Integrating Geography Teaching and Learning Using Information and Communication Technology

by

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DECLARATION

I, **Alan Alistair Felix**, declare that the thesis, **Integrating Geography Teaching and Learning using Information and Communication Technology**, submitted for the qualification of **Philosophiae Doctor in Education** at the University of the Free State, is my own independent work.

All the references that I have used have been indicated and acknowledged by means of complete references.

I further declare that this work has not previously been submitted by me at another university or faculty for the purpose of obtaining a qualification.

……………………………………… 30/08/2021 ………………………….

SIGNED DATE

ABSTRACT

Title: Integrating Geography teaching and learning using information and communication technology (ICT).

Keywords:

ICT; integration; Geography

Abstract:

Since the evolution of computers and the internet, there have been continuous attempts to increase the use of ICT's in the teaching and learning environment because ICT is seen as a tool for spreading quality in education. Educational technology's primary goal as applied to pedagogical contexts, is to facilitate the teaching and learning process; moving away from a teacher-centered approach to a more learner-centered approach. Reports have shown that teachers are not adequately skilled to achieve the benefits of using ICT to improve education and instruction of Geography in the Intermediate Phase (Grade 4 to 6). The pedagogical aspects of ICT integration, knowledge regarding the application of ICT skills and utilizing technologies effectively in classroom settings, have received little attention. Therefore, this paper seeks to investigate strategies to improve the integration of Geography teaching and learning using ICT a South African school. This qualitative study was informed by a participating action research (PAR) design, employed two purposefully sampled Geography teachers, an SMT member and a SGB member. Data was solicited from observations, workshops, discussions and interviews. For the interpretation and analysis of data, the researcher uses critical discourse analysis (CDA). The findings indicated that in order to achieve integrated Geography teaching and learning using ICT, a more comprehensive strategy is needed for successful implementation. This need to start from the implementation of different policies at from departmental level to school level. Current policies, for example, does not make provision how teachers must integrate ICT in the Geography classroom. Policies at school level, like the

use of WiFi, must benefit the Social Science teacher to use it for developing teaching material for example. The school management must also play a bigger role in setting the environment for the Geography teacher to maximize the use of technology resources. This include proper training for Geography teachers to implement ICT in the teaching and learning. Some of the strategies also need to include the training in the different knowledge’s for the integration of ICT in Geography teaching and learning. A comprehensive strategy is needed because Geography teachers will realize the value of using ICT, and therefore, it will increase the probability for the maximum utilization in the Geography classroom.

DEDICATION

I dedicate this study:

To my late father and mother, Johannes and Maria Felix, who raised me and inspired me to work hard and pursue my dreams.

To my wife, Alicia, and children for always being there and for inspiring me to keep on going.

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LIST OF ACRONYMS

ICT – Information and Communication Technology

TPACK - Technological, Pedagogical, and Content Knowledge

PAR - Participatory Action Research

RNCS - Revised National Curriculum Statement

CAPS - Curriculum and Assessment Policy Statements

WWW - World Wide Web

BECTA - British Educational Communications and Technology Agency

CHAPTER 1

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1. INTRODUCTION

Teaching and learning with ICT is currently one of South African education's major talking points since moving towards the 4th Industrial Revolution. Due to the advantages of using ICT in the classroom, technology implementation in the Geography classroom will offer didactical alternatives to teach various spatial skills and knowledge to apply in various settings. Hence, this study investigates strategies to improve the integration of Geography teaching and learn using information and communication technologies (ICT) in the Intermediate Phase (grade 4-6) of the South African schooling system. Study was conducted at a primary school in the Northern Cape, Kimberley. This chapter gives an overview of the study, starting with the origin and background to contextualize the problem statement. It also provides a brief outline of the conceptual framework, methodology and design, value of the research, limitation of the study, ethical consideration for the study and a short conclusion for the chapter.

1.2. ORIGIN AND BACKGROUND OF THE STUDY

Geography is an attempt to find order in a seemingly chaotic world because it seems to be, according to Bonnett (2008:2), all-inclusive and endless in-depth and range. Therefore, geographers are equipped to understand and address problems facing the world with social and environmental justice and the efficient, equitable and sustainable use of resources (Bonnett 2008:4). The issues above are explored through the concepts of space, place and environment, with a particular interest in the interaction between humans and space (Lanche 2011:75; Xuan, Duan & Sun 2015:112). These features contribute to the debates to necessitate Geography as a school subject in the curriculum and develop an attitude of mind and a mode of thought for learners in schools (Marshen 2003:8). According to the National

Geographic Society (2013:7), students are naturally curious about how the world works, and Geography is a discipline that can excite this curiosity. Also, Geography teachers, want to prepare young people with the opportunity to develop their understanding and interest to pursue the Geography-dependent careers that are critical to the national interest (National Geographic Society 2013:2). The concepts of space, place and environment can be learned from a young age in schools because Van Harmelen (1999:1) claims that Geography teachers need to adopt teaching strategies that will deliver geographical knowledge, skills and values which will enable learners to function effectively and responsibly in space, place and time in the Intermediate Phase (IP) curriculum. The CAPS document (RSA DoE 2011) provides the guidelines for teachers what to teach in the Geography curriculum. The different content topics for the teaching of Geography in the Intermediate Phase (IP) are divided in the different grades and the skills and concepts that need to be taught are embedded in the aims. These content and concepts must be integrated with the aims and skills as indicated in the CAPS document. What further is of importance is that the CAPS document encourage teachers to bring the world into the Geography classroom by using visual resources that can make information more accessible towards the aims of Geography (RSA DoE 2011:9). These can be done by using different teaching methods which are related to Geography. Some include the lecture or presentation method, question and answer method, research or project method, group work, laboratory method and fieldwork. Furthermore, Lim, Rahim, Bai and Peng (2018:3); Koç (2018:312) and Singh (2020:35) asserts that different teaching methods should be supplemented by one or another in the Geography classroom to grasp the topic and content and to increase their geographical processing skills.

The fast pace of ICT development had an effect on the international educational scene during the past two decades. The development of the world wide web (WWW) contributed even more to this phenomenon. The WWW brought new educational technology opportunities because of the computer's excellent capabilities to provide a rich and wide array of learning opportunities (Resnick &

Wirt 1996:84; Wario 2014:23; Majumdar 2015:6). The establishment of the British Journal of Educational Technology (BJET) in the 1970s played a considerable role in developing ICT education in the UK for example (Hawkridge 1999:293). Being a British journal, the BJET, published articles about Africa, America and Australia, which illustrated an international interest in educational technology (Hawkridge 1999:293). In the 1980s, the emphasis on the use of computers in UK classrooms grew, and, according to Kent (1992:164), Geography has been a front runner in grasping the pedagogic potential of the new technology.

However, teaching with technology is a complex, integrated process since it involves people and procedures in which learning is purposive and controlled (Bester & Brand 2013:3). Therefore, it is the well-coordinated use of digital devices as tools for problem-solving, deeper learning, understanding and transacting curricular content for students to do authentic tasks (Christensen 2019:1; UKEssay 2018:1). The 21st century learning environment therefore, according to Fullan and Langworthy (2014:1), needs to be one that encourages learners to engage in profound learning experiences in Geography because these learners are seen as problem solvers, critical thinkers, effective collaborators and communicators. Therefore, as Fullan and Langworthy (2014:2) stated, "new pedagogies which implies a new model of learning partnership between and among students and teachers, aiming towards deep learning goals and enabled by pervasive digital access". Therefore, Bindu (2016:26) asserts that information and communication technology (ICT) can help transform a teaching environment into a learner-centered one that will contribute to deep learning. These innovations influence everyday local, distant, and global spaces in a geographical context (Inga & Thomas, 2018:44). According to Lache (2011:78), in technology implementation in Geography, the classroom offers interesting didactical alternatives for teaching various spatial sceneries. ICT provides teachers and learners with immediate access to up-to-date, topical Geography information and our highly interconnected world. ICT development creates many opportunities for Geography teachers to collect geographical data and develop learners' conceptual knowledge and understanding (Smith, Sefton & Chaffer 2015:27).

Since the coming of the digital revolution (computers, internet) in the classroom, most teachers have seen this as the most significant change in the recent past and as the biggest challenge for the Geography teacher in the future (Solari, Demirci & Van der Schee 2015:2). According to Ghavifekr, Razak, Ghani, Ran, Meixi & Tengyue (2014:26), ICT could not be used for instructional delivery before ensuring that teachers are competent and have mastered appropriate ICT integration skills. Challenges facing integrating ICT in Geography teaching include inadequate ICT integration knowledge and teachers' skills and teachers' beliefs that ICT can improve teaching and learning. Other challenges relate to the context of the schools and practices involving integrating educational technology, resources and software that do not notably improve education and instruction (Shradha & Budhedeo 2016:4764).

However, literature reveal that integrating ICT in Geography teaching and learning in South Africa has primarily focused on secondary school, especially on geographical information systems (GIS) (Fleischmann & Van der Westhuizen 2016; Britz & Webb 2016). This suggests that not enough research has been done on ICT integration in primary school Geography teaching, especially in the intermediate (IP) phase. As describe by Bester and Brand (2013:3), teaching with technology is a complex, integrated process since it involves people and procedures. Therefore, primary school teachers need to be properly trained in the use of ICT integration in Geography to make a meaningful contribution in their classroom. The researcher was also a ICT trainer for the Western Cape Education Department. He discovered that although the training's original aim was to provide teachers with ICT skills for teaching, it was not as comprehensive for effective Geography teaching. The training was not structured in focusing on using ICT tools and other principal features that will capitulate a more comprehensive strategy for the sustainable and effective use of ICT in the Geography classroom.

1.3. PROBLEM STATEMENT

There are reports that teachers are not adequately skilled to achieve the benefits of using ICT to improve education and instruction of Geography (Mndzebele 2013:409; Shradha & Budhedeo 2016:4762). The pedagogical aspects of ICT integration, knowledge regarding the application of ICT skills, and utilising technologies successfully in classrooms have received little attention in teacher training (Mndzebele 2013:409; Rani & Kant 2016:3329; Wilmot & Dube 2016:337). Van der Westhuizen *et al.* (2012:192) elaborate further that a lack of training on how to make effective use of technologies is one of the challenges for Geography teachers.

Also, there is not enough evidence available to show which comprehensive strategy can be used to integrate ICTs into classroom activities which will support the teaching and learning of Geography (Constance & Musarurwa 2016:57). Therefore, this study seeks to investigate strategies to improve the integration of Geography teaching and learning using ICT in the Intermediate Phase classroom. This will be done by exploring ways of integrating Geography teaching and learning through the use of ICT.

1.4. RESEARCH AIM, RESEARCH QUESTIONS AND RESEARCH OBJECTIVES

Research Aim:	**Research Question:**
The research aims to investigate strategies to improve the integration of Geography teaching and learning using ICT in the Intermediate Phase Social Science classroom.	How can integrated Geography teaching and learning be achieved through the use of ICT the Intermediate Phase Social Science classroom?

Research Objectives:	Sub-questions:
To identify Geography teachers' perspectives on integrating Geography teaching and learning using information and communication technology (ICT).	What are the Geography teachers' perspectives on integrating Geography teaching and learning using information and communication technology (ICT)?
To determine how Geography teachers are using integrated teaching and learning through the use of ICT.	How are Geography teachers using integrated teaching and learning through the use of ICT?
To determine the challenges when Geography teachers are using integrated teaching and learning through the use of ICT.	What are the challenges experienced by Geography teachers in integrating teaching and learning through the use of ICT?
To establish the conditions conducive for Geography teachers when integrating teaching and learning through the use of ICT.	What are conducive conditions needed for Geography teachers to apply integrated teaching and to learn through ICT?

1.5. THEORETICAL AND CONCEPTUAL FRAMEWORK

This study was conducted within the theory of Diffusion of Innovations that was proposed by Rogers (1995; 2003) as the theoretical framework. Rogers (1995) explained that the spreading out of innovation is a process by which, through certain channels, novelty is communicated among the members of a social system over time. It provides a popular framework that helps how new ideas and technologies are spread and adopted in a community (Rogers 1995:2). It is regarded as most appropriated and beneficial for investigating the adoption or use of technology in an educational environment (Surry & Farquhar 1997:24; Sahin 2006:14). At first, the theory can help to explain why most educational technologists do not understand the reasons why an innovation is or is not adopted. Secondly, the more the educational technologists understand Rogers' theory on diffusion of innovations, the better they are prepared to work effectively with potential adopters. Thirdly, Rogers' theory on diffusion of innovations could result in developing a systematic model of adoption and diffusion for the field of educational technology. Innovation are communicated through certain channels over time among members of a social system, which implies that there are four main elements in the diffusion process according to Rogers (1995:5). These elements are innovation, communication channels, and the social system.

The conceptual framework underpinning the study, to investigate strategies to improve the integration of Geography teaching and learning using ICT, was based on the synthesized form of knowledge from Koehler and Mishra's (2009:62), Technological, Pedagogical, and Content Knowledge (TPACK). According to various literature (Azlim, Amram & Rusli 2015:1794; Ali, Haolader & Muhammad 2013:406; Koh, Chai & Tsai 2014:185), technology has become one of the teaching resources that can enhance teaching and learning over time in a general sense.

Since there are no guidelines to guide integrating ICT in teaching and learning in the Intermediate Phase in South Africa, it led to ineffective ways of using technology as a teaching resource (Buabeng-Andoh 2012:137; Mosia 2016:10). Koehler and Mishra's (2009) TPACK, which knowledge base is coming from Shulman's (1987:2) PCK, argues that there is a knowledge base for teaching that frames teacher education for the use of ICT. Chai. Koh and Tsai (2013:32) describe TPACK as the knowledge that aims to integrate ICT in teaching and learn a subject matter. Mishra and Koehler (2006:1017) contribute considerably in shaping TPACK and gives practitioners a vocabulary to describe the knowledge needed for using technology for teaching (Koehler & Mishra 2009:62).

TPACK has emerged as a clear and useful framework for researchers to understand technology integration in teaching and learning (Baran, Chuang & Thompson 2011:370). TPACK acted as a useful framework for thinking about what knowledge teachers must have to integrate technology in teaching and how they might develop that knowledge beyond content, technology and pedagogy alone (Mishra & Koehler 2006:1028; Baran, Chuang & Thompson 2011:371). Using TPACK as a conceptual framework provided the researcher with the raw material needed to explore the research questions, and the analytic approach allows the researcher to address those questions effectively.

Also, since within this research project, technology is needed to successfully co-create with different stakeholders. Using the TPACK framework gave the researcher an option to look at the complex phenomenon (like technology integration) in ways that are amenable to analysis and development. Using TPACK as a conceptual framework for this research project, the researcher guided teachers to understand the complex relations between the different knowledge bases (Khine, Ali & Afari 2017:1605).

1.6 RESEARCH PARADIGM, METHODOLOGY AND DESIGN

Since the study investigates strategies to improve the integration of Geography teaching and learning using ICT, it requires rich data to understand the problem. This requires the researcher to interact with participants in their natural environments to make meaning contextually, and therefore it necessitated a qualitative methodology (Nieuwehuis 2007:51). Using a qualitative approach also allowed the researcher to conduct a detailed examination of specific cases that arise in the natural flow of social life, as for this thesis in the everyday school context (Newman 2014:168).

Motives and meanings are time and context-bound (Edirisingha 2012:1), and therefore interaction with participants in their natural setting allowed the researcher to obtain rich data to make a meaningful analysis. Based on the ontological assumption, in this research project, the researcher could ask questions, “what is there to be known” in reality regarding integrating Geography teaching and learning using ICT. Scotland (2012:11) explained that reality differs from person to person in an ontological view, and for this reason, the researcher uses different people to understand their views.

On an epistemology assumption, the research project also wanted to investigate how teachers understand, and they need to explain how they know (procedural and substantive knowledge) Geography teaching and learning using ICT (Cohen, Manion & Morrison 2007:8; Newman 2014:202).

The study used a participatory action research (PAR) design process as a practical intervention to create conditions that will foster space for empowerment, leading to change and guidance of the participants' future (Muligan, Wilkinson, Lusty, Dolome & Bong 2015:97). Using PAR, the “voices” of the co-researchers are vital factors to respond to the study's objectives. The qualitative features of the individual’s feelings, views and patterns are revealed without control or manipulation from the researcher (MacDonald 2012:36). PAR is a means to address power-sharing, deal with challenges collectively that will lead to development, and be people-centred (Amaya & Yeates 2014:3; Mulligan *et al.* 2015:97).

The study participants were chosen based on their knowledge and experience in education (Wright-St Clair 2015:57). Therefore, a purposive sample was seen as the most suitable for this qualitative study (Bernard 2013:164), which consist of two Geography teachers, a school management team (SMT) member and a school governing body (SGB) member. The study participants, especially the teachers, will act as co-researchers because they have direct experience of the Geography classroom's teaching and learning. The small sample was because the researcher guides the sample's type and size (Pellissier 2007:24) typically and that the participants were likely to be informative about the research topic (Springer 2010:283).

Coincide with Strydom (2011:332), and these participants were automatically linked to the particular field in which the enquiry was taken. Therefore, these participants were seen fit for purpose for this study. These participants were also selected based on the researcher's convenience because of availability, convenience and proximity (Pellissier 2007:24). A qualitative methodology underpinned the study. Therefore, qualitative data collection methods utilised for the research project, and for that reason, multiple methods were used (De Gialdino 2009:1). Hence, for the study, the researcher employed minutes of meetings, field notes, workshops, free-attitude interviews and observations for data collection methods.

Through observations, the researcher established the environment, nature of resources and materials used to support the teachers when implementing the lessons. The success of the observations depended on the fact that the observer was a teacher who had experience in Geography teaching and learning using ICT. For this reason, the researcher could interpret the situation far better than could otherwise be in any other setting that did not share similar characteristics with the researcher's profession. The conversations of the interviews were audiotaped and transcribed for data analysis.

One of the key elements of qualitative data is data reduction. The purpose of data collection, analysing, interpretation, and presentation is to produce findings, according to (Patton 1990:267) culminating activities of qualitative inquiry. For this research project, the researcher used critical discourse analysis to interpret the data generated by minutes of meetings, field notes, workshops, free-attitude interviews and observations. Notes were written and typed (transcriptions) then the coding system was utilized to analyze the data. According to the literature (Nieuwenhuis 2007:104; Research Methodology in Education 2016:1), coding is when the researchers locate significant parts using different symbols or descriptive words that the researcher determines.

The coding procedure helped the researcher identify similarities or consistencies across data from field notes, observations, and interviews. After coding the collected data, data interpretation was followed to seeks answers and explanations for the research questions and objectives.

