2008) and Makoe (2011) who suggest that mobile learning allows learners to have easy access to information from their schools or universities, using tools they are familiar with. By making these relatively small pedagogical adaptations the teachers would interact and engage with their learners in a technologically meaningful manner which would continually interest and inspire their students.

6 CHAPTER SIX – REFERENCES

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CHAPTER SEVEN – APPENDICES

Appendix 1:

INFORMATION DOCUMENT

A study on the use of SMS Cell-phone Technology to support teaching and learning of Natural Science with Gr. 7 learners

To whom it may concern,
My name is Karen Walstra and I am a Masters in Education student (Student No. 336136) at the University of the Witwatersrand. I am majoring in Educational Technology. I am inviting Gr. 7 learners who have access to a cell phone to participate in a research study using SMS communication, after school hours. I am doing research on how Gr. 7 learners would respond when they receive an SMS question related to Natural Science class work after school. The project would involve a maximum of 90 Gr. 7 learners who have volunteered to participate from three chosen schools, and the Gr. 7 Natural Science teachers. All the schools are in the Johannesburg area.

In this study I want to learn whether Gr. 7 learners, who have voluntarily offered to participate, would:

- engage in an SMS activity related to school work, after school,

- engage freely and voluntarily without fear or outside pressure,

- respond to the SMS questions with appropriate and relevant answers,

- continue to respond to the SMS questions even without receiving feedback to their SMS responses,

- respond more frequently, to the following SMS questions, if feedback was received,

- involve others; such as family members or peers, when sending their responses,

- communicate with others via SMS about their response,

If a Gr. 7 wishes to participate I would need the following information:
- a signed consent letter by the parent or guardian
- a signed consent letters by the Gr. 7 learner who has access to a cell phone after school.
- a completed background information questionnaire by the Gr. 7 learner.
Each learner should return these three documents in the given envelope to ensure confidentiality when returning the information to the teacher.
The name and contact details of the university supervisor overseeing the research: Supervisor: Dr. Liz Brenner, Liz.Brenner@wits.ac.za

What is involved in the study?
During this study each participating Gr. 7 learner would have to have access to a cell phone after school. He / She would be asked to respond to a maximum of ten SMS questions over a two week period. The questions will be related to Natural Science class work. He / She would not have own a cell phone, he / she would just have to have access to one after school, and the cell phone is not required at school, as the SMS question would be sent in the afternoon. An SMS token or money to the value of R10 will be offered to all participants to cover the costs

of the SMSes to be sent. The Gr. 7 Learner's participation in this study is completely voluntary; the SMS responses to the SMS questions should be answered voluntarily and freely, without any fear or obligation.

He / She would also have to complete two questionnaires (one before the study starts and one after the study is completed) providing us with information about him/herself.

I would like to assure the learner, the teacher and the school that if you do not wish to participate or are not in a position to participate in this study, the others (such as other learners, teacher or schools) would not be aware that you were not a participant. As a participant you (the learner, teacher and school) may withdraw at any time. However the consequences of your withdrawal from the research may affect the overall results and findings. I'd appreciate it you give it careful consideration before agreeing to participate.

Use of information:
All learners' SMS answers will be logged anonymously as only the cell phone number is recorded on the data-base. We will not be able to link a name to the cell phone number.

The final research information would be used in a research report, and may be used for journals articles and conference proceedings, with the Rector's permission.

I would like to emphasize that there are no risks being involved in the study, and learners may enjoy a new way of being involved in homework and learning.

Should you require any further information regarding this study please feel free to contact me, Karen Walstra, at kwalstra@stithian.com or on 011-577-6200.

Thank you for considering participating in the study.
Regards,
Karen Walstra

Appendix 2: (Request for Permission Document - Principal)

REQUEST FOR PERMISSION DOCUMENT
A study on the use of SMS Cell-phone Technology to support teaching and learning of Natural Science with Gr. 7 learners

Dear Principal,

Permission for Gr. 7 learners to be involved in SMS research for Masters in Education Research. As part of my Masters in Education, Technology Education Research at the University of the Witwatersrand investigating interactive-response learning using SMS technology in primary school children via the learner's cell phone.

Process of the research:
- One question message per day that the subject is taught for approximately two school weeks to all learners who are willing to be involved in the project. (max. 10 SMS)
- The content of the questions will relate to school subject information, which will be discussed with the relevant subject teachers.
- The learners need not bring their cell-phones to school, as the SMS could be replied to in the afternoon after school.
- This is a voluntary process and the learners do not have to participate.

For learners to participate they would need to:
- have their parents written permission
- have his or her own cell phone.
- respond via SMS to 10 questions within a two week period.

Request:
I request permission for you to allow me:
- to use Gr. 7 learners, who have their own cell-phones, from your school to be involved in this project.
- to contact the relevant parents, via their children, to obtain consent for them to be involved in the project.
- to contact and obtain permission from the learners.
- to contact and obtain permission from the relevant teacher and to communicate with him / her during the project.