1.7 VALUE OF THE RESEARCH

Information from the study will help teachers who want to obtain more knowledge on transforming their teaching practice to accommodate the 21^{st}-century learner in their classroom. Furthermore, the study becomes valuable to support developmental programmes for teachers who want to use ICT in Geography teaching and learning in the Intermediate Phase. The study can bring some answers to the challenges regarding the implementation of ICT's in school, which was brought under the attention of the SMT and SGB members who participated in the study. The Department of Education can use the study to inform their training programmes for in-service teachers. Furthermore, teachers and trainers can use design thinking to improve the collaborative process in designing activities for Geography teachers and all subjects.

1.8 ETHICAL CONSIDERATIONS

Ethical clearance was sought from the University of the Free State, Faculty of Education Ethics Committee. All the necessary documents regarding the research were provided according to the policy guidelines for research and evaluation. Permission was obtained from the Northern Cape Education Department and the principal of the affected school. Informed consent was sought from the participants. Participants were informed what the research is about, how their participation is necessary and that they have the right to withdraw from the study without repercussions.

Participants were informed that participation is voluntary, that their identities and information are treated confidentially, that anonymity of research participants is guaranteed, that I worked according to principles of beneficence or no harm to participants, and reciprocity (Halai 2006:5). I were also mindful of issues relating to power relations as observed during the research, and all data and documents were password protected and locked away safely

1.9 LAYOUT OF CHAPTERS

The study compromises the following chapters:

Chapter 1 provides an orientation and background to the study, which investigates strategies to improve the integration of Geography teaching and learning using ICT. The chapter at first;

Chapter 2 gives a description on the theoretical framework on Rogers' diffusion of innovation and its main elements, then TPACK as the conceptual framework, and its different knowledge components. This is followed by a review of the literature related to the study. The literature on reviewing Geography as a subject and the teaching thereof, then about ICT related in the geographical educational setting.

Chapter 3 describes the design and methodology of the study. Also, in the chapter, the researcher discusses the appropriateness of PAR as a methodology. The chapter discusses methods of data generation and data analysis, which employed CDA techniques.

Chapter 4 presents, discusses and analyses the data and provides the interpretation for each of the study's four objectives.

Chapter 5 is the final chapter of the study. It provides the reader with the findings, recommendations, a strategy and conclusion arguments that highlights the research.

1.10 CONCLUSION

This chapter introduced the study's orientation and background to investigate strategies to improve Geography teaching and learning using ICT. This aim was pursued because of the lack of research on the topic, the development of new technologies for teaching and learning, and developments in the kind of learner we need to teach in the 21st century. Using TPACK as a framework will contribute to the knowledge base for teacher training and development. The study employs a qualitative methodology and methods because the aim is to interpret meaning in the study to investigate strategies to improve Geography teaching and learning using ICT. The study will provide teachers with a knowledge base on integrating Geography teaching and learning using ICT.

CHAPTER 2
THEORETICAL FRAMEWORK, CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW FRAMING THE STUDY FOR INTEGRATING GEOGRAPHY TEACHING AND LEARNING USING ICT

2.1 INTRODUCTION

This chapter aims to present the theoretical and conceptual framework that informed and guided the design of this study. The study intends to investigate strategies to improve Geography teaching and learning using information and communication technology (ICT). The chapter at first explains what constitutes a theoretical framework and explains Rogers' theory on diffusion of innovation as a theoretical framework. This is followed by what constitutes a conceptual framework and explains TPACK as a conceptual framework. A discussion on TPACK's origin and components then how to measure TPACK. A third part of the chapter will be on the literature of Geography teaching and ICT in education.

2.2 THEORETICAL FRAMEWORK

Osanloo and Grant (2016:13) describe the theoretical framework as the "blueprint" for the entire dissertation inquiry and is the underlying structure of your study (Merriam & Tisdell 2016:85). It serves as the guide on which to build and support your study and is used as a structure that guides research by relying on a formal theory, which is constructed by using an established, coherent explanation of certain phenomena and relationships (Eisenhart 1991:205). The aim is to make research findings more meaningful, acceptable to the theoretical constructs and ensures generalizability and assist in stimulating research (Adom, Yeboah & Ankrah 2016:439). Crawford (2020:39) indicated that the theoretical framework should do the following: Identify the theory cluster, identify specific theories relevant to that cluster, identify the theory selected for the study, and state how the study will contribute to the body of knowledge related to the theory.

2.2.1 Rogers' theory on diffusion of innovation

Rogers (1995) developed this model to explain the diffusion of the innovation process. Rogers (1995) explained that the spreading out of innovation is a process by which, through certain channels, novelty is communicated among the members of a social system over time. Dibra (2015:1457) explained that innovation maybe an idea, practice, or object that is perceived as new by potential adopters and should be considered as desirable to adapt. Rogers's theory on the diffusion of innovation provides a popular framework that helps how new ideas and technologies are spread and adopted in a community (Rogers 1995:2). Jwaifell and Gasaymeh (2013:140) added that the diffusion of innovations theory offers valuable insights into the process of social change, as the main qualities provide a successful spread of an innovation. These include the significance of peer-to-peer conversations along with peer networks and the understanding the needs of different user segments.

It is regarded as most appropriated for investigating the adoption of technology in an educational environment (Sahin 2006:14). According to Surry and Farquhar (1997:24), Rogers' theory on diffusion of innovations is beneficial to the field of educational technology. At first, Rogers' theory on diffusion of innovations can help to explain why most educational technologists do not understand the reasons why an innovation is or is not adopted. Secondly, the more the educational technologists understand Rogers' theory on diffusion of innovations, the better they are prepared to work effectively with potential adopters. Thirdly, Rogers' theory on diffusion of innovations could result in developing a systematic model of adoption and diffusion for the field of educational technology.

Since much diffusion research involves technological innovations, Rogers used the words "technology" and "innovation" as synonyms. Rogers (2003:13) explained that technology is the design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome. It is composed of two parts, namely, hardware and software. Rogers (2003:259) describe hardware as the tool that embodies the technology in the form of a material or physical object and software as the information base for the tool. Sahin (2006:14) states that software, as a technological innovation, has a low level of observability, its rate of adoption is slow.

2.2.2 Main elements in Rogers' diffusion of innovation

Innovation are communicated through certain channels over time among members of a social system, which implies that there are four main elements in the diffusion process according to Rogers (1995:5). These elements are 1) *innovation*, 2) *communication channels*, 3) *time*, and 4) *the social system*.

2.2.2.1 Innovation

Rogers (2003:12) describe innovation as an idea, practice, or project that is perceived as new by an individual or other unit of adoption. Sahin (2006:14) explained that even if the innovation may have been invented a long time ago, and the individuals perceive it as new, it may still be an innovation for them. However, Rogers (1995:13) noted that "newness" in an innovation may not be a factor in the diffusion and adoption of innovations as an individual may have already heard about the innovation, but was not persuaded to adopt it. Therefore, to reduce the uncertainty of adopting the innovation, individuals should be informed about its advantages and disadvantages to make them aware of all its consequences (Sahin 2006:14). These consequences can be classified, according to Rodgers (2003), as desirable versus undesirable (functional or dysfunctional), direct versus indirect (immediate result or result of the immediate result), and anticipated versus unanticipated (recognized and intended or not). Desirable consequences are the functional effects of an innovation to an individual or to a social system. On the other hand, undesirable consequences are the dysfunctional effects of an innovation to an individual or to a social system. Direct consequences are the changes to an individual or a social system that occur in immediate response to an innovation. Indirect consequences are the changes to an individual or a social system that occur as a result of the direct consequences of an innovation. Anticipated consequences are changes due to an innovation that are recognized and intended by the members of a social system. Unanticipated consequences are changes due to an innovation that are neither intended nor recognized by the members of a social system.

2.2.2.2 Communication channels

The second element is the communication channel, which is describe by Rodgers (2003:5), as a process in which participants create and share information with one another in order to reach a mutual understanding. Rodgers explains that this communication occurs through channels between sources and the “source” can be an individual or institution that originates a message. These channels can be a mass medium or an interpersonal channel (face-to-face), which is also refer to as sources by Rodgers (2003:204). Since diffusion is a very social process, interpersonal channels are more powerful to create or change strong attitudes held by an individual (Sahin 2006:14). Watson (2007:10) stated that in recent years, web-based interactions such as emails, chat rooms, online discussions and blogs have influenced the adoption of innovations.

2.2.2.3 Time

The third element in the diffusion of innovation process, involves time. Time involves three aspects of diffusion: a) *the innovation-decision process*, b) *the innovativeness of an individual*, and c) *an innovation rate of adoption*.

The *innovation decision process* is an information-seeking and information-processing activity, where the individual passes from first knowledge of an innovation to forming an attitude towards the innovation, to a decision to adopt or reject the innovation, then to its implementation, and finally to confirmation of this decision (Rodgers 1995:21). Rodgers (1995:21) categorizes this innovation-decision process into five steps which follow each other in a time ordered sequence: 1) knowledge, 2) persuasion, 3) decision, 4) implementation, and 5) confirmation, as shown in Figure 2.1.

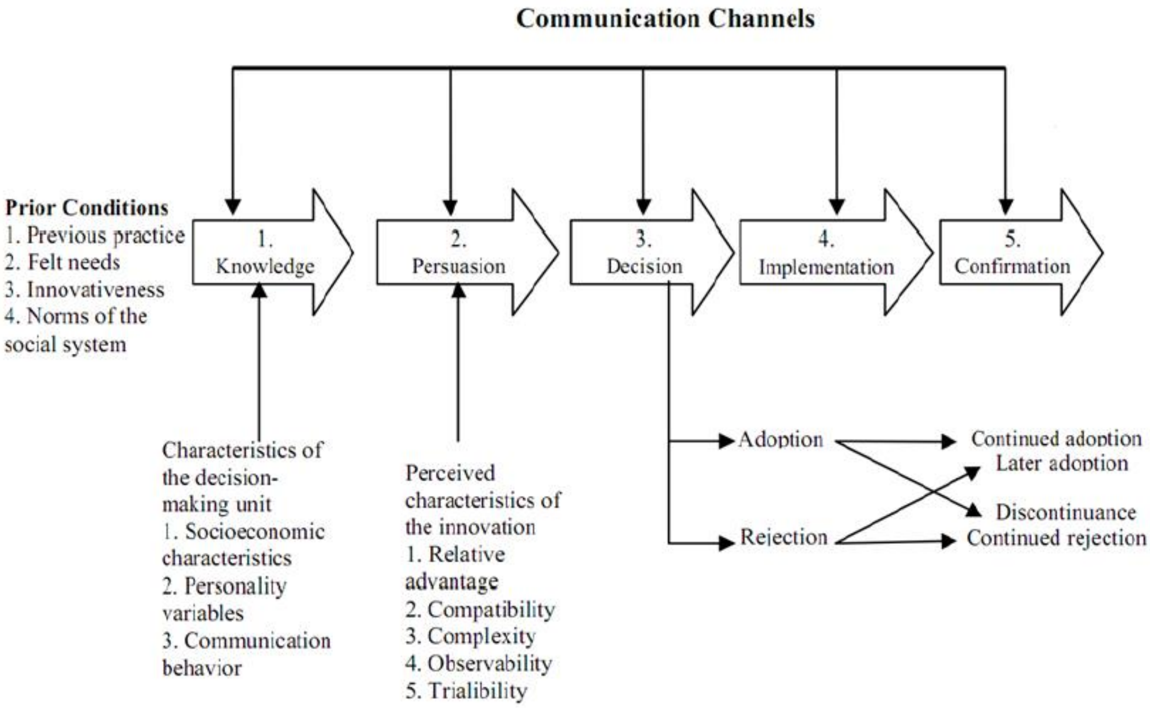


Figure 2.1: Stages of Innovation-decision process, based on Rodgers (1995:163)

The knowledge stage occurs when potential adopters learns about the existence of the innovation and seeks information about the innovation. The importance of users' knowledge on technology integration is emphasized by asking questions to determine what the innovation is and how and why it works (Rodgers 2003:21; Seemann 2003:28). These questions form three types of knowledge's according to Rodgers: a) awareness-knowledge, b) how-to-knowledge, and c) principles-knowledge. Sahin (2006:16) describe the knowledge's as follows: The awareness-knowledge represents the knowledge of the innovation's existence and can motivate the individual to learn more about the innovation. The how-to-knowledge, contains information how to use an innovation correctly. The principle-knowledge includes the functioning principles describing how and why an innovation works. The next stage in the innovation decision process, is the persuasion stage. Rodgers (1995:24) states that this stage is related to the users' attitude which can be positive or negative towards the innovation. The persuasion stage is more affective (or feeling) centered while the knowledge stage is more cognitive (or knowing) centered because the user is more sensitively with the innovation (Rodgers 2003:176). Following the persuasion stage, is the decision stage. In this stage, Rodgers (2003:177) explains that the individual will choose to adopt or reject the innovation since most individuals first want to try the innovation in their own situation and then come to an adoption decision. Following the decision stage, is the implementation stage. At this stage, an innovation is put into practice although uncertainty about the outcomes of the innovation can still be a problem at this stage. The implementer may need technical assistance from change agents and others to reduce the degree of uncertainty about the consequences. At the last stage, the confirmation stage, the innovation decision has already been made, but the individual looks for support on the decision. Rodgers (2003:189) further stated that it is possible that the decision can be reversed if the individual is exposed to conflicting messages about the innovation.

Time also involve *the innovativeness of an individual,* where members of a social system are classified on the basis of innovativeness (Rodgers 2003:22). These classifications are indicated by categories, which rate adoption in terms of how early or late he/she adopts the innovation on a cumulative frequency basis over time. The classification includes innovators, early adopters, early majority, late majority, and laggards, as seen in Figure 2.2 below.

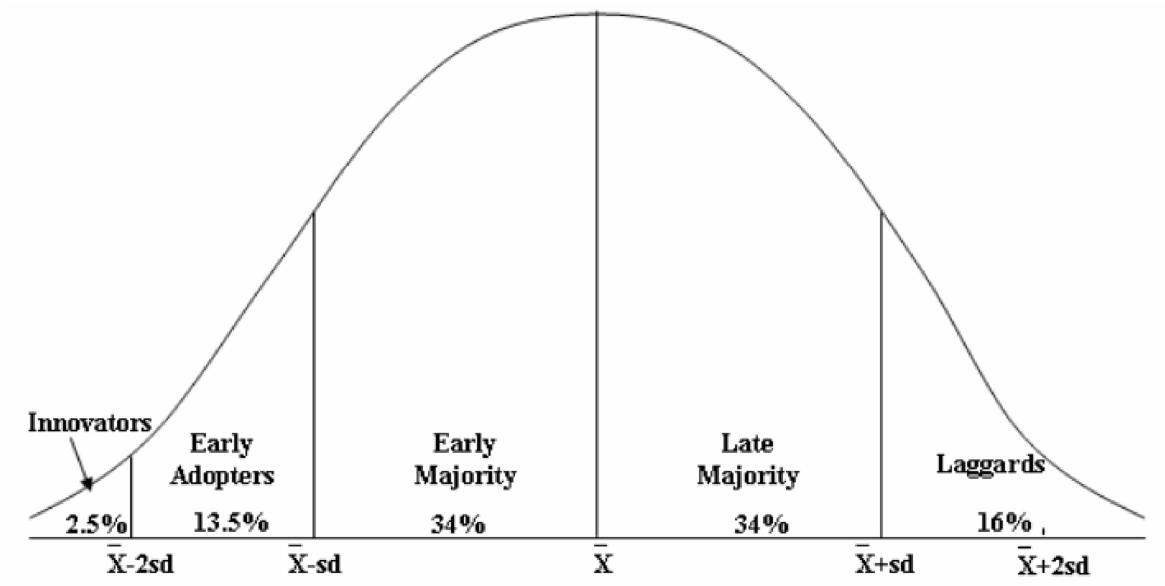


Figure 2.2. Adopter Categorization on the Basis of Innovativeness (Source: Diffusion of Innovations, fifth edition by Everett M. Rogers.

In each category is defined using a standardized percentage of the respondents, for example, the area lying under the left side of the curve and two standard deviations below the mean includes innovators who adopt an innovation as the first 2.5% of the individuals in a system (Sahim 2006:19). Rogers (2003) explained that innovators are willing to experience new ideas, and should be prepared to cope with a certain level of uncertainty about the innovation. Early adopters, on the other hand, are more limited with the boundaries of the social system, and Rodgers argued that they are more likely to hold leadership roles in the social system. The early majority have a good interaction with other members of the social system, although they do not have the leadership role that early adopters have. The late majority, wait until most of the peers adopt the innovation because peer pressure may lead them to the adoption of the innovation. The laggards, are more skeptical about innovations and their interpersonal networks mainly consist of other members of the social system from the same category. Sahim (2006:19) indicated that laggards tend to decide after looking at whether the innovation is successfully adopted by other members of the social system in the past. Due to all these characteristics, laggards' innovation-decision period is relatively long.

The third aspect of time involves *an innovation rate of adoption* which usually measured as the number of members of the system who adopt the innovation in a given time period (Rodgers 2003:221). Sahim (2006:17) explained that the perceived attributes of an innovation are significant predictors of the rate of adoption. The variance in the rate of adoption of innovations is explained by five attributes, namely, relative advantage, compatibility, complexity, trialability, and observability. Rodgers (2003) explained that new technology will be increasingly diffused if potential adopters perceive that the innovation: is perceived as being better than the idea it supersedes; is compatible and is perceived as consistent with the existing values, past experiences, and needs of potential adopters; to understand to which degree an innovation is perceived as relatively difficult to understand and use; can be experimented with on a limited basis before adoption, and shows the degree to which the results of an innovation are visible to others.

Sahim (2006:17) indicated that to increase the rate of adopting innovations and to make relative advantage more effective, direct or indirect financial payment incentives may be used to support the individuals of a social system in adopting an innovation.

2.2.2.4 The social system

As the last element in the social system, Rodgers (2003) describe it as a set of interrelated units engaged in joint problem solving to accomplish a common goal. Since the social structure is part of the social system, it will influence the social system because of the social norms, role of opinion leaders, type of innovation decisions and the consequences of innovation (Rodgers 1995:23).

This study employs the Rogers theory on diffusion of innovation to investigate the integration of Geography teaching and learning using ICT. The theory allows the researcher to utilize qualitative research methods to explore the relationships between the four main elements in the diffusion process by which individuals adopts an innovation.

2.3 CONCEPTUAL FRAMEWORK

According to Ivey (2015:146), a conceptual framework is described as a written or visual presentation that explains the main concepts, the key factors, and the presumed relationship amongst them either graphically or in narrative form. Rogers (2016:1708) points out that the conceptual framework focuses on the issues under discussion, improvements underway, and individuals studied. The presentation of the conceptual framework provides an orientation to the study and reflects the researcher's stance, and enables him to make explicit assumptions about how things are related in the world (Henning, Van Rensburg & Smit 2007:25).