Use of information:
I would like to use the information received from the response SMS and the questionnaires completed during the research.

Regards,
Karen Walstra

------------✂--
Please complete and return to Mrs Karen Walstra as soon as possible:

I _____ (Name of Principal) am willing for my Gr. 7 learners who have cell-phones, have given permission and their parents have given permission to participate in the cell-phone research project, as well as the Gr. 7 NS teacher to participate in the project.

_____   _____
Principal's Signature   Date

Appendix 3: (Request for Permission Document - Natural Science Teacher)

REQUEST FOR PERMISSION DOCUMENT
A study on the use of SMS Cell-phone Technology to support teaching and learning of Natural Science with Gr. 7 learners

Dear Gr. 7 Natural Science Teacher,

Permission for you to be involved in research regarding your Gr. 7 learners using SMS technology for Masters in Education Research.

As part of my Masters in Education, Technology Education Research at the University of the Witwatersrand investigating interactive-response learning using SMS technology in primary school children via the learner's cell phone.

Process of the research:
- One question message per day that the subject is taught for approximately two school weeks to all learners who are willing to be involved in the project. (max. 10 SMS)
- The content of the questions will relate to school subject information, which will be devised and discussed with the relevant subject teachers.
- The learners need not bring their cell-phones to school, as the SMS could be replied to in the afternoon after school.
- This is a voluntary process and the learners do not have to participate.

Your role as the NS teacher would be:
- participate in an initial overall discussion about the children involved in the project
- Participate in an initial discussion about the NS topics and information being taught and the possible SMS questions that may be sent to learners
- formulate possible questions related to the NS topic being taught, which could be SMSed to the children.
- participate in a phone call discussion each evening after the SMS is sent, about the responses received

For learners to participate they would need to:
- have his or her own cell phone.
- respond via SMS to a maximum of 10 questions within a two week period.

Request:
- I request permission from you to participate in this research project with your Gr. 7 NS learners, who have their own cell-phones, and voluntarily want to be involved in this project.

Use of information:
- I would like to use all information received from you – verbal or written.

Regards,
Karen Walstra

---------------✂--
Please complete and return to Mrs Karen Walstra as soon as possible:

I _____ (Name of Teacher) am willing to participate in the research project with my Gr. 7 NS learners who have cell-phones and who have given permission, and their parents have given permission to participate in the cell-phone research project.

_____   _____
Teacher's Signature   Date

Appendix 4: (Request for Permission Document - Parents)

REQUEST FOR PERMISSION DOCUMENT
A study on the use of SMS Cell-phone Technology to support teaching and learning of Natural Science with Gr. 7 learners

Dear Gr 7 Parents,

Permission to be involved in SMS research for Masters in Education Research

As part of my Masters in Education, Technology Education Research at the University of the Witwatersrand investigating interactive-response learning using SMS technology in primary school children via the learner's cell phone.

Process of the research:
- One question message would be sent to him / her per day that Natural Science is taught for approximately two school weeks. (maximum 10 SMS)
- The content of the questions will relate to school subject information.
- The child need not bring her / cell-phone to school, as the SMS can be replied to in the afternoon after school.
- This is a voluntary process and the learners do not have to participate.
- Participants will receive a small monetary contribution to cover cost of SMSes (R10 per participant)

For your child to participate he / she would need to:
- have his / her own cell phone.
- respond via SMS to 10 questions within a two week period.

Request:

I request permission from you, if your child has a cell-phone to allow your child / ward to participate in this pilot research activity.

I request that he / she completes the questionnaire and provides me with his / her cell phone number so that communication and research can begin.

Use of information:

I would like to use the information received via the learner's response SMS and the questionnaires he / she completes for my research.

Regards,

Karen Walstra

--------------✂--

Please complete and return to Mrs Karen Walstra as soon as possible:

I _____ (parent/ guardian's name) allow
_____ (child / ward's name) to participate in the cell-phone research project.

I allow my child to respond to 10 SMS questions in a two week period.

I know that my son's identity will remain anonymous during this process.

_____   _____
Parent / Guardian's Signature   Date

Appendix 5: (Request for Permission Document - Learner)

REQUEST FOR PERMISSION DOCUMENT
A study on the use of SMS Cell-phone Technology to support teaching and learning of Natural Science with Gr. 7 learners

Dear Gr 7 Learner,

Permission to be involved in SMS research for Masters in Education Research
As part of my Masters in Education, Technology Education Research at the University of the Witwatersrand investigating interactive-response learning using SMS technology in primary school children via the learner's cell phone.

- Process of the research:
- One question message would be sent to you per day for two school weeks. (10 SMS in total)
- The content of the questions will relate to school subject information.
- You, the learner need not bring your cell-phone to school, as the SMS can be replied to in the afternoon after school.
- This is a voluntary process and the learners do not have to participate.
- Each participant will receive a small monetary contribution to cover the cost of the SMSes (R10 per participant)

For you to participate you will need to:
- have your own cell phone.
- respond via SMS to 10 questions within a two week period.