Asserts with the previous author's Rogers (2016:1708) describes it as an argument about why the topic one wishes to study matters and why the means proposed to study it are appropriate and rigorous. By argument, the authors meant that a conceptual framework is a series of sequenced, logical propositions to ground the study and convince readers of its importance and rigour. By rigorous is meant that the conceptual framework should argue convincingly that the research question is an outgrowth of the argument for relevance, the research design maps onto the study goals, data provided the researcher with the raw material needed to explore the research questions, and the analytic approach allows the researcher to address those questions effectively. For this research project, Koehler and Mishra's (2009) Technological, Pedagogical, and Content Knowledge (TPACK) will be used as the conceptual framework.

2.3.1 Technological, Pedagogical and Content Knowledge (TPACK) as a Conceptual Framework

2.3.1.1 TPACK Framework

Many definitions have become available to describe the Technological Pedagogical Content Knowledge framework (TPACK). Mishra and Koehler (2006:1019) are seen as the architects of the TPACK framework, which builds on Shulman's (1987) PCK theory of pedagogical content knowledge (Hofer & Bell 2015:1). Mishra and Koehler (2006) constructed the abbreviation as TPCK, but it was renamed (Schmidt *et al.* 2009:124) as TPACK. Misha and Koehler (2006:1019) describe TPACK as the relationship between technology, pedagogy and content knowledge (Doering, Veletsianos & Scharber 2009:321; Leendertz, Blignaut, Nieuwoudt, Els & Ellis 2013:1; Bilici, Guzey & Yamak 2016:238).

Doering *et al.* (2014:4133) added further that this is the knowledge that all teachers need to know for successful teaching and reframes the "essential qualities of knowledge required by teachers for technology integration in their teaching" by introducing technology knowledge as an additional domain. Another definition of Bostancıoğlu and Handley (2018:572) describe as the knowledge that teachers require to make decisions about the potential use of technology in educational contexts has been referred to as Technological Pedagogical Content Knowledge or 'Total PACKage'.

Research of Arya, Christ and Wu (2020:1) define TPACK as the integrated areas of the knowledge that teachers must have about technologies, how to use them, and knowledge about pedagogy and content and provides a framework for analyzing the extent and quality of teachers' integration of these. Their literature takes the development further that it can also be used to analyze the TPACK integration of teachers in their teaching with ICT. For effective integration of technology, according to the TPACK framework, teachers must synthesize their knowledge of curriculum content, teaching strategies and the affordances and constraints of technological tools and resources (Hofer & Harris 2010:1; Chai *et al.* 2013:32).

2.3.1.2 Historical Origin of TPACK

From the 1980s, the researcher believed that a knowledge base exists for teaching, but there were no specific characteristics of what it consists of (Shulman 1987:3). Different categories were developed to evaluate teachers and test teacher effectiveness, but researchers had no unified criteria (Shulman 1987:5). In dealing with these categories, Shulman (1987) highlighted that investigators ignored the classroom's central aspect, which is the subject matter. Shulman (1987) articulated no questions regarding how the subject matter was transformed from the teacher's knowledge into the content of instruction or how the content to what students came to know or misconstrue.

This led to the identification and blending of content knowledge and pedagogical skill. Shulman (1986:8) developed an explicit set of characteristics or categories for a knowledge base for effective teaching, which he called PCK, which include: content knowledge (CK); general pedagogical knowledge (PK); curriculum knowledge; pedagogical content knowledge (PCK); knowledge of learners and characteristics; knowledge of educational context; and knowledge of educational ends, purpose and values. Sothayapetch, Lavonen and Juuti (2013:85) indicated that PCK had paved the way for understanding the complicated relationship between the content and teaching of a subject using specific teaching and evaluation methods.

Rapid developments in technology, the computer and the internet during the 21st century has transformed society into a digital knowledge age, and digital environments were becoming an essential characteristic of the world (Rampersad 2011:1; Ghavifekr *et al.* 2014:24; Köksal & Razi 2015:1; Niess 2017:6). Since schools were part of the knowledge society, Ghavifekr *et al.* (2012:2190) affirm that schools needed to consider ICT integration in their curriculum. Teachers become more interested in teaching with digital technologies, and they believed that technology could become one of the teaching aids that can enhance teaching in a general sense (Azlim *et al.* 2015:1794; Ali *et al.* 2013:4061).

However, Mishra and Koehler's (2006:1023) research on the effectiveness of using technologies when integrating technology in instruction did not reveal much change in teacher practices. Mishra and Koehler (2006:1024) argue that, due to transformation and technology's presence in the modern classroom, it is no longer enough to confine the teacher's knowledge to Shulman's (1987) PCK. Furthermore, technology in education foster new directions for understanding how teachers could conceptualize knowledge systems (Hunter 2015:5) and this, motivated researchers to design a framework for using technology as a teaching aid (Buabeng-Andoh 2012:137; Mosia 2016:50).

Over the years, especially by 2005, multiple scholars' proposals merged to describe the knowledge teachers need for teaching with technology (Niess 2011:300; Niess 2017:2) and was labelled Technological Pedagogical Content Knowledge using the acronym of TPCK. TPCK was portrayed, as seen in Figure 2.3, to demonstrate how PCK was connected with TPCK.

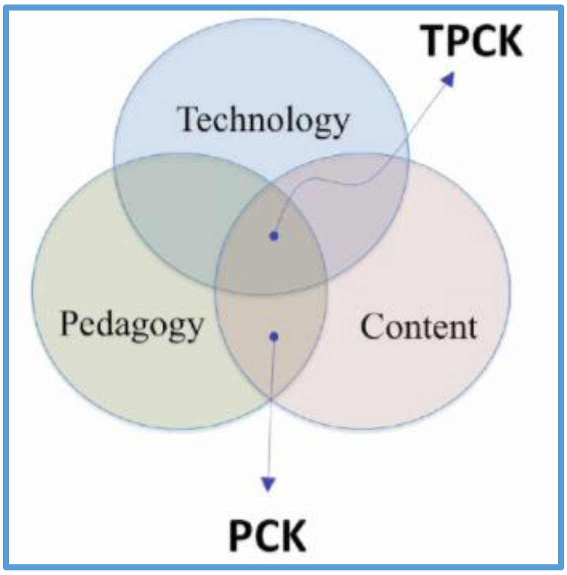


Figure 2.3 Initial visualization of the TPCK model and how it is connected with PCK. Adopted from Niess (2017:7)

Niess (2017) stated that at the Ninth Annual National Technology Leadership Summit, the TPCK name was changed because it was somewhat problematic for many scholars and teacher educators. The acronym was changed to TPACK to emphasize the three kinds of knowledge (Technology, Pedagogy and Content) and describe the idea as a total package for supporting teachers in integrating technology to improve student learning (Thompson & Mishra 2007:38). Since then, it was portrayed as seen in Figure 2.4.

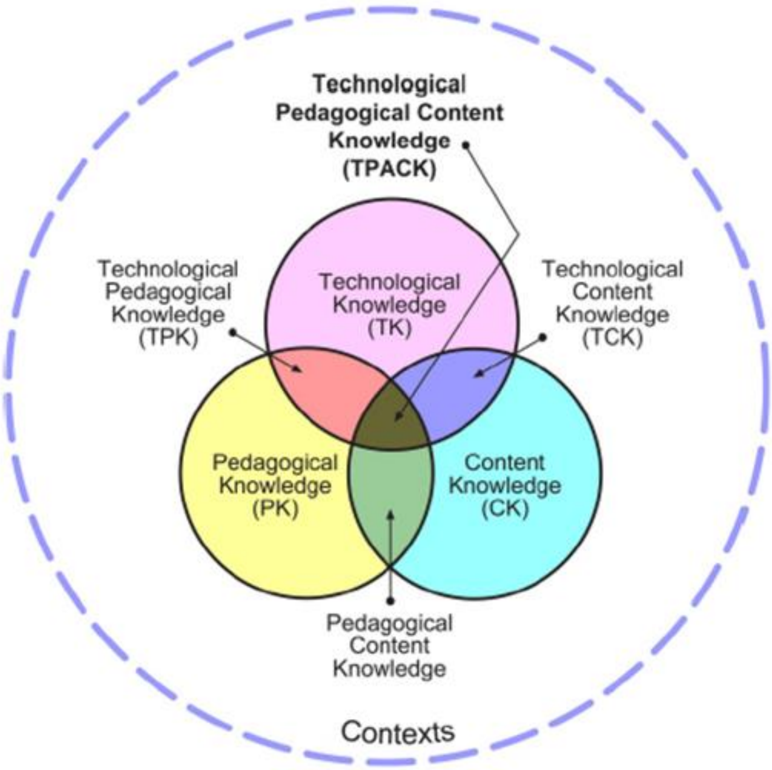


Figure 2.4 TPACK framework and its knowledge components *(Source: tpack.org)*

The framework proposed by Mishra and Koehler (2006:1025), emphasizes the connections, interactions, affordances, and constraints between and among content, pedagogy, and technology. According to Figg and Jaipal-Jamani (2012:4684), in this model, knowledge about the content (C), pedagogy (P), and technology (T) are central for developing good teaching, and this model additionally emphasizes the complex interplay of these three bodies of knowledge. In the next section, components of TPACK will be presented

2.3.1.3 Components of TPACK

This section of the study will be focusing on the components of TPACK as a conceptual framework. This is done to explain the different knowledge constructs that will inform teachers when teaching with technology. Views from Shulman (1987) will inform the researcher's discussion, Koehler and Mishra (2009) and other authors on the different factors that are viewed as components of TPACK. Baran *et al.* (2011:371), Kuo (2015:3), Koehler and Mishra (2009:64) and Hammond & Manfra (2009:163) listed seven components that are included in the TPACK framework:

- content knowledge (CK);
- pedagogical knowledge (PK);
- pedagogical content knowledge (PCK);
- technology knowledge (TK);
- technological content knowledge (TCK);
- technological pedagogical knowledge (TPK) and;
- technological pedagogical content knowledge (TPACK)

2.3.1.3.1 Content Knowledge (CK)

Content knowledge is knowledge about the actual subject matter; as for this project, teachers must know the subject matter of Geography (Hofer & Bell 2015:3; Shulman (1987:8). Tepner and Dollny (2012:203) assert that knowledge is subject-specific facts and concepts formed due to curriculum-related work. Additionally, according to Cox (2008:15), a person with content knowledge will also understand their subject matter structures. Geography teachers need to know which specific content and concepts they need to teach. Understanding the different concepts of Geography can be complex, e.g. space.

Teachers need to understand that when teaching Geography, it is a learning process that must motivate students to know, understand, read, and assimilate space and avoid the isolated memorization of the spatial elements that compose it (Lache 2011:76). Teaching with maps is one of the critical areas in the development of Geography skill. Bonnet (2008:56) argues that understanding maps and interpreting the vast amount of information in maps is vital to teachers' content to know to teach it. Therefore, Cogill (2008:1) claims that teachers with strong CK may teach in more appealing and dynamic ways.

2.3.1.3.2 Pedagogical Knowledge (PK)

Shulman (1987) describe PK as a term to describe the broad principles and strategies of classroom management, assessment, lesson plan development, and student learning (Cogill 2008:2). Hofer and Bell (2015:3) and Grossman (1990:6) elaborate by describing PK as the teacher's understanding of best practices for teaching, various strategies, and instructional methods to support student learning. Considering the different definitions of PK will ultimately lead to teachers knowing the processes and mechanisms of learning and ways to support and guide students' learning processes. The implications for Geography classroom are that Geography teachers need to ensure that lessons need to occur in a unique and effective classroom climate, be effective, and be well managed (Roberts 2011:2).

This idea of how knowledge is constructed is derived from social-cultural theory as proposed by Vygotsky (1978). Adom *et al.* (2016:2) describe constructivism as an approach that asserts that people construct their understanding and knowledge of the world through experiencing things and reflecting on those experiences. Therefore, learner interaction is a key element of constructivist learning and teachers need to have the PK to teaching in such a manner. According to Adam (2017:35), this links the idea of using technologies to facilitate learning rather than delivering through them. This demand teacher to change their practices, and eventually add double complexity to their pedagogical approaches (Koehler & Mishra 2009). Adams (2017:36) states that this double complexity is represented in terms of marrying teachers' use of digital technologies with their pedagogical approaches. Using these learner-centered methods, will ultimately construct knowledge through the use of technologies.

Sothayapetch, Lavonen and Juuti (2013:86) affirm that teachers need to know how to manage the classroom to promote student achievement. Classroom management focuses on three components: content management, conduct management and covenant management. Sothayapetch *et al.* (2013:87) claim that models of teaching have been grouped in different families. These families emphasise different goals for teaching and learning and different types of social interaction. The families are the social family, the information-processing family, the personal family, and the behavioural systems family. Therefore, Geography teachers need to make sure that their lessons are grounded geographically in these families.

2.3.1.3.3 Pedagogical Content Knowledge (PCK)

PCK is the knowledge that deals with the teaching process (Shulman 1986). It is different for various content areas, as it blends both content and pedagogy, intending to develop better teaching practices in the content areas. By combining knowledge and skills and using the big concepts to shape the content, learners will develop their geographic literacy and develop as active and independent global citizens to participate in the world (Blankman 2016:3).

To successfully teach Geography, teachers need to rework content by asking themselves three knowledge-based questions: what am I going to teach, how am I going to teach it, and why am I going to teach it in this way. In this way, the teachers combine their pedagogical content knowledge and the subject of Geography, as illustrated by Blankman (2016:3) in Figure 2.5 below.

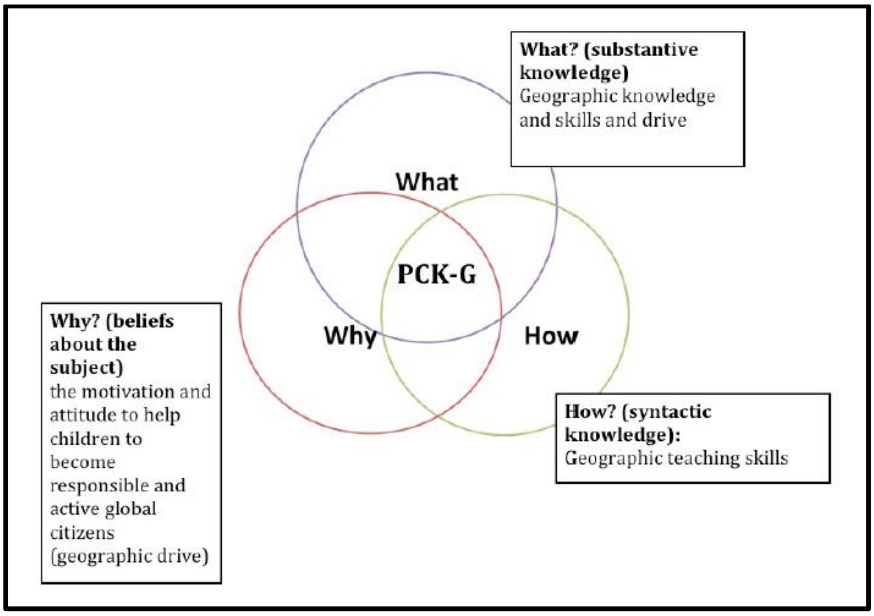


Figure 2.5 PCK for the subject of Geography. Source: Blankman (2016:3)

According to Blankman (2016), teachers need a well-developed geographic subject knowledge, geographic skills and geographic drive. The teachers need to transform this knowledge, skills and drive into forms suitable for teaching. Learners will build a geographic view and have an understanding of spatial issues (What). Teachers need to transform these aspects during lessons on how (How) they should teach learners to use a map. Finally, teachers can transform their geographic drive into helping learners become global citizens (Why).

2.3.1.3.4 Technology Knowledge (TK)

According to Koehler and Mishra (2009:1-14), their definition of TK goes beyond the traditional notions of computer literacy. TK refers to one's ability to use computer technology to manipulate programs and hardware to produce desired results (Cox 2013:16). The requirement is that teachers understand information technology broadly enough to apply it productively in the Geography classroom, recognize when information technology can assist or impede the achievement of the Geography lesson's aim, and continually adapt to changes in information technology. TK encompasses a comprehensive understanding of modern technologies such as computers, the internet, digital video, interactive whiteboards (IWB) and data projectors, and multimodal software applications. Having adequate TK, teacher's uncertainty in the use of technology will be reduced, and this will fasten their rate of adoption (Rodgers 2003:259; Sahin 2006:14).

2.3.1.3.5 Technological Content Knowledge (TCK)

Koehler and Mishra (2009:65) described TCK as how technology and content influence and constrain one another. Teachers need to understand which specific technologies are best suited for addressing subject-matter learning in their domains and how the content dictates or perhaps even changes the technology or vice versa".

With TCK, teachers need to master more than their subject matter in Geography. They must have a deeper understanding of how technologies can be used to represent the subject. For many teachers, innovation is not new, as indicated by Rodgers (1995:13), but they do not know how to adopted it or was not persuade to adopt it. Therefore, teachers must be informed of the consequences of using technology in the Geography classroom, to improve their TCK. Teachers need to understand which specific technologies are best suited to address the Intermediate Phase's content. Harris and Hofer (2009) demonstrated activity types used in the Geography classroom, as seen in Table 2.1.

Table 2.1 Activity types for Geography

Activity Type	**Description**	**Possible Technologies**
Create an illustrated map	Students use pictures, symbols, graphics to highlight key features in creating an illustrated map	Google Earth, PowerPoint
Create a picture/mural for students	Students create a physical or virtual image or mural	Paint, Photoshop
Create a map	Students label existing maps or produce their own; print-based materials or digitally	PowerPoint, Google Earth
Complete charts/tables	Students fill in teacher-created charts and tables or create their own in traditional ways of using digital tools	Word, Inspiration, PowerPoint

2.3.1.3.6 Technological Pedagogical Knowledge (TPK)

Koehler and Mishra (2009:65) and Harris and Hofer (2009:100) defined TPK as understanding how teaching and learning can change when particular technologies are used in particular ways. This includes the pedagogical affordances and constraints of a range of technological tools which means teacher need to have the knowledge of using technology to implement teaching methods. According to Adams (2012:37), effective pedagogical practices can be interpreted differently depending on the available digital technologies. Although, the constructivist view of learning was not originally grounded on a basis of understanding that included the role of digital technologies, educational researchers indicated a good interplay between the use of ICT and instructional practice of constructivism (Mikropoulos & Natsis 2011; Tsai 2001, 2004). Makgato (2012:1399) indicated that teachers should have understanding of constructivist theory, principles and pedagogy in order to provide effective teaching and learning in the technology classroom. Hosseini (2015:99) stated that the constructivist environment provided a learner-centric environment. Therefore, the role of the instructor is not to prescribe which kind of technology a teacher should use for teaching, but to provide opportunities for helping teachers to learn how to use technology and pedagogy (TPK) for a particular content. In doing this this the instructor will influence the innovation-decision process (as a time element) according to Rodgers (1995:21). At this knowledge stage in the innovation-decision process, the teacher learns about the existence of the innovation, and ask questions to determine what the innovation is and how and why it works (Rodgers 2003:21). This will in essence lead to a faster adoption rate, and there is a possibility that the innovators are willing to experience new ideas.

With a constructivism dimension teachers need to facilitate learners to use technology to construct different forms of knowledge representation (Koh, Chai & Tsai 2014:187). Teachers who have a good TPK, will use the technological environment to support the technology and scaffolds the learning rather than being the object or derivative of the learning (Gilakjani, Leong & Ismail 2013:58). And in doing this, the teachers will also have an influencial role on the social system (in this case the classroom) to engage in solving problems to accomplish a common goal (Rodgers 1995:23). Gilakjani *et al.* (2013:59) explained that the critical attribute of cognitive tools is the forms of learner activity and engagement that they support and encourage. Therefore, cognitive tools still need the informed teachers to design and supervise the learning activity, but they act to amplify and distribute the cognitive tasks through their design and application.

The Geography teacher can use a variety of technological tools in their teaching. When teaching 'maps', teachers can use Google Earth so that the learner can visually see the maps. This will lead to the deepening in their understanding of concepts being taught. A deeper understanding of the constraints and affordances of technologies and the disciplinary contexts wherein they function is needed. Harris and Hofer (2009:102) emphasize that using technology in a Geography classroom can only be successful if pedagogical principles are considered. Before a teacher decides to use the technology, they should verify pedagogically which content should be taught in differentiated ways, according to students' learning needs. Which concepts are challenging to learn, and how technology can overcome conceptual challenges. Teachers can make a selection from the Social Science CAPS document and select certain concepts to incorporate technology. The most significant aspect of this conceptual framework is a combination of all the previously discussed knowledge's – the development of TPACK.

2.3.1.3.7 Technology, Pedagogy, and Content Knowledge (TPACK)

TPACK is an emergent form of knowledge that goes beyond the components of content, pedagogy and technology. It is seen as the basis of effective teaching with technology. To accomplish effective teaching in Geography concepts by using TPACK, Koehler and Mishra (2009:66) acknowledge the understanding of the following:

- the representation of concepts using technologies;

- pedagogical techniques that use technologies in constructive ways to teach Geographical content;
- knowledge of what makes concepts, such as map work, etc. difficult or easy to learn and how technology can help redress some of the problems that students face;
- knowledge of students' prior knowledge and theories of epistemology; and
- knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones.

According to Muniandy, Mohammad and Fong (2007:47), technology use should be embedded within a learning theory to support the methodology. The use of computers can enhance cognitive powers of students during thinking, problem solving and learning. Learners should be able to act and learn in an environment that would provide them with the choices, tools, and constructs to help them learn, and not merely instruct them (Gilakjani *et al.* 2013:57). A number of studies (Koehler, Mishra & Yahya 2007; Cavin 2008) have shown the potential of constructivist environments to develop TPACK. Gilakjani *et al.* (2013:58) describe this relationship between technology use and constructivist teaching practices as one that constructivist-minded teachers advocate technology as a worthwhile learning tool in their student-centered classroom. Constructivists do believe there is a place for practice and drill. They recognize the fact that learners require opportunities to assimilate new information in repetitive and multiple ways. Therefore, Hosseini (2015:102) revealed that there is a strong evidence that constructivism can help facilitate the development of TPACK.

Teachers with knowledge of TPACK act with an intuitive understanding of the complex interplay between the three essential components of knowledge (CK, PK, TK). Ravitch and Riggan (2017) stated that there is an interconnectedness of the conceptual framework concepts. The different concepts of TPACK are in relation to one another, explaining the different knowledge that a teacher need to have when teaching with ICT. In having these knowledge, the time for the innovativeness of an individual, could possibly make the adoption to innovation earlier than later (Rodgers 2003:22). The TPACK framework will give the researcher insight regarding the Geography teacher's content knowledge, pedagogical knowledge, pedagogical content knowledge, technological knowledge, technological content knowledge and technological pedagogical knowledge. This knowledge will also make it possible for the researcher to make assumptions about how teachers integrate Geography teaching and learning using ICT in the Intermediate Phase classroom. The above-presented components will be used to inform the researcher regarding the different knowledge bases, which will be needed to investigate strategies to improve Geography teaching and learning using ICT. Finally, they will be used to clarify the research questions on integrating Geography teaching and learning using ICT.

2.4 Teacher acceptance model to measure TPACK development of teachers

According to Niess (2017:10), the dual indication of TPACK spurred further research in the TPACK construct, both at the center of the model and the total package.

Niess, Lee, Sadri and Suharwoto (2006:11) argued that there is no constructional framework for measuring how teachers TPACK are developed. This led to the development of a teacher acceptance model to measure the TPACK development of teachers. As seen in Figure 2.6, Niess (in Niess 2017:11) have identified five levels of teacher acceptance and integration with technologies that can be regarded for the successful implementation of TPACK.

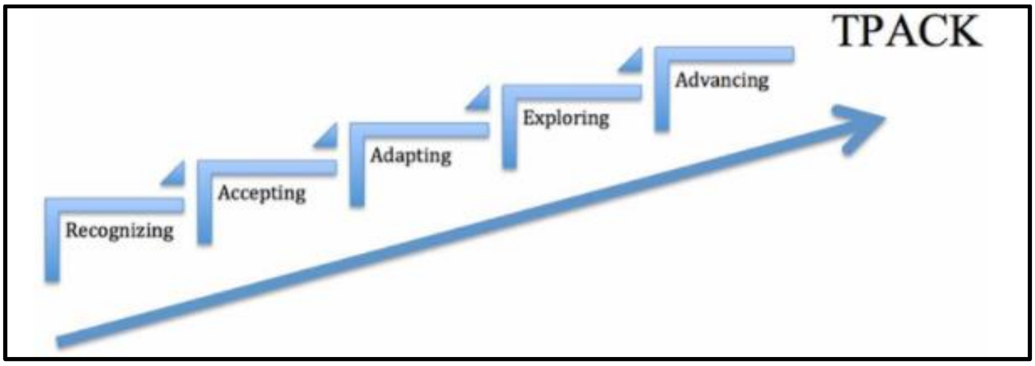


Figure 2.6 Visual presentation describing teachers' acceptance and TPACK development for integrating technologies in their teaching and learning. *Source: Niess,2017:12*

a. **Recognizing:** At the first level, the teachers are learning about a specific technology. Teachers can use specific technologies and recognize an alignment of their capabilities with subject matter topics. At this level, the teachers are not yet ready to consider technology use as an instructional tool. At the recognizing level, the users do not have the knowledge on how to use technology in as an instructional tool and they will be at the awareness-knowledge phase (Rodgers 1995; 2003). They have the knowledge of the innovation’s existence and the individual can be motivated to learn more about the innovation.

b. **Accepting:** Teachers form a favourable or unfavourable attitude oward teaching and learning specific subject matter topics with specific technologies. The acceptance level, can be more related to the next stage in the innovation decision process, which is the persuasion stage. Rodgers (1995:24) states that this stage is related to the users’ attitude which can be positive or negative towards the innovation, and if positive, they will adopt earlier.

c. **Adapting:** At this level teacher is beginning to incorporate technology in their teaching. Teachers engage in and implement in their classroom activities to adopt or reject, teach, and learn subject matter topics with specific technologies. At the adapting, exploring and advancing stage, can relate to the decision and implementation stage of Rodgers theory (1995; 2003). Here the individual will choose to adopt the innovation, and put to practice, since individuals first want to try the innovation in their own situation and then come to an adoption decision.

d. **Exploring:** Where teachers integrate specific technologies as learning tools when teaching and learning multiple subject matter topics, and where they consistently explore the use of the technologies for teaching additional subject matter topics.

e. **Advancing:** Where teachers evaluate students' understanding using specific technologies as subject matter tools and actively support integrating teaching and learning subject matter topics with the technologies.

In this study, this acceptance model was used to determine the teacher's developmental levels of TPACK. Data collected from the interviews and lesson presentations were used to determine at which level the different teachers were developing their TPACK and were incorporated in the data analysis.

Using Rodgers theory of diffusion of innovation and TPACK, as my respective theoretical and conceptual framework, made the research findings more meaningful and acceptable to the different constructs in relation to my aims and objectives of the study. The theoretical framework could give me lens from which to support my thinking about the problem and the analysis of the data and the conceptual framework gave me a generative framework that I could use for expediting my entire research process in obtaining the research objectives. Therefore, I could use Rodgers diffusion of innovation and TPACK to also understand the different knowledge that teachers have and what they need, what their perspectives are and the time frames for them to adopt ICT for the integration in Geography teaching and learning.

2.5 LITERATURE REVIEW: GEOGRAPHY AND GEOGRAPHY TEACHING

2.5.1 Conceptualization of Geography

Since this research study wants to contribute to a broader audience in the education sector, it is necessary to give an overview of what Geography constitutes because this will give the non-geographer a sense of the importance of Geography. For many years, when people think about Geography, one thing will come to mind: knowing where places are. However, Geography involves more than that. Bonnett (2008:2) claims that Geography seems to be an all-inclusive and endless in-depth and range subject and deal specifically with the real world (Taylor 1994:24). Therefore, Geography is an attempt to find order in a seemingly chaotic world; and its methods reflect the challenges of acquiring environmental and international knowledge to suggest solutions to significant and persistent problems (Demirci, Gonzalez & Bednarz 2018:4; IAGI 2010:1; Solari *et al.* 2015:15).

Since the development of the social theory concept, which follows a Marxism and behaviorism philosophy in the 1970s, Geography has been typified by rapid epistemological change. The social theory concept is concerned with the relations between members, partners, and socialization processes between individuals (Kellerman 1994:1). The social theory was typified by adopting a less "rigid" approach to explaining daily life and social change, meaning that time and space can be viewed as constituting both context and composition in the social process (Kellerman 1994:2). These epistemological changes led to the redefinition of human Geography.

It was first defined as the study of the social process's contemporaneity in time and space, and it was redefined to understand the simultaneity of time and space in structuring the social process (Dear 1988:270). Since then, there have been different classifications of space and place in defining Geography, out of different perspectives (Giddens 1990:18). At first, the materialist perspectives on the Historical Geography of space and time; then space and time in the capitalist epoch and finally, the cultural and political responses to the changing dimensionality of space and time. These changes led to different definitions of what constitutes Geography. Matthew and Herbert (2008:1), SA DoE (2011:12), and De Blij (2012:4) define Geography as the study of the human and physical environment and processes over time.

Therefore, geographers are uniquely equipped to understand and address critical problems facing the world and are motivated by issues such as social and environmental justice and the efficient, equitable and sustainable use of resources. Lanche (2011:75) describes Geography as a science that studies the closest and farthest geographical spaces. This would entail understanding the interaction between man and space; to approach the experiences people have in the places they live; to go into depth on the studies of social-territorial complexity, and studying space from/ to the people who live there.

OFSTED (2011:8) defines Geography as a subject that explains where places are, how places and landscapes are formed, how people and their environment interact, and how a diverse range of economies, societies and environments are interconnected. It builds on pupils' own experiences to investigate places at all scales, from the personal to the global. In contrast, Xuan *et al.* (2015:112) stated that Geography explores the relationship between the earth and its peoples through the study of place, space and environment. What is clear from the literature is that authors are not consistent in defining Geography, but there are many correlations between the definitions.

The notions of space, place and human environment, which explain the temporal and spatial dimensions of human lives, and the social and cultural construction of space and place (Morojele & Muthukrishna 2012:90) give meaning to Geography. From these correlations, there are three defining complementary concepts in the geographical thought: place, space, and environment. The Institute of Australian Geographers Incorporated (IAGI) (2010:1) describe the concepts as follows:

- At first is the concept of ***place***, where geographers explore what places mean, how people shape places, and how places shape our lives. This brings many areas of Geography together in a holistic approach to understanding the characteristics of and relationships between localities, cities, regions, countries and continents;
- The second is the concept of ***space,*** where geographers examine how, why and with what effect diverse phenomena vary across the earth's surface. Geographers understand space to be configured by the movement and organization of people and materials as well as being a location for social and material action; and
- The third concept is the ***environment***, where geographers investigate biophysical environments encompassing terrestrial, marine and atmospheric systems. These investigations include the nature, dimensions and causes of environmental change; the shared relationships between the environment and people; the resources biophysical systems provide and their sustainability.

Therefore, geographers need a clear understanding of the simplistic perspectives of space, place, and environment (Madikizela-Madiya 2018:266) to offer solutions to sustainability, environmental and human crises. Inga and Thomas (2018:44) argue that technical innovations can change lives or ease some of these solutions in recent times.

2.5.2 Geography as A School Subject

In the previous paragraphs, it was necessary to explain the definitions and concepts that necessitates understanding Geography in general. In the development of Geography worldwide, it has become clear that there was a need to include Geography in the school curriculum. Therefore, in the following paragraphs, the researcher will give an overview of the historical development of Geography as a school subject and developments in the South African school curriculum.

2.5.2.1 Historical Development

Over the years, Geography has developed as a school subject under much debates because of its nature in different parts of the world. The study of Geography across the world was done within a country's boundaries, which affects the school curriculum itself. In some countries, the separation was not recognized, while in others, it was built into the limited curriculum time because Geography is forward-looking and progressive (Tilbury & Williams 2003:1; De Miguel González 2020:5). In some cases, Geography was integrated into courses or subjects related to science. Tilbury and Williams (2003:1) and Robertson, Maude & Kriewaldt (2019:15) stated that school Geography is mostly concerned with map work, fieldwork, and new technologies to enhance learner knowledge of spatial knowledge.

The 1880s were an essential time during the development of Geography as a school subject. At first, Geography was seen as a repository of world knowledge, and there needs to be a case for Geography as a school and university subject in the modern world. Geography could not have been established in schools and university unless it acquires the states of an academic discipline (Marshen 2003:7; Unwin 2013:66). According to the success of Geography in establishing a space in schools was sealed with the journal's rollout, *The Geographical Teacher*, which helped to disseminate knowledge and understanding of the subject (Marshen 2003:8; De Miguel Gonzalez 2020:3).

The journal and other research reports (articles) supported the case for Geography because the main objective should not be merely to accumulate information but develop an attitude of mind and a mode of thought characteristics of the subject. The UK based Royal Geographical Society and the Geographical Association (GA) was the most influential during this time. These organizations played a pivotal role in reviving the status of the subject and developed a variety of campaigns and strategies to mobilize support for the subject and to emphasize its potential contribution to a general school curriculum in the UK (Daugherty & Walford 1980:6; Williams 1985:39; Madikizela-Madiya 2018:268; De Miguel Gonzalez 2020:3).

2.5.2.2 International and South African trends in Geography Curriculum Developments

Geography has been in the school curriculum of various countries for over a long time. Debates on the geographic knowledge and the positioning of Geography within the curriculum are a continuous development topic (Morgan 2014:54; Casindar 2015:96). In the Australian Curriculum, for example, Geography exist as a distinct entity in the school curriculum, the time allocation given towards it was reduced, and there was now less likelihood of the subject being taught by teachers trained in its method (Casindar 2016:259).

The discipline was still placed in the general learning area of Humanities and Social Sciences. Their curriculum was structured in a dual nature, with the curriculum being structured around two units per semester, one of which was essentially physical Geography, and the other more framed around human Geography (Maude 2013; Casinader 2015). Concerns about overcrowding in the primary curriculum have led to a national agreement that the Geography, History, Economics and Business, and Civics and Citizenship curricula will be rewritten into integrated humanities and social sciences subject through primary school (Knott 2015).

However, in the UK, it was only during 1991 that the subject gained a legal status required to be taught at stages five to eleven years old. Their national curriculum was divided into core (English, Maths and Science) and foundation subjects (remainder of the curriculum) (Lambert & Jones 2013:18). Although there was first a steady rise in Geography, this was followed by a decline in the amount of curriculum time spent on Geography (Catling, Bowles, Halocha, Marting & Rowlings 2007:122). Geography’s popularity has grown over recent years in countries like the US and the UK, where it was seen as one of the “other subjects” (Madikizela-Madiya 2018:267). This growth in the popularity of Geography, has later spread to other continents around the world.

Geography officially featured in the South African school curriculum during the time of mass education in the 1953’s, which was known as the Bantu education system, and it was during a later stage that it was introduced in the curriculum as part of the Social Sciences (Manik 2016:446; Lyer 2017:4). During the pre-democracy education system (although different for black and white learners), topics included topography of the local area, climate, employment, transport, fishing, mining and industries (Lyer 2017:6).

During this era, there were notable differences in the content covered, time allocation and resources between black and white learners. During the 1800s, a new curriculum plan was set out for government primary schools in South Africa, including ‘Descriptive Geography’ (Ferguson & Immelman 1961:37). From the 1960s onwards, there was an international move towards a more scientific approach to Geography and where the Committee of Heads of Education (CHE) and the Joint Matriculation Board (JMB) selected the Cape Senior Syllabus for Geography as the new, national core syllabus (Van der Merwe 1982:93).

The syllabus objectives were devised to impart geographical knowledge, develop geographical skills, improve the environment's perception, and encourage appraisal of actions that impact the environment. The skills to be developed were oracy, literacy, numeracy, graphicacy and fieldwork techniques

(Van der Merwe 1982:94). It was noted that graphicacy and interpretation skills are both developed by map work, which should be integrated with every section of the syllabus' (Transvaal Education Department 1983:10). Van der Merwe (1982:95) asserts that the *International Charter on Geographical Education report,* with a strong emphasis on knowledge and skills related to place and related spatial issues, let South African syllabus revision in the 1990s.

According to Clark and Branson (2012:685), Geography has an assured place in education, and for many teachers, it is a subject that has become a 'form of life'. Following the National Curriculum's introduction in 1989 and Geography's first programmes of study in 1991, Geography teaching was developed or reintroduced in primary schools (Catling & Willy 2009:2; Manik 2016:452). Several curriculum changes were a key feature between apartheid and the democracy stage in South Africa. According to Beets and Le Grange (2008:68), the changes occurred in three phases: introducing the interim syllabus in 1995; the introduction of Curriculum 2005 in 1997; and the Revised National Curriculum Statement (RNCS) in 2002.

The first post-apartheid curriculum was called Curriculum 2005 (C2005), and the predecessor (the interim syllabus called NATED 550) was a modification of the apartheid syllabus between 1995 and 1997 (Le Grange & Ontong 2018:13). Under the new democracy, Geography was implemented in the new C2005 in 1997 within the learning area called Human and Social Science (Siebörger 2018:2). The Human and Social Science learning area consist of Geography with the integration with Natural Science and History. C2005 was announced as a major change from subjects that was content loaded to one based on outcomes (construction of knowledge) (Manik 2016:452).