Request:
- I request permission, if you have a cell-phone to participate in this pilot research activity with your parent's / guardian's permission.

Use of information:
- I would like to use the information received from the response SMS and the questionnaires you complete for my research.

Regards,
Karen Walstra

---------------✂--
Please complete and return to Mrs Karen Walstra as soon as possible:

I _____ (child / ward's name) am willing to participate in the cell-phone research project.
I will respond to the 10 SMS questions in the two week period.
I know that my identity will remain anonymous during this process.
I will complete the research question for the research process to begin.

_____   _____
Learner's Signature   Date

Appendix 6: Background Information Questionnaire

Research Using SMS Cell-Phone Technology To Support Teaching And Learning In Primary Schools.

BACKGROUND INFORMATION QUESTIONNAIRE

Thank you for being willing to be involved in this research project using cell phones.

Please complete the following information and return the sheet as soon as possible to your teacher.

Cell-phone No: _____

Make of cell-phone: _____ (e.g. Nokia, Samsung, etc)

Name of School: _____

Age: _____ years old.

Tick the relevant box:

Gender: ☐Female ☐ Male

Please answer the following questions as honestly as possible.

How do you mainly use your cell-phone to communicate?

☐ Talk ☐SMS ☐MXIT

☐Other (please state how) _____

Who do you communicate via SMS with the most? In order of frequency

(Number the blocks for 1 to 5: 1 is most and 5 is least / never)

☐Parents

☐Other family members

☐Friends

☐People you don't know

☐ Other (please explain) _____

Have your parents / guardians given you cell phone rules / guidelines?

☐ Yes ☐No

If yes, give an example of the type of rule / guideline they gave:

_____

Appendix 7: 'Review of Research' Questionnaire

A Study Of The Use Of SMS Cell-Phone Technology To Support Teaching And Learning Of Natural Science With Gr. 7 Learners.

'REVIEW OF RESEARCH' QUESTIONNAIRE

Thank you for taking part in this research activity. Please complete the following questionnaire. Remember that all your responses on this sheet and all the information during the research will remain confidential.

Please complete the following information.

Name of School: _____

Tick the relevant box: Gender: ☐Female   ☐ Male

Please answer the following questions as honestly as possible.

How did you feel about being involved in this project?

- ☐   felt happy to be involved, did not mind answering the SMSes
- ☐   felt the project invaded in my free time after school, answered most of the questions reluctantly.
- ☐   felt the project invaded in my free time after school, answered some of the questions reluctantly.
- ☐ felt the project invaded in my free time after school, did not answer the questions.

How did you feel about having to send an SMS answer?

- ☐   did not mind answering the SMSes
- ☐   did not mind answering the SMSes, but it wasted my money
- ☐   minded answering the SMSes, it wasted my time
- ☐   minded answering the SMSes, it wasted my money

How did the adults around you affect you involvement in the project?
- ☐   I answered the questions, because I wanted to
- ☐   I answered the questions, because I my teacher said I must
- ☐   I answered the questions, because I my parent/s said I must
- ☐   I answered the questions, because I thought I might get into trouble if I did not answer them

Who did you communicate with most about the answers to the questions?

Label only three block: M – most often used, S – Sometimes (two blocks)

☐Parents – discussion at home

☐Friends from school – as a discussion

☐ Friends from school – using cell-phone technology, state how, e.g. MXit, SMS

   _____

☐Other family members – as a discussion

☐Other family members – using cell-phone technology, state how, e.g. MXit, SMS

   _____

☐ Other (please explain) _____

Has this project changed your parents' ideas about cell-phones?

☐ Yes   ☐No

If yes, explain how?

_____

After being involved in this project, if cell-phone was allowed at your school, how would you use it to help you with schoolwork?

Comments, please:

_____

Any other comments or thoughts you wish to share about the project:

_____

_____

_____

Appendix 8: Ethics Clearance Letter

Wits School of Education

STUDENT NUMBER: 336136
Protocol: 2010ECE65

10 February 2012

Ms. Karen Walstra
P O Box 378
BANBURY CROSS
2164

Dear Ms. Walstra

Application for Ethics Clearance: Master of Education

Thank you very much for your ethics application. The Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate has considered your application for ethics clearance for your proposal entitled:

A study of the use of SMS Cell-phone Technology to support teaching and learning of Natural Science with Gr. 7 learners.

The committee recently met and I am pleased to inform you that clearance was granted. The committee was delighted about the ways in which you have taken care of and given consideration to the ethical dimensions of your research project. Congratulations to you and your supervisor!

Please use the above protocol number in all correspondence to the relevant research parties (schools, parents, learners etc.) and include it in your research report or project on the title page.

The Protocol Number above should be submitted to the Graduate Studies in Education Committee upon submission of your final research report.

All the best with your research project.

Yours sincerely

Matsie Mabeta
Wits School of Education
(011) 717 3416

Cc Supervisor: Dr. L Brenner (via email)