In C2005, the pedagogical approach was altered from a teacher-centered classroom to a learner-centered classroom with a strong focus on constructivism. However, during this time, there was much debate surrounding how the subject (which was called a learning area) was structured. According to Siebörger (2018:2), the subjects' integration lost their distinctive character, which resulted in an unsystematic conceptualization (Madikizela-Madiya 2018:270). One other concern was that History and Geography consisted of sub-disciplines shortened or lost during the integration process and the difficulties of implementing the curriculum in resource-poor schools (Beets & Le Grange 2008:69).

Physical Geography in C2005 was located in Natural Sciences, which means there was a chance that it gets lost because of the many sub-disciplines such as geology, astronomy and development studies. These debates led to a review of C2005, and several recommendations were made, which ultimately led in 2002 to the Revised National Curriculum Statement for Grades R to 9 (RNCS) in which Social Science replaced the Human and Social Science Learning Area (Madikizela-Madiya 2018:271). Although linked together in one learning area, both disciplines will have their content and conceptual bases (DoE 2002:19). Within the RNCS, it was the first attempt to include map skills into the curriculum content, and it introduced the learning of process skills (Le Grange & Beets 2005:276; Manik 2016:453). According to Beets and Le Grange (2008:71), the C2005 remained the foundation of the RNCS where the specific outcomes were replaced by fewer curriculum-linked outcomes called learning outcomes.

Within the RNSC, Geography gained its distinct identity in the Social Science learning area (Beets and Le Grange (2008:71). Within the RNCS, Geography outcomes were linked to the development of enquiry skills to investigate key concepts and processes in Geography; knowledge and understanding of the interrelationships between people, resources and the environment; and critical analysis of development issues on a local, national and global scale. (SA DoE 2002:5). Although the RNCS was an improvement over C2005, there were still shortcomings; Lyer (2017:9) stated that the curriculum could be improved by evolving with the changing political and socio-economic climate of South Africa.

Furthermore, the RNCS did not provide learners with substantial opportunity to engage with Africanism and economic status issues and issues with spatial competences (Manik 2016:453; Lyer 2017:10). Also, within the RNCS, there were areas of dissonance between what was stated in curriculum documents and what was occurring at the grassroots level (Manik 2016:453). These issues prompted another curriculum review. From 2012 until the present, the National Curriculum Statements Grades R-12 was drafted. The new curriculum statements represent a policy statement for teaching and learning in South African schools, which consist of the a) Curriculum and Assessment Policy Statements (CAPS); b) National Policy pertaining to the Programme and Promotion Requirements (NPPPR) and; c) National Protocol for Assessment Grades R-12 (SA DoE 2011).

The South African Education department developed a CAPS document for each subject in the intermediate phase which capitulates the the necessary knowledge, skills and values have capitulated each subject (SA DoE 2011). Geography as a school subject in the CAPS document is broken down into three broad fields; the first relates to the biophysical environment, the second to human activities, and the third to statistical methods of representing facts, including maps (Hurry 2017:3). Sieborger (2018:14) identified another field that has to do with space (where people are and how much space they occupy). According to Hurry (2017:3) school, Geography has five critical characteristics:

(i) Geography is a study of phenomena at a particular place;
(ii) Geography is a science that is concerned with spatial distribution and position of phenomena;
(iii) Geography stresses the relationship which exists between different elements;
(iv) Geography is the one school subject that studies the environment holistically; and
(v) Geography studies changes at a place.

These characteristics are embedded in core concepts (Figure 2.7) of Geography in the CAPS document and are again embedded in the Intermediate Phase school curriculum content. At first, within the CAPS document, precise specifications of what is to be taught and learnt on a term-to-term basis. Geography is situated in the Social Science subject alongside History. According to Wilmot and Irwin (2015a:142), the CAPS document's Geography content is viewed as well balanced and comprehensive throughout the primary school phase.

The CAPS focus on high knowledge and high Geography skills as specified in Table 2.2 (SA DoE 2011:4). In the Social Sciences IP curriculum, Geography aims to help young people understand the complex world in which we live. These concepts result in the gaining of geographical knowledge to understand socio-economic, cultural, political and environmental issues (Siebörger 2018:12).

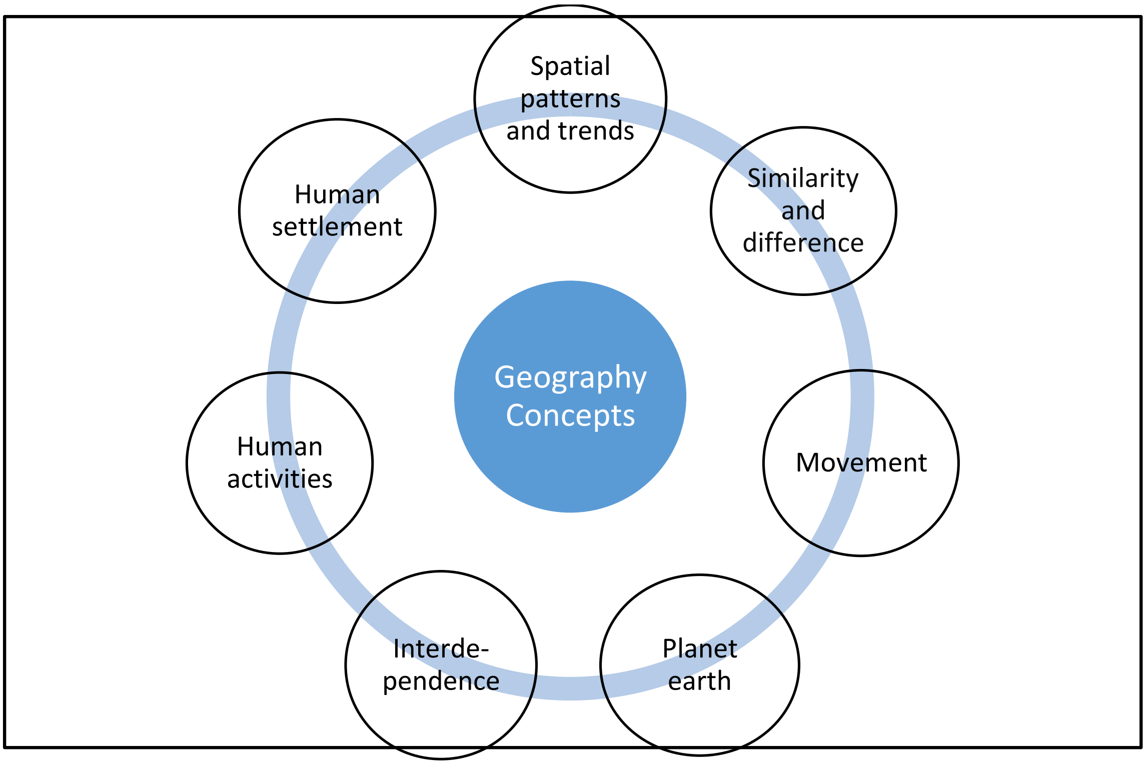


Figure 2.7 Geography Concepts (adapted from SA DoE 2011:12)

Although the IP curriculum provides a general education experience, teachers need to adopt teaching strategies that will deliver Geographical knowledge, skills and values, which will enable all learners to function effectively and responsibly in space-place and time (Van Harmelen 1999:1). To achieve quality in their teaching and learning in their classrooms, they need to understand what Geographical knowledge and skills are required. Therefore, it is necessary to understand the aims of the curriculum to achieve quality in teaching and learning using ICT.

The researcher noted that the CAPS document that describes the content (per term), the aims of the subject, the skills, concepts and assessment that needs to be done in Social Science (Geography) in the IP was imperative for the study. Geography and History are taught in the Social Science subject in the General Education and Training Band (GET) from Grades four to six in all South African schools. Although the IP curriculum provides a general education experience, teachers need to adopt teaching strategies that will deliver Geographical knowledge, skills and values, which will enable all learners to function effectively and responsibly in space-place and time (Van Harmelen 1999:1). These will be described at 2.5.3. This Geography curriculum (CAPS) aims to develop learners' knowledge (content, skills and concepts), as seen in Table 2.2 below.

Table 2.2 Geography curriculum aims and examples of skills involved (SA DoE 2011:18)

The CAPS Geography curriculum aims to develop learners who:	**Examples of the skills involved.** **Learners will be able to:**
Are curious about the world they live in	1. Ask questions and identify issues 2. Discuss and listen with interest 3. Collect and refer to information (including newspapers, books and, where possible, websites)
Have a sound general knowledge of places and the natural forces at work on earth	1. Read and use sources in order to assimilate information 2. Use the information to describe, explain and answer questions-people/places/relationship between them

Understand the interaction between society and the natural environment	1. Consider, syndissertation and organize information 2. Make links between cause and effect; change and continuity 3. Acknowledge and appreciate diverse lifestyles and world views
Think independently and support their ideas with sound knowledge	1. Use Geographical knowledge to solve problems 2. Discuss and debate issues 3. Recognise bias and different points of view 4. Develop own ideas based on new knowledge 5. Suggest solutions to problems
Care about their planet and the well-being of all who live on it	1. Engage with issues relating to the planet, its people and resources with knowledge and sensitivity 2. Act responsibly towards people and the environment
Understand and work with a range of sources – including maps, data and photographs	1. Use and draw maps 2. Identify and extract information from texts photographs 3. Work with data and statistics in the form of graphs, tables and diagrams 4. Cross-reference information using different sources

Observe and engage with phenomena in their environment	1. Develop observation, interviewing and recording skills through fieldwork 2. Interview people and apply social skills 3. Process, interpret and evaluate data
Find out about places, people, events, and issues using different sources, e.g. books, people, photographs, the Internet	1. Devise and frame questions 2. Develop and apply research skills 3. Analyze, process and present information
Communicate ideas and information	1. Speak in an explicit and informed way 2. Write in a structured and coherent way 3. Draw maps, sketches, simple illustrations, graphs, and flow charts 4. Provide reasoned explanations
Make informed decisions and take appropriate action	1. Work cooperatively and independently 2. Plan and evaluate actions systematically and critically

Source: CAPS document (SA DoE 2011:14)

According to the CAPS document (SA DoE 2011:14), the Geography content and concepts must be integrated with the aims and skills indicated in Table 2.2 above. The aims of Geography relate to the child's general education, and aims are generally long term and relate to the pupil’s understanding of the subject. These aims (in Table 2.2) are closely related to those of Hurry (2017:5), which describe the aims of Geography for all levels to improve teaching and learning. Hurry (2017:6) describes that the primary aim of Geography teaching should explain the pupil's environment.

In this manner, they will be curious about the world, and learners will understand the interaction between society and the environment, as stated in CAPS (SA DoE 2011). What further is of importance that the CAPS document encourages teachers to bring the world into the Geography classroom by using visual resources that can make information more accessible to learners and teach towards the aims of Geography (SA DoE 2011:9). This can be done using various innovative tools such as the internet, Google Earth and videos to increase the learner's positive learning experience (SA DoE 2011:9; Solari *et al.* 2015:2).

Although the CAPS document is encouraging teachers to use ICT, this is also justified in the various policies in South Africa. Some of these policies were already drafted since 2004, with the Department of Education white paper on e-education. The E-education policy goal (SA DoE 2004:17) in the document were articulated that every South African manager, teacher and learner in the general and further education and training bands will be ICT capable. Furthermore, the Department of Education’s “Action Plan to 2019”, towards realization of schooling 2030, defined four key strategies to improve ICT integration in education. According to Padayachee (2017:39), the strategies include; (i) establish links between the usage of ICT in the classroom and learning goals; (ii) understanding the various types of technologies available; (iii) establish collaborations with stakeholders to drive e-education; (iv) analyzing the statute que of e-education initiatives and their envisioned results.

Padayachee (2017:39) confirmed that the Department of Education is calling for more research to be done in ICT integration to determine the categories of available technologies and whether these categories have been or could be integrated successfully.

2.5.3 Teaching and learning of Geography in the Intermediate Phase class setting

The researcher’s study investigates strategies to improve the integration of Geography teaching and learning using ICT. It is vital to reflect on the different teaching methods needed to improve the teaching and learning of Geography in the classroom. Different teaching methods have been used over the years in the Geography classroom, supplemented with ICT use (Abraimova 2020:169). Golightly (2018:437) argues that teaching strategy's choice has an important influence on Geography learners' teaching and learning experience.

A teaching method that supports creative thinking will create learners who will be active in the lesson and stimulate a learner-centered environment when teaching Geography with technologies (Artvinli 2017:10). In the following paragraphs, the researcher will give a short description of the teaching methods commonly used in the Geography Intermediate Phase (IP) classroom and an example of the use of ICT's.

2.5.3.1 Lecture or Presentation Method

Khan and Akbar (2008:50); and Mangal and Mangal (2019:339) describe the Lecture or Presentation method as a traditional teaching method. The Presentation method enhances the standard lecture method by using visual materials such as slide presentations, video, OHP and PowerPoint (Westwood 2008:20). According to Westwood (2008:17), in the Lecture or Presentation method, the teacher communicates the students' geographical knowledge orally. Students are the passive recipients of information and take on various forms, ranging from the typical 'talk-and-chalk' to formal and informal lectures (Basha 2007:85; Muhammed 2016:59).

According to Mangal and Mangal (2019:340) and Muhammed (2016:59), some of the advantages of using the lecture method in Geography are:

- Controlling and monitoring the teaching-learning Geography activities;
- Can realize the lower cognitive objectives of the learner;
- Help teacher to plan and mould his teaching according to the needs of the Geography subject-matter;
- Help maintain a proper channel of motivation, enthusiasm and interest in the Geography classroom;

- Helps in following logical sequence in teaching as facts and information get pre-organized.

Although there are certain advantages in using the lecture method in Geography, it was also indicated in literature (Kaur 2011:2, Mangal and Mangal 2019:340; Danaei, Zarshenas, Oshagh & Khoda 2011:1) there are several disadvantages in using this specific method in the teaching of Geography. Two of the most common disadvantages are the following:

- It involves the teacher doing all the talking with little or no input from the learners. This means that learners are taking on a passive role to the Geography lesson, which can hinder spacial learning or the opportunity to discuss various Geography content;
- Using the lecture method can be unstimulating for Geography learners because they need to sit for a long time and listen to the teacher. This will ultimately have an impact on them by not staying focus on the lesson at hand.

The lecture method is generally used in conjunction with presentations or presentation software as an ICT resource (Muhammed 2016:70). This can be done by showing photographs of different localities or geographical features shared with pupils (BECTA 2004:4) while the teacher talks or explains the specific feature. Using the presentation software will provide geographic information and increase student interest and attract their attention to Geography in the IP (Ayas 2015:173).

2.5.3.2 Question and Answer Method

According to Basha and Rao (2004:99), in this method, an effort is made to systematize learners' previous knowledge by posing questions that leads to a good understanding and organizing geographical knowledge (Freahat & Smadi 2014:1804). The different types of questioning (lower-order and higher-order) are of much importance, and therefore, Orlich, Harder, Callahan, Trevisan, Brown & Miller (2013:213) claim that Geography teachers must be knowledgeable in the process of framing questions that will enhance geographical enquiry and creativity (Al Falah 2017:12).

These questions can be asked on different Geography dimensions, such as recalling individual facts or narrow/broad answers to a specific question. Lim *et al.* (2018:1) describe these dimensions as follows: questions with narrow dimensions encourage convergent thinking and expect limited answers. Questions with broad dimensions encourage divergent thinking and accommodate a wide variety of answers, whereas questions with recall dimensions test existing knowledge and observations, while questions with thought dimensions use old knowledge to create new knowledge and ideas in learners.

For example, a conceptual question type can be described in a narrow dimension as ‘What is the ozone layer's function?’ or in a broad dimension as ‘To what extent does the ozone layer contribute to global warming?’.
Some of the advantages of using question and answer method to its full extent in Geography are that teachers need to establish which role the students play and the extent of their engagement in the learning process to maximize geographical enquiry (Barnes 2008:231; Hogan, Rahim, Chan, Kwek & Towndrow 2014:171). Using the different questions correctly in the Geography classroom, teachers can shape students’ thinking and anchor their geographical understanding (Lim *et al.* 2018:2).

According to Ababio (2013:30), another advantage of using the question and answer technique is that it can motivate Geography learners. This can be done by asking learners to inject their personal experience of geographical issues in their answers and provide proper feedback. Qatipi (2011:72) stated that the question could be stated during four stages of the Geography lesson:

- Introduction, here questioning helps to establish human contacts; to discover what the class knows of the specific topic of Geography;

- Presentation, which through questioning manages to maintain interest and alertness; to encourage reasoning and logical thinking; to discover if there is an understanding of the geographical topic;
- The application helps students through questioning to focus and clarify; to make observations; to clear up misunderstandings; to assist individuals.
- The conclusion makes students revise, test results, and suggest.

Some of the disadvantages of this method in the Geography classroom; however, according to Singh (2020:34) is that:

- It requires much skill on the part of Geography teacher to make proper use of this method;
- It may sometime mar the atmosphere of the class;
- This method generally is entirely embracing for timid students and;
- It is time-consuming for the Geography teacher and
- This strategy cannot teach the whole content-matter.

Question and answers teaching method can be used in different ways using ICT in the Geography IP classroom. An example from Lambert and Balderstone (2010:334) explain that aerial photographs can be projected with a data projector.

With these photographs, the teacher can set up a video clip of the moving process (river or waves) in a loop. Questioning can then be used to probe pupils understanding of the process, with pupils coming up to label features and speculating about the impacts of these processes and possible change to landforms. Another example from Anderson (2013:1) is with the use of cameras. They can make visual questions by taking photographs of what geographical feature they like to question and explaining it to the class.

2.5.3.3 Research or Project Method

The project method in Geography is defined as a biological, life learning activity involving investigation by an individual or small group with relatively little direct interaction with the teacher where learners have to produce an artefact to demonstrate their mastery of content (Varma 2005:43; Pejdo & Horvat

2017:258; Inusah 2020:93). This method is synonymous with an approach that allows the learner to learn from their active processing of information using a range of authentic resources in Geography (Westwood 2008:35; Kołodziejski & Przybysz-Zaremba 2017:30).

According to Varma (2005:43), Prince and Felder (2006:14), and the SA DoE (2011:15), the Geography activities needs to be purposeful, needs to lead to the production of a final product, and there must be a strong emphasis on geographical environment. The advantages for the Geography teacher to use this method in the Geography IP classroom are according to Kołodziejski and Przybysz-Zaremba (2017:28), and Inusah (2020:94) are:

- enabling the realization of geographical activities,
- mastering the ability to group-work, co-operation and responsibility for one's work;
- developing interrogative thinking;
- sharing the results of community work; and
- the possibility to express one's opinions, thoughts, and ideas regardless of the adults' opinions and beliefs.

However, some disadvantages are using the project method in Geography. According to the research from Harmer and Stokes (2014:2); Habok and Nagy (2016:30); and Aldabbus (2018:73), some of the disadvantages of using the project method in the Geography classroom are:

- all schools do not have the geographical resources to use this method;
- Sometimes efforts are wasted in an attempt to base the whole of the geographical syllabus on projects;
- highly time-consuming activity and requires excellent attention to detail";
- students who lack the skills of working in groups may face some challenges in working collaboratively; and
- it is demanding in planning and preparation, facilities, student discipline, monitoring, and evaluating.

One way of using ICT with the project-based teaching method in Geography is for learners to use the internet. Freeman (2003:211); Ruthven, Hennessey &

Deaney (2004:2); Ditzler, Hong & Strudler (2016:182); and Solem (2001:23); McKnight, O'Malley, Ruzic, Horsley, Franey & Bassett (2016:195) gives a useful example when teaching about the weather. Learners can compare different weather data of areas. Learners can use the internet to research weather information about the places under investigation. According to the authors, the internet can be perceived as a virtual library to supplement textbooks to provide a rich source of information for the project.

2.5.3.4 Group Work

Group work or cooperative learning is an instruction method that gets students to work together in groups on a specific geographical topic (Lambert & Balderstone 2012:109; Armitage 2017:43). Group work needs to be carefully thought out and manage but can offer valuable opportunities in the Geography classroom. The purpose of group work is to encourage learners to work together towards a common goal. Therefore, teachers need to design social interaction structures and to learn activities to maximize their own and each other's learning (Kagan 1989:12; Johnson, Johnson & Holubec 1993; Cruickshank, Johnson & Metcalf 2009:251).

Some of the advantages by Armitage (2017:43) using group work in the Geography classroom are as follows:

- it breaks complex tasks into parts and steps;
- refine understanding through discussion and explanation;
- give and receive feedback on performance;
- develop stronger communication skills; and
- it challenges assumptions.

On the other hand, according to Lambert and Balderstone (2012:109), some of the disadvantages make planning activities more difficult for the teacher. Teachers must be careful to design group work so that all participants will be engaged. Teachers also have to align group activities to learning objectives and standards carefully. Some learning objectives pair better with group work than others, so teachers should be cognizant of forging project-based learning when it is not the most effective learning strategy for the course objective.

According to Mellingsaeter and Bungum (2014:117); and Yli-Panula, Jeronen & Lemmetty (2019:4), group work can be used as follows in a Geography IP lesson with ICT if learners need to develop a plan for Japan to cope with earthquakes. Each group need to design a leaflet to explain what to do in the event of an earthquake. They discussed their ideas in their home groups and then assigned one task to each group member. This has the advantage of ensuring that all students are involved as they are all responsible for one task.

Groups can use computers to create their leaflets, and with the help of interactive whiteboards (IWB), they can present their leaflets to the rest of the class. Using the IWB may facilitate a 'joint workspace', a social realm in which the students' dialogues are situated. Using group work in Geography education allows learners to practice how to behave ecologically, socially, economically, or politically (Mellingsaeter & Bungum, 2014:118).

2.5.3.5 Laboratory Method

According to Basha (2007:76) and Narule (2019:3), Geography is taught like a science subject during the laboratory method. Meaning that the teacher carries out experiments where the teacher demonstrates an experiment and the learners will follow it, whereas the completion will be to prepare a chart, model, and maps. The means that the learners are not merely listeners but are compelled to observe to perform the experiments on their own to make sure concepts of Geography are transparent (Varma 2005:43).

Advantages, according to Mikanjuola and Ben Sidiq (2013:2) and; Hamidu, Ibrahim and Mohammed (2014:82), are that with the use of the laboratory method, learners will be able to translate what they have read in their Geography texts to practical realities. Thereby enhancing their understanding of the learnt geographical concept; learners tend to understand and recall what they see more than they hear. Laboratory work is vital in Geography because there is otherwise no opportunity for deliberate and close observation of geographical facts.

There are, however, some limitations in the use of the laboratory method according to Harichandan, Shaik, and Sunni (201312), Mikanjuola and Ben Sidiq (2013:2) and; Hamidu *et al.* (2014:82). These are: class sizes are making it difficult for teachers to be encouraged to use it, lack of geographical equipment and material carry out practical's, not easy to make learners discover geographical facts or concepts, and this method cannot be used for teaching economic, regional, historical and human Geography.

Integrating ICT using the laboratory method is claimed to promote collaborative learning, explorative learning or engaged learning (Badeleh 2012:610). Therefore, the internet serves to integrate virtual simulations, models, and dynamic visualizations, create learning communities, and design learning environments to use the laboratory teaching method in Geography (Chui & Linn 2011:2).

Furthermore, Ajamoghlyan (2016:11) claims that modelling the geographical phenomena and process by implementing technology makes the educational material more exciting and affordable. Ajamoghlyan (2016:12) explains that the Geography teacher can display universal sunlight photographs of charts, graphs, and geographic phenomena with the internet. The teacher can also download specific geographic demonstrations that simulate a specific topic for the Geography laboratory from YouTube and develop questions around the project for learners to answer.

In a lesson with Google maps, in a study by Garyfallidou and Ioannidis (2018:595), learners explore the earth dynamically and interactively to understand the spatial context. Using Google maps, according to Garyfallidou and Ioannidis (2018:595), will allow learners to engage in the lesson, explore the earth, explain what they identify, and evaluate the implications of what they have learned.

2.5.3.6 Fieldwork or/and Observation Method

A field trip for studying a part of the country or spot is the most useful method of teaching Geography because it presents the objects understudy in their natural environment (Varma 2005:41; Lambrinos & Bibou 2006:241; Holton 2017:199). With a field trip, the learners gain an opportunity to gain first-hand observation of a geographical object, learners will begin to form a world idea from their experience, and by constructive thought, they form a conception of things and events (Basha 2007:73; Kim 2020:1).

Williams and Catling (1985:245); and Dolan (2016:49) assert that fieldwork will allow the learners to investigate a new environment in which the children can use their geographical skills and knowledge and acquire new skills, knowledge and experiences, which can start at the school grounds. Smith (1987:209) has divided the fieldwork value into three broad categories of experience – outdoor studies, outdoor pursuits, and personal and social development. Outdoor studies relate to the child's cognitive development and provide opportunities to apply ideas generated in the classroom to the real world.

The second experience identified by Smith (1987), the outdoor pursuits, emphasizes some element of personal physical challenge, the development of physical and practical skills, and enhanced awareness of safety issues from experiences outside the classroom. The third category is the least tangible, according to Smith (1987), because this stresses the development of self-awareness and awareness of the needs and skills of others in the context of working co-operatively in new environments.

Other advantages for using fieldwork in Geography are; learners perceive fieldwork to be beneficial to their learning because they experience ‘geographical reality’, develop subject knowledge, acquire technical and transferable skills and interact socially with lecturers and peers. A field trip provides a much-appreciated opportunity for social interaction and group work which may be rare and provide learners with a sensory experience of the place under observation (Fuller 2006:116; Lambert & Balderstone 2010:281; Holton 2017:199).

There are some disadvantages and challenges when using fieldwork in Geography IP teaching. According to Sauerborn and Brühne (2012:142) and; Holton (2017:199), it is difficult with a large number of students, teachers ignoring the pedagogic reasoning behind taking students out of the classroom and placing them in the field, it is an organizational effort, activities can be a risk of injury, it is sometimes difficult to assess, students not used to this kind of activities and it is challenging for students to concentrate during the outdoor activities.

The use of ICT can enrich or enhance the fieldwork experience outside the classroom without the necessary (financial and safety) risk. One way of doing this is with the use of the internet. Best (2011:67) explains that teachers can use YouTube videos to bring you close to geographical features. For example, learners or teachers can develop questions about weather phenomena, like a tornado, play the video about it, and analyze it using questions. The same can be done for natural hazards like volcanoes. Learners can use mobile phones and take some photographs around the school ground to label these with annotations. A class project could see a photo montage created, presenting an overview of an important geographical issue.

In recent years, virtual reality (VR) technology has become popular and been adopted in simulation. With VR technology, in research from Chang and Wu (2018:41), the authors explain that learners can use it to discover the virtual world. Users can change the virtual environment by adding buildings and trees, for example. The 3D simulation of the physical world's 3D simulation provides an excellent geographical scenario for users and allows them to experience spatial variation dynamics.

Other research in the use of ICT for fieldwork in Geography lessons is with virtual field trips. This can be done with the use of the internet or other software like Google maps. This will bridge virtual fieldwork with physical field trips and facilitates inquiry-based fieldwork and experiential learning (Minocha, Tilling & Tudor 2018:1). Using virtual software, teachers can set the virtual field trip on Google maps for the learners to follow at different points of a particular place to investigate (Friess, Oliver, Quak & Lau 2016: 546).

In conclusion, it is clear from the literature that ICT can enhance the learning opportunities when using different teaching methods in the teaching of Geography (Hogan *et al.* 2014:173). Teachers can experiment with different teaching methods for teaching new content topics in Geography with ICT. Furthermore, Lim *et al.* (2018:3), Koç (2018:312), and Singh (2020:35) asserts that different teaching methods should be supplemented by one or another in the Geography classroom to grasp the topic and content and to increase their geographical processing skills.

2.6 INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT) IN EDUCATION

2.6.1 Definition of ICT

Various definition of information and communication technology (ICT) exist in literature. Tondeur (2007:7), Almadhour (2010:4) and Fu (2013:112) define ICT as the use of technology tools which includes computers, the Internet, and electronic delivery systems such as radios, televisions, and projectors, among others. Another definition states that ICT includes all tools and technologies used to record information, the technology used to communicate through sound or images and technology to broadcast information (Patesan, Dalagiu & Zechia 2018; Dlamini, Dumas, Lewis, Lilley, Madhav, Molotsi & Simelane-Mnisi 2018:40). In a South African context, the Education Department (RSA DoE 2004:15) defined ICT as the combination of networks, hardware and software as well as the means of communication, collaboration and engagement that enable the processing, management and exchange of data, information and knowledge.

Segoe and Mays (2017:115); and Dlamini *et al.* (2018:42-52) give examples in Table 2.3 of the different tools and technologies of ICT that can be used in education.

Table 2.3 Examples of ICT tools/technologies that can be used in ICT.

Technologies used to record information	Flash disks, CD’s, DVD's, cell phones, tablets
The technology used to communicate through sound or images	Microphones, digital cameras, cell phones, podcast, tablets, interactive whiteboard
Technology to broadcast information	Computer, laptop, data projector, radio, television, podcast, mp3 files, tablets,
Note: The computer and laptop can do in most cases all these functions	

2.6.2 ICT in Education

The fast pace of ICT development has brought a change in the way we live and work. This ICT phenomenon had burst onto the educational scene during the past two decades, even in the educational setting. Developments of the World Wide Web (WWW) contributed even more to this phenomenon. The WWW brought new educational technology opportunities because of the computer's excellent capabilities to provide a rich and wide array of learning opportunities (Resnick & Wirt 1996:84; Wario 2014:23; Majumdar 2015:6). ICT has been seen as the provider of tools needed to contribute to the knowledge society, and therefore teachers are almost inevitably presented with the demand to integrate ICT (Tondeur 2007:8; Kaware & Sain 2015:25; Ramadan, Dahiyat, Bontis & Al-Dalahmeh 2017:438). Therefore, in the following section, the researcher will overview what ICT in education means and how different countries approach it.

ICT in education is viewed by Manchekar (2015:8) as technologies that consist of electronic devices and associate human interactive materials that enable the user to employ them for a wide range of teaching and learning processes and personal use. This view is supported by Noor-Ul-Amin (2016:4), Ei Morabit (2018:3), and Tripathi (2019:10), who asserts that ICT in education is, used to accelerate and facilitate the educational process with specific objectives to extend high-level educational opportunities. Noor-Ul-Amin (2013:2) elaborate by stating that information and communication technologies in the educative process have been divided into two broad categories: ICTs for Education and

ICTs in Education. ICTs for education refer to the development of information and communications technology specifically for teaching/learning purposes, while the ICTs in education involve adopting general components of information and communication technologies in the teaching-learning process.

Even though their views seem differently, these authors assert in identifying the purpose of ICT in education. ICT in education aims to use ICT in all education systems, developing and utilizing information resources, facilitating information, exchange and knowledge sharing, and promoting educational modernization (Huang, Kinshuk & Price 2017:67). Regarding teaching and learning, Vrasidas, Zembylas and Glass (2009:8) believe that technology in education aims to provide authentic and engaging learning experiences in the classroom.

This will provide powerful means of supporting education driven by individual learner's needs and based on learners taking control of managing and accessing knowledge for themselves (Jimoyiannis 2012:8). All around the world, the development of ICT played a role in the education sector. In many sectors and countries, information technology was taught through other subjects, including Geography (Freeman 1997:203). The establishment of the British Journal of Educational Technology (BJET) in the 1970s played a considerable role in developing ICT education in the UK (Hawkridge 1999:293). Although BJET was a British journal, it intended to have an international presentation (Jackson 2000:164). Even in the first year, it had articles about Africa, America and Australia, which illustrates an international interest in educational technology (Hawkridge 1999:293). In the 1980s, the emphasis on the use of computers in UK classrooms grew, and, according to Kent (1992:164), Geography has been a front runner in grasping the pedagogic potential of the new technology.

During the 1990s, when the internet impacted society and schools, schools were already connected with the UK's internet (Durbin & Sanders 1996:15). The UK government has launched many government initiatives to develop ICT in education. Some of these initiatives were the Micro-electronics in education in the 1980s, Information Technologies project for schools in the early 1990s and 1989 to 1995, Information Technology was introduced as a cross-curricular subject in the UK national education curriculum Jackson (2000:158).

As computers' power and capabilities have increased, policy-makers in different countries have come to see ICT as a viable way of responding to challenges that they face. Developed and less-developed countries have seen the need to implement ICT policy in education (UNESCO 2011:4). Singapore, Namibia, Jordan, Uruguay and Rwanda were just some of the countries that have developed ICT in Education projects and policy changes to increase ICT development in the education system (UNESCO 2011:38).

In South Africa, the policy was written to include ICT in the comprehensive schooling system because the benefits of using ICT were adopted by the South African government after its use worldwide. This started in 1995 when a Ministerial Committee's Technology-Enhanced Learning Investigation began with a strategic planning process (Schoolnet 2000:1). This plan focuses on implementing various vital projects, which have been identified throughout this process as key to efforts to introduce and use technologies effectively in South African education and training.

They focus on providing a supportive environment in which educational decision-makers at various levels can make effective decisions about which technologies to introduce into teaching and learning environments and implement these decisions successfully. In 2001, the National Department of Education and the Department of Communication jointly released a Strategy for Information and Communication Technology in Education, which is believed to have laid the basis for the e-Education White Paper adopted in 2004 (RSA DoE 2004:8).

2.7 BENEFITS OF USING OF ICT IN GEOGRAPHY TEACHING AND LEARNING

ICT is considered a powerful tool for educational change and reform, and the school is an important environment in which learners can participate in a wide range of computer activities (Fu 2013:112; Madlela 2015:352). Some studies have shown that appropriate use of ICT can raise geographical, educational quality and connect learning to real-life situations (Lowther, Inan, Strahl & Ross 2008; Crawford 2013:1; Hassan & Mirza 2020:1845). Since learning is an ongoing activity where learners change their expectations by seeking knowledge, using ICT will be an indispensable prerequisite for these learners in developing geographical skills (Fu 2013:113).

Through ICT, learning can occur anytime and anywhere, and Intermediate Phase (IP) learners can be actively involved in the learning processes (Lu, Hou & Huang 2010:102). Teachers with a visionary thinking approach to ICT integration and the skill to construct scenarios will generate energy in a classroom that will foster Geography teaching and learning and produced students with more confidence (Leeder 2006:104). The use of ICT in Geography teaching and learning has an immense benefit for learners and teachers in the Intermediate Phase classroom (Chigona 2011:3; Fu 2013:113).

In the next section, the researcher will discuss these benefits under the following headings: support student-centered and self-directed learning; produce a creative learning environment; promote collaborative learning in a distance-learning environment; offer more opportunities to develop critical (higher-order) thinking skills; enhance Geography teaching and learning, support teaching by facilitating access to course content.

2.7.1 Support student-centred and self-directed learning

O'Neill and Mcmahon (2005:1) and Akgunduz and Akinoglu (2016:106) describe student-centered learning as the shift in power from the expert teacher to the student learner, driven by a need for a change in the traditional environment with the use of ICT. Self-directed learning and student-centered learning are linked to one another (O'Neill & Mcmahon 2005:2; Francis 2017:4). The Information Resources Management Association (Wu & Raghupathi 2018:695) describes self-directed learning as a delivery model where the learner needs to be self-directed in the learning process.

The interactive, user-centered, and open structure of new ICT's are ideal for a student-centered and self-directed learning environment for Geography IP learners (Van de Westhuizen *et al.* 2012:4). In a research study by Ghavifekr, Mohd Salleh, Shaharom, Abd Rahim and Seng Yu (2016:7765), it was evident that learners' interaction in using ICT can enhance their self-directed Geography skills. The style of teaching Geography gives more freedom to students in choosing their way of learning by using ICT as the primary self-directed learning tool (Yılmaz, Yılmaz & Ezin 2017:88).

With the use of ICT, students are now more frequently engaged, and they build new geographical knowledge through accessing, selecting, organizing, and interpreting information and data (Lea, Stephenson & Troy 2003:322). Based on learning through ICT, learners can use information and data from various geographical sources and critically assess the Geography learning materials (Gaible & Burns 2005:28; Fu 2013:113). A student-centered ICT classroom student will enhance their geographical enquiry skills to deepen their understanding of environmental and spatial relationships (Hassel 2000:81).

Research from Van der Schee (2003:209) suggests that ICT stimulates student-centered learning, mostly when ICT is used with interactive multimedia methods of instructions. Hurley, Proctor & Ford (1999:129), Leask (1999:41), Jackson (2000:165), Kennewell and Beauchamp (2OO3:72) and Van der Schee (2003:209) provides some reasons why ICT improve student-centred and self-directed learning in Geography:

- ICT helps learners to process information easy and fast;
- produce dynamic images to represent relationships;
- ICT gives learners immediate access to richer source materials; and
- ICT helps learners to access a wide range of up-to-date information sources.

Research from Reed, Kreylos, Hsi, Kellogg, Schladow & Yikilmaz (2014); and Chang, Irvine, Wu & Seow (2018:42) give examples of how a student-centered and a self-directed approach to a Geography lesson with ICT can be made. Firstly, learners can use ICT tools (e.g. mobile phone) to experience virtual space and interact with virtual objects. Reed *et al.* (2014) and his team created an augmented reality toolbox to show topographical models. Learners will be able to reshape the sandbox's terrain and the corresponding spatial information, including coloured contour lines and represent the new terrain.

Secondly, with a combination of the internet and mobile devices, learners can develop a learning trail. They can go to a designated location and complete the assigned learning tasks by observing the environment and their mobile devices' information. In this way, learners will have exercise in observation and spatial learning in the IP.

2.7.2 Produce a creative learning environment

A creative learning environment is described by Jindal-Snape, Davies, Collier, Howe, Digby & Hay (2013:2) as classrooms or schools which create healthy conditions for learning, where learners are challenged by expectations and engaged in learning with good social and emotional skills.

Spree (2014:4) asserts that a creative environment is not defined by only content conveyable but rather as activities that immerse the learners in their environment with all their senses and contribute to positive learning outcomes (Moolman, Essop, Makoae, Swartz & Solomon 2020:2). Boys (2011:5) elaborate by stating that creative and useful learning spaces or environments are a frame of mind, not only a comfort zone but also a place where students can take a risk and deal with uncertainty in the Geography IP classroom.

ICT provides a more creative and flexible environment to different learning inquiries in the Geography classroom (Freeman 2003:204; Hassel 2000:80; Fu 2013:114). For example, in the Geography classroom, e-books and Google can investigate Geography content for specific activities. Learners can access all types of texts from beginning to advanced levels with ease through computers, laptops, personal digital assistants (PDAs), or iPads (Chuku & Abraham 2018:29). More specifically, these Geography e-books may come with some reading applications, which offer a reading-aloud interface for cross-curricular integration with Geography, relevant Geography vocabulary-building activities, games related to Geography skills and vocabulary acquisition, and more.

Fitzgerald (2004:2) elaborates that where teachers and learners are engaged in creative environments, it will lead to authentic and deep learning and will have more encouraging geographical outcomes. New technologies will promote a creative learning environment and an important teaching tool creatively and teach creativity in Geography (Obradović, Bjekić & Zlatić 2015:293). Classroom organization for ICT will foster a creative environment for the integration of ICT in the Geography IP classroom. Different activities will necessitate different form of organization in the Geography classroom.

Eivers (2018:49) suggests that teachers need to organize their classroom to work independently, in pairs, or co-operative groups. Working individually means the teacher needs to allow learners to work independently with the computer to revisit concepts previously learned or enrich their learning using complex learning tools like simulations. When working in pairs or groups of three to five children on projects involving ICT use, children may be assigned (or may select) roles including the driver, navigator, co-pilot and timekeeper. Support one another in their completion of assigned Geography activities.

Using different ICT resources in the Geography IP classroom increase a positive Geography learning environment. A study was done by Houtsonen and Rehunen (2000:189-193), for example, regarding the use of ICT in an environmental education lesson as interesting, and they value the illustration animations and sound effects that were used in the classroom. In another study done by Prasetya (2018:560) with students, the results indicated that the use of media, because of the lessons' creative environment, has enhanced students' performance in the application of environmental media.

2.7.3 Promote collaborative learning in a distance-learning environment

Literature (Erkens, Bodemer & Hoppe 2016:387; Kopeinik, Lex, Seitlinger, Albert & Ley 2017:409) describes collaborative learning as a situation in which two or more students learn something together and commonly searching for understanding, solutions, or meanings or creating a product. It represents a significant shift away from the typical teacher-centered milieu in classrooms (Albert & Ley 2017:409). The distance-learning environment is an environment where the study method is conducted by correspondence, without students need to be in the actual institution (Simpson 2018:iv).

It is a teaching and learning system specifically designed to be carried out remotely using ICT where students are required to do different online activities (Varshneya 2017:6; Markova, Glazkova & Zaborova 2017:685; Bukhkalo, Ageicheva & Komarova 2018:205). Research done by Graham and McNeil (1998:181) using web-based sources for Geography students to promote collaborative learning, the outcome of the research project was that students, collaborative geographical skills increase with the use of ICT. Geography learners can communicate, share, and work collaboratively anywhere, any time in a distance environment (Lu, Hou & Huang 2010:102; Singh 2019:1). For instance, a teleconferencing classroom could invite students worldwide to gather together simultaneously for a Geography topic discussion.

Geography learners may have the opportunity to analyze problems and explore ideas and develop concepts remotely. Students acquire knowledge together and share diverse learning experiences to express themselves and reflect on their learning (Mutohar 2012:8; Fu 2013:114). Sangrà and González-Sanmamed (2010:209) asserts that the link between collaborative learning and ICT has revealed possibilities that increased the collaborative nature in a virtual environment in the IP classroom.

2.7.4 Offer more opportunities to develop critical (higher-order) thinking skills

Higher-order thinking skills (HOTS) involves the learning of complex judgmental skills (critical thinking and problem solving) when students encounter unfamiliar problems (Saido, Siraj, Nordin & Al_Amedy 2018:14). HOTS, which is the highest part of Bloom's taxonomy (Tanujaya, Mumu, & Margono 2017:78), through the use of ICT will positively influence student learning and will help students to become knowledge constructors rather than knowledge users (Dalal 2016:25; Ganapathy, Singh, Kaur & Kit 2017:76).

Using ICT's for simulation and modelling in Geography has been shown to develop higher-order thinking skills (Dala 2016:25). It is asserted by Xiang and Liu (2017:66) that one of the advantages of using ICT tools like Google Earth over traditional means are obvious in building higher-order skills in spatial thinking. Using ICT's in Geography IP teaching and learning will promote higher-order thinking skills because it can be used as an active learning approach where students can construct geographical knowledge themselves (Kuisma & Nokelainen 2018:3).

In using ICT in the geographical enquiry process, learners in the primary school will progress from describing and identifying to higher-level skills of analyzing and interpreting (Rodgers & Streluk 2002:2; Majumdar 2015:6).

2.7.5 Enhanced Geography Teaching and Learning

The Department of Education and Training (in Killen 2010:20) describes quality in teaching and learning as the premise that teachers should use pedagogical practices that are deliberately designed to help learners develop a deep understanding of critical concepts, skills and ideas. However, Wittek and Kvernbekk (2011:672); and Wittek and Habib (2013:275) argues that there has never been a clear, unambiguous answer to what quality entails, although a consensus has been reached that in practice, quality means "fitness for purpose".

It is argued by Serhan (2009:440) and Lowther *et al.* (2008:198) that if learners can be more autonomist (take control) of their learning in Geography through the use of ICT's, this will lead to quality in teaching and learning. Students' creativity can be optimized and may discover new Geography multimedia tools and create materials in the styles readily available to them through games, CDs, and television (Gee 2007:4).

ICT is widely seen to enhance teaching and learning, especially in Geography (Sangrà & Gonzalez-Sanmamed 2010:207; Chang & Wu 2018:35). Technology should be harnessed to provide the student with a great potential to develop the disciplinary knowledge of geographical thinking to explain, analyse, evaluate, form an opinion and take action of what they have learnt (Chang & Wu 2018:35). According to Chang and Wu (2018:35), there are two ways that technological tools can help to increase the quality of teaching and learning in using ICT, and that is through the affordances that support the cognitive endeavour of learning and affordances that support the students' geographical thinking.

The multimedia nature of ICT resources offer opportunities for the improvement of geographical skills, which will lead to the improvement of Geography teaching and learning in the IP classroom (Rodgers & Streluk, 2002:1). Teaching with ICT multimedia resources will encourage and enable learners to engage in intellectual activities, such as problem-solving and communication, that will ultimately enhance learning (Leask & Meadows 2000:1; Killen 2010:18).

ICT brought a massive change in education; it makes the teaching and learning process effective and exciting for a learner in the Geography classroom (Noor ul Amin 2016:3). Research from Sangrà and Gonzalez-Sanmamed (2010:214) indicates that ICT at schools improves students' attention and perception skills. ICT, therefore, helps to create better learning conditions by raising and promoting students' attention skills.

There are many ways in which ICT can support Geography to enhance the teaching and learning process in the IP. Freeman (2003:204) highlighted some of the important aspects:

a) ICT is a tool for enquiry learning – it helps geographers to assemble, organize, analyse and present information in words, maps, diagrams, and tables.
b) ICT is a resource for obtaining secondary source material – up to date resource materials widen students' experiences and provide a basis for carrying out investigations.
c) ICT helps measure physical events and situations – automatic weather stations or other environmental monitors offer more regular data to help them carry out fieldwork.
d) ICT is used to model real-world situations – Technology offers an opportunity to use and create dynamic models.

e) ICT helps communicate and present information – computers offer a means of presenting information for various audiences, and these may communicate electronically to students.

2.7.6 Support teaching by facilitating access to content (resources)

Serhan (2009:440) states that ICT fosters autonomy by allowing educators and learners to create their material, thus providing more control over content than is possible in a traditional classroom setting (Fu 2013:115). UNT Teaching Commons (2020:1) explains that for learner-centered teachers, the preparation lies in facilitating access to content and developing Geography assignments and learning activities that help the students take responsibility for their learning. For this reason, ICT resources will support IP Geography teachers and learners by providing access to different resources, and it enables teachers to exchange good ideas and obtain peer support (Cener, Acun, & Demirhan 2015:192; Hassel 2000:90; Freeman 2003:203; Chang & Wu 2018:35).

Van der Westhuizen (2007:41) concurs that ICT can transform the way Geography knowledge is packaged, delivered, accesses and acquired to alter educators' core production and delivery process. This transformation of resources offers an opportunity to meet learners' needs in a cost-effective way (De Sousa 2008:31). Traditional Geography resources can easily be transformed into digital resources by using the internet or other programmes—the use of the internet for internet-based research support geographical enquiry (De Sousa 2008:31). Learners are used to using the internet and know the value of it for them. Therefore, the value for Geography teachers using ICT lies in its ability to enhance teaching with technology aid (Shepherd 1998:35; Wellington 2006:109). According to Wellington (2006:88), the advantages of using ICT in Geography IP learning are plentiful, and several claims made by enthusiastic supporters of ICT include immediate and easy access; any time any place usability; affordability; the power to use multimedia in course content, motivated students and staff; and the claim that staff save time.

2.7.7 ICT Support Visual Learning

Using visuals in the teaching and learning process plays a huge role in how learners process information in Geography (Daniels 2018:1). Learners in the IP prefer visual effects, moving pictures, and other entertainment with educational content to learn from (Haydn 2000:99; Deaney, Ruthven & Hennessy 2003:141). Some of the benefits of using visuals in teaching and learning, according to Daniels (2018), are:

- Help students engage with materials;
- Enhance tactile hand-eye-mind connections that will improve recall and retain learning; and
- Develop higher-order thinking skills

Daniels (2018:2) states that visual learning and teaching are creative ways to engage students in visual literacy, visual language, and visual communication. Visual literacy has been defined by Daniels (2018:2) as the ability to do three things:

- Decode – to understand and translate communications made with visual imagery;
- Image – to create, interpret, and manipulate mental modes of visual imagery; and
- Encode – to express thoughts and ideas using visual imagery.

The study of spatial patterns and locational knowledge development is the central parts of Geography, and the map in all its forms plays a vital tool in this process (Weeden 2003:168). Daugherty (1989:30) claims that maps are one form of communication that geographers can use to investigate a place.

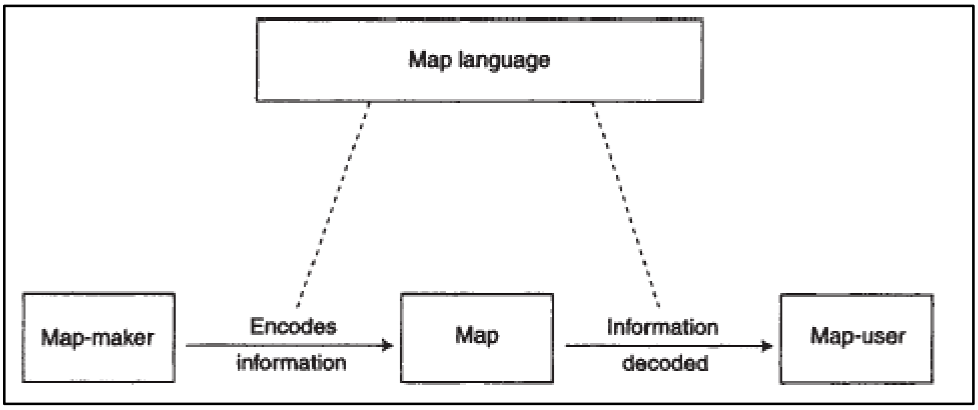


Figure 2.8 A simplified map communication system
Source: Gerber and Wilson (1989:198)

For learners to use maps as a visual tool, they need to have the ability to read and interpret the map because the map is a communication system (Figure 2.8). The structure above indicates the need for a common understanding of map language; otherwise, there will be confusion and misunderstanding in learners' learning (Weeden 2003:169). Therefore, Beaudry (2015:58) claims that technology literacy is the central component to integrate the traditional (written and spoken) and the non-traditional (visual and visual presentation) forms of literacy. He explains this in Figure 2.9 below, which was developed by Sinatra (1986).

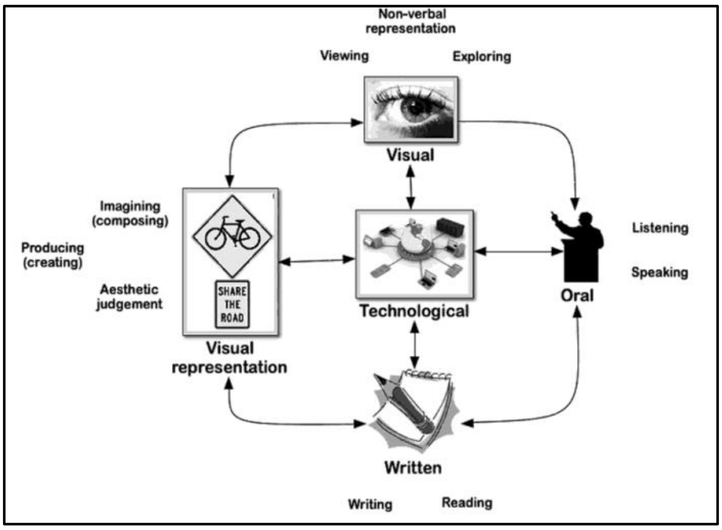


Figure 2.9 Conceptions of visual literacy
Source: Sinatra (1986)

The model suggests that visual and visual presentation are equal to the traditional modes of literacy and it is best understood as an integrative and complex concept Beaudry (2015:58). Visual representation in pictures, videos and graphics are just as necessary for learning. Since there is a growth in the power and affordances of technological tools, visually literacy, with ICT, is likely to be propelled into new prominence for geographical learning (Beaudry 2015:86). There is a wide variety of software for developing visual literacy and concept mapping (Beaundry & Wilson, 2010:78).

For Geography, this is of utmost importance because it is regarded as a visual subject (Treves, Mansell & France 2020:6). Visual literacy in Geography is defined as graphicacy, and it is seen as fundamental educational skills along with literacy, numeracy, and articulacy (Burton & Bartlett 2005:158; Eilam 2012:82; et al. 2020:6). Although graphicacy is linked to Geography as a subject, it seems best imparted through Geography on a school level. This is purely because, in Geography, maps, diagrams, photography, and other spatial documents are the tools of graphicacy and the basis of Geography (Burton & Bartlett 2005:158).

Therefore, when communicating in graphic form, learners must both encode and decode spatial information using symbols which requires the utilization and application of spatial perceptual skills and concepts (Clifford, Cope, Gillespie & French 2016:350). Since technology development, teachers and learners can have access to various visual tools (Daniels 2018:2). Visual teaching and learning resources can be accessed fast and easy with technology because of the internet, especially in project-based Geography learning when the internet can provide accurate data (Draper 2010:36).

Since Geography is regarded as a highly visual subject, multimedia will complement student learning in Geography. Therefore, ICT will automatically lead to using different multimedia streams by presenting material using both words and pictures (Treves *et al.* 2020:6). The first asset of Geography teaching and learning is the map, but many topics need more than a map, and it is difficult to understand for pupils when teachers explain and reading from books. For the

Geography teachers, content can be interactive and can link one form of content to another selectively (Van der Schee 2003:206).

Using pictures and word association helps develop IP learners' vocabulary when used with visual material and can improve enquiry learning in Geography (Lambert & Balderstone 2000:110). For example, difficult topics or concepts can be highlighted by using video, graphics or models (Taylor 1996:26). However, the development of technology leads to more developments in visual presentation tools like simulation software. Geography is a complex subject that relies on developing spatial awareness and skills and understanding a range of abstract concepts (Hassel 2000:88).

It is difficult for a teacher to illustrate these concepts ‘live’. With simulation software, this is, however, possible. These kinds of software will show a model (e.g. earthquake) with features that cannot be seen in a standard textbook. Some abstract geographical concepts can now become ‘live’ with this type of software. However, Hassel (2000:89) indicates that using simulation software requires data to download the software or simulation models, leading to a drawback.

Different multi-media resources can help geographers collect, organize, analyze and present information in words, maps, diagrams and tables from primary and secondary sources (Freeman 2003:205). This is also supported by research from McKendrick and Bowden (1999:9); Krygier and Reeves (1997:5); Lambert and Balderstone (2000:111) and Kent (2003:342), showing that audio-visual resources can be used effectively to support teaching and learning in Geography because visual presentations and representation are integral parts of Geography education.

Not only are there advantages in the use of ICT resources from a teaching and learning view, but research from Haydn (2000:99); Deaney *et al.* (2003:141) has shown that learners prefer visual effects, moving pictures, and other entertainment with educational content to learn from. Furthermore, Rodgers and Streluk (2002:2) state that out-of-date resources no longer inhibit teachers. Especially in the case with atlases, because there are many changes in national and international boundaries. ICT also bring these maps alive, turning them into places with similarities and differences to places pupils know and live. The internet disseminates high-quality materials at almost no cost and allows Geography learners in the IP to experience a learning environment rich in knowledge and experiences (Kamenetz 2009:3; Tucker & Courts, 2010:38).

2.7.8 ICT Support Assessment in Geography Teaching

According to McCormick (2004:17) and Malyuga (2016:320), the development of the web has renewed the interest in ICT use for assessment, if only because web sites as a learning environment required the simultaneous development of ways of assessing learners in Geography. New developments in ICT opened up the interest in how teachers can use ICT's to assess learners' capabilities in Geography, whether for formative or summative assessment. McCormick (2004:20) argues that ICT in the assessment of Geography might be used to improve the learning experience, where it might improve the efficiency of assessment or cope with large numbers.

Different approaches to assessing Geography skills have been developed over the years, like for example, computer-based assessments (CBA), which go beyond simple multiple-choice test formats (Redecker 2013:2). Due to technological advances, as seen in Figure 2.10, a wide range of tools are available to assess Geography teaching and learning skills.

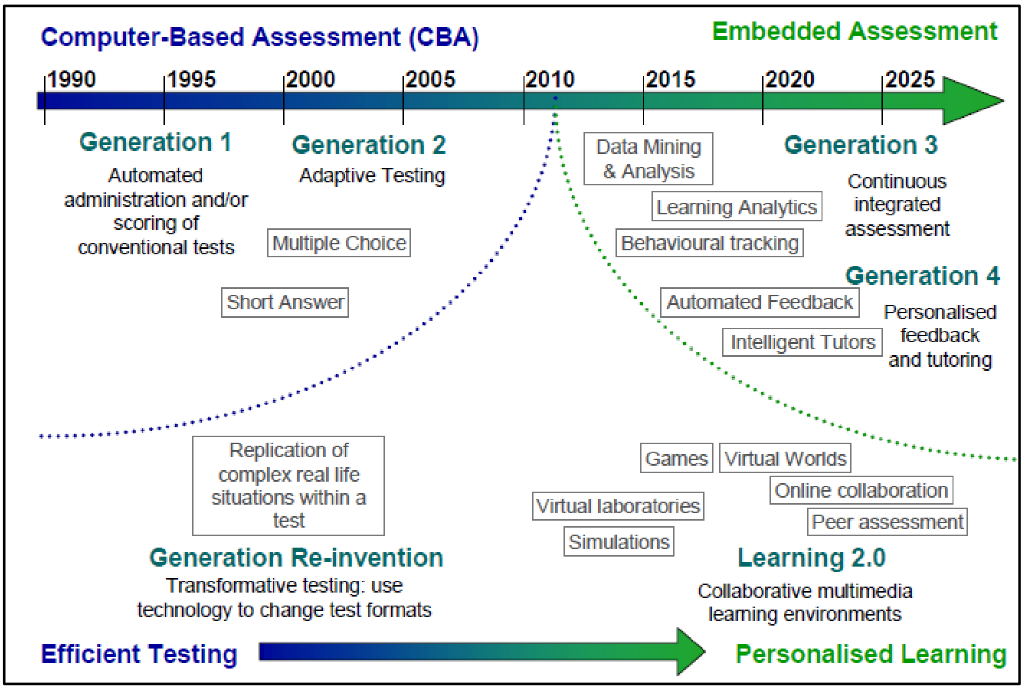


Figure 2.10 Overview of developments and trends in technology-enhanced assessment
(Source: Redecker 2013:3)

Redecker (2013:2) asserts that current available technology-enhanced learning environments, tools and systems (as seen in Figure 2.10) can support 21st-century assessment strategies, thus allowing for the development of generic geographical skills (Redecker & Johannessen 2013:81). Ibieta, Hinostroza, Labbé & Claro (2017:426) argue that adopting ICT in teaching processes entails many benefits for students, particularly a potential improvement in their learning achievement.

These infused ICT learning environments allow learners and teachers to assess performance, understand mistakes and learn from them, and these data can be used as a basis for assessment and can also be direct feedback to learners in the IP (Redecker 2013:3). Current strategies to foster competency-based assessment focus on computer-based testing, online quizzes or simple games, and e-portfolios. Computer-based testing can be used for formative and summative assessment; it has become possible to embed authentic tasks in a multiple-choice format so that that competence can be reliably assessed.

With computer-based testing, feedback becomes instant and targeted, and the difficulty of test items can be adapted automatically. However, games and quizzes for Geography teaching are scattered over the internet, isolated and limited in scope (Redecker 2013:4; Oddershede, Donoso, Farias & Jarufe 2015:150). More examples from Beauchamp (2015:210) indicate the wide variety of how ICT can be used for assessment. Written assignments can be recorded and build them collaboratively on blogs and wikis. Sound recordings can be enhanced by high-quality video, and recording can be distributed and edited.

Many of the promising assessment tools are still experimental in scope, particularly learning analytics and embedded assessment, which are expected to become the most promising technological innovations for assessing key skills in the Geography IP classroom. Although technology is constantly evolving, and some have only recently available, it is a worrying factor but not surprising that the take-up of assessment in schools is slow (Redecker 2013:5).

2.8 USE OF ICT'S IN GEOGRAPHICAL INTERMEDIATE PHASE EDUCATION SETTING

In the previous section, I gave an overview of how ICT use can benefit the teaching and learning of Geography in the Intermediate Phase (IP) classroom. In this section, however, the researcher will refer to the use of ICT in the geographical setting, meaning the use in the Geography classroom and specifically focus on how teachers can prepare (lesson preparation) and which ICT tools can be used by the teacher when teaching (lesson presentation). This will be done by describing specific ICT tools used in Geography teaching and learning using ICT.

2.8.1 Lesson Preparation

Teaching in the 21st century facing the current challenges, such as the seeking of new ways in searching for 21st learner-centered teaching and learning methods, challenges of ICT integration itself and develop skills for the 21st-century learner, as mentioned previously, can be a daunting experience for teachers (Hendriksen, Richardson, & Metha 2017:140). Therefore, one probable implication is the need to enhance teachers' lesson preparation to successfully implement Geography teaching and learning using ICT in the IP classroom (Mungai 2015:30).

Teachers at first need to know how to plan for the integration of technology in their lessons. In a study conducted by Hong (2016:42) the participants (teachers) indicate that lesson preparation or lesson plans will enhance their use of ICT in Geography pedagogical practices in the school. Research from Tondeur *et al.* (2015:568) indicated the positive impact of teachers developing lessons grouped in design teams and shared strategies for ICT improvement collaboratively. Therefore, factors involved in the integration process for teaching and learning with ICT must not be addressed individually in schools, and teachers need to know how to plan and design the learning process before integrating technology in the classroom (Uslu & Usluel 2019:518).

Sarıca, Yıldırım and Usluel (2016:1) claim that technology integration literature has shown that ten years ago, the focus was on how technology was used, while more recent studies laid more emphasis on teachers' thoughts about design for implementation. In the past five years, in the quest for a teaching preparation strategy for 21st-century skills to strengthen teacher's TPACK, a shift was towards the use of Design Thinking (DT) as a process for ICT integration preparation education (Chai & Tsai 2012:1056; Lor 2017:36).

Lor (2017:6) states that even based on Bloom's revised taxonomy of educational objectives, DT could be said to involve all forms of cognitive activities, including remembering, understanding, applying, analyzing, evaluating, and creating. Design Thinking in an education setting uses a dynamic and non-linear framework (Scheer, Noweski & Meinel 2012:12) and follows an iterative process broken down into five steps as seen in Figure 2.11 (Design Thinking Toolkit 2015:2): Discovery, Interpretation, Ideation, Experimentation and Evolution.

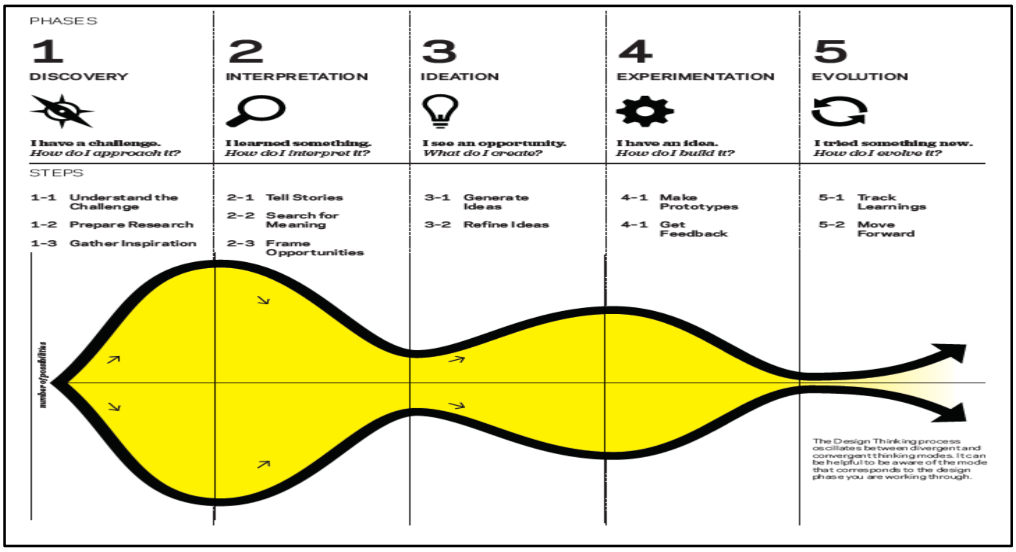


Figure 2.11 Design Thinking processes. *Design Thinking Toolkit for Educators, 2016:15.*

In the first stage, discovery builds a solid foundation for one's ideas, and in this stage, one can create meaning solutions and begins with a deep understanding of needs and challenges (Mueller-Roterberg 2018:5). In the second stage (Interpretation), you need to transform your ideas, with peers, into meaningful insights. This can be done by creating visual reminders (mind maps, Venn diagrams). The third stage (Ideation) means to generate many ideas, and brainstorming encourages you to think expansively and without constraints. Mueller-Roterberg (2018:5) suggests that the ideas can then be analyzed in a customer-oriented manner to identify weak points, and a selection decision can be made based on an idea evaluation. The fourth stage (Experimentation) is the actual stage to bring your ideas to life. During this stage, one needs to develop prototypes to make tangible, learning ideas while building them and sharing them with other people.

The final stage (Evolution) is the development of the concept over time (IDEO, 2016), which involves planning the next steps, communicating the idea to people who can help you realize it, and documenting the process. One's ideas need to be developed and tested through further experiments and feedback. Chai, Koh and Tsai (2013:40) argue that teachers must be experienced in this form of thinking. Designing a new way of learning with technology is essentially a form of contextualized knowledge creation and may open up teachers' perspective on what teaching and learning should be and what knowledge creation is.

Research done by Koh *et al.* (2015:538) argues that DT can be utilized to exploit TPACK to engender twenty-first-century learning skills and lead teachers to become more flexible and adaptive in their approach to teaching and learning, especially in teaching with technology in the IP classroom. Mishra and Koehler (2006:1017) proposed the technological pedagogical content knowledge (TPACK) framework as a means of fostering design thinking among educators.

Using a design thinking process in Geography teaching and learning will allow learners to be involved with problem-solving approaches to solving complex geographical problems and can be best achieved through collaborative and human-centered activities (Aflatoony & Wakkary 2015:1). Using design-based instruction in the Geography classroom could offer IP learners distinctive benefits to transfer their knowledge from familiar to unfamiliar contexts. Such pedagogy enabled students to develop their design-based meta-cognitive strategies in solving unknown problems (Aflatoony & Wakkary 2015:11).

Research by Aflatoony and Wakkary (2015:2) asserts that teaching design thinking was beneficial, enabling learners to make thoughtful decisions to solve simple to complex problems in their everyday life situations and enhanced critical-thinking skills. In research from Harth and Panke (2018:392), they studied lessons from grade six teachers who use DT in teaching maps and learners could worked collaboratively with an environment topic. In using a DT approach, these learners had the opportunity to experience new integration of signs, things, actions and environments. Aflatoony (2015:12) claimed that in an educational context like the above, design-thinking skills could be learned through pedagogical approaches that involve problem-based learning, project-based learning, and inquiry-based learning in classroom activities. Meaning that for IP teachers using these approaches in their teaching and learning, will help learners learn complex Geography, respiratory structure, systems and elements, interaction design, and product design (Carroll 2010:16).

2.8.2 Lesson Presentation

In this section, different ICT tools will be discussed that can be used during lesson presentations in the Geography IP classroom. According to literature (Amin 2013:38; Majumdar 2015:6; Pathak & Manoj 2018:44; Padayachee 2017:38), some of the tools that can be used in the application of ICT in the teaching of Geography in a lesson include teleconferencing, email, audio conferencing, television lessons, radio broadcasts, internet, interactive applications, interactive voice response system, cell phones, CD ROMs, laptops, tablets, interactive whiteboards or SMART boards and E-readers. In the Geography classroom, these technologies can be used more straightforwardly, according to Dlamini *et al.* (2018:53, 54, 57).

To encourage deep learning with the use of ICT's in Geography teaching and learning, the use of learning activity types (LAT) will help increase teachers' ICT competency in a lesson (Harris *et al.* 2010:575; Harris & Hofer 2016:2867; Fullan & Langworthy 2014:20). They suggested the following LAT for Geography. Table 2.4 will give Geography IP teachers a tool to use possible technologies when dealing with certain activities.

Table 2.4 LAT's for Geography

Activity Type	**Brief Description**	**Possible Technologies**
Read Text	Learners extract information from textbook, census data	Digital archives, Web sites, electronic books, CIA World Factbook
Engage in database enquiry	Using printed and digital data available online learners pursue original lines of enquiry	CIA world factbook, census data
Complete a review activity	Students engage in some form of question and answer to review content	IWB review games, survey tools
Create an illustrated map	Learners use pictures, symbols and graphics to highlight key factors in creating an illustrated map	Outline maps available online, Google Earth, presentation software

Develop a knowledge web	Learners created webs, and learner organize information in a visual/spatial manner; written or digital format	Concept mapping software, presentation software, word processor
Generate questions	Learners develop questions related to concepts	Word processor, Wiki
Role play	Learners take on a character, role, experience, or experiment with a concept, live, videotaped or recorded.	Video creation software (Moviemaker), digital video camera
View Presentation	Learners gain information from teachers, guest speakers, and peers; synchronous/asynchronous, oral or multimedia	Presentation software, videoconferencing, video creation software (e.g. Movie Maker, iMovie), concept mapping software
View Images	Learners examine both still and moving (video, animations) images; print-based or digital format	Presentation software, word processor, video creation software (e.g. Movie Maker, iMovie), image sharing sites (e.g. Flickr.com)
Discuss	In small to large groups, students engage in dialogue with their peers; synchronous/asynchronous, structured or unstructured	Discussion forum, discussion in wikis and blogs
Debate	Students discuss opposing viewpoints; formal/informal; structured/unstructured; synchronous/asynchronous	Discussion fora, discussion or commenting in blogs and wikis
Experience a Field Trip	Students travel to physical or virtual sites; synchronous/asynchronous	Virtual field trips, presentation, video creation software and Google Earth to develop their own virtual tours
Research	Students gather, analyze, and synthesize information using print-based and digital sources	Digital archives, word processor, concept mapping software to structure

Adapted from: Harris; Hofer; Schmidt; Blanchard; Young; Grandgenett and Van Olpen (2010:596) and Harris and Hofer (2016:2866).

Literature (Hassell 2000:85; Catling & Willy 2009:79; Leeder 2006:111; Tilbury & Williams 2003:207; Gannon 2015:99-102; Freeman 2003:206; Tripathi 2002:1) suggests ways (in Table 2.5) in which ICT's can be used in Geography teaching and learning in the IP.

Table 2.5 ICTs in Geography

Presentation packages: PowerPoint, etc.	Research information for investigations. Support decision making, e.g. on the use of rainforest. Develop presentations on different countries
Simulations and modelling software	Investigate the effects of migration on population change, etc.
Digital images (internet, cameras)	Record information on fieldwork, view of buildings, investigate flood hazards, etc.
Email, web links	Exchange information, develop webpages, collaborations with other schools about countries under study. Develop WebQuest about any Geography information. Virtual teams of learners can work together to solve problems
Google maps	View places in student lives. Ask students about landmarks, etc.
Google Earth	Create virtual field trips
Mapmaker Interactive	A geospatial tool to show students patterns of rainfall, land cover, etc.
Interactive Whiteboards	Animated geographical features like volcanoes, etc. Sound and videos can be attached to worksheets, etc.
Automatic data logging weather station	Collect weather data electronically
Art and design software	To create and modify digital images of landscapes.

Referencing software (Encarta, etc.)	To learn about other countries.

Context and concepts that make up the essence of school Geography are relatively constant but the skills and techniques underpinning geographical understanding change more rapidly with time (Freeman 2003:3). For this reason, technology pervades the pedagogy and methodology of Geography so that we can now gain access to instant resources electronically.

2.8.2.1 Use of Interactive Whiteboard (IWB)

An interactive whiteboard (IWB) is a "large, touch-sensitive board which is connected to a digital projector and computer (Ormanci *et al.* 2015:532; Tunaboylu & Demir 2017:82). The projector displays the image from the computer screen on the board; the computer can be controlled by touching the board (as seen in Figure 2.12), either directly or with a special pen (BECTA 2003:1; Tunaboylu & Demir 2017:82).

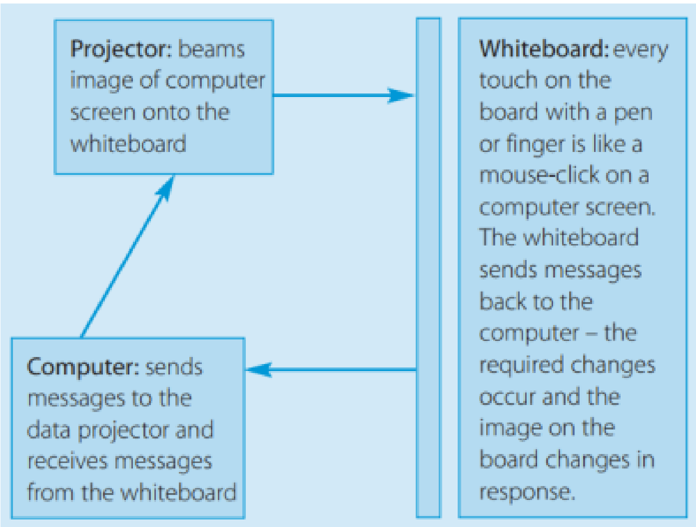


Figure 2.12 Working of an IWB: BECTA, 2004

PowerPoint is part of the MS Office suite by Microsoft to be used for creating presentations. Since technology has changed the classroom by replacing chalkboard using projectors to engage with learners, these projectors have been used in conjunction with PowerPoint presentation software. PowerPoint presentations for education are relevant in the learning of any subject and have transformed the teaching-learning process (Onivehu & Ohawuiro, 2018:48).

Using PowerPoint presentations will enrich the Geography teaching-learning environment because it can convey textbook concepts in a more visually appealing way (Priva 2017:1). This can be done using various forms of pictures, animations and graphics (Jones 2003:2; Sagar & Pandey 2014:77; Priva 2017:1). Furthermore, these presentations are more appealing to sensual audio-visual modalities, captivating motivation, and foster critical skills and concretization of abstract concepts in IP teaching and learning (Jones 2003:2; Sagar & Pandey 2014:78). This is especially important for Geography, whose learning necessitates images, drawings, visuals and graphs, realia and natural resources (Onivehu 2018:49). The PowerPoint slides help Geography learners appreciate the details, distinctive features, and critical points in the slides' figures when graphic presentations are used (Bartsch & Cobern 2003:77).

Using PowerPoint presentations for Geography teaching and learning will benefit Geography teachers in the IP. The instructional purpose is to describe abstract concepts and whose learning needs images, drawings, visuals and graphs, realia, and natural resources. (Bartsch & Cobern 2003:78; Yucel 2007:713; Onivehu & Ohawuiro 2018:49). Onivehu and Ohawuiro (2018:49) argue further that the effective use of PowerPoint presentations is leverage to help learners in the IP to encode information into the auditory working memory and relevant images into the visual working memory.

2.8.2.2 Benefits of using IWB

The British Educational Communications and Technology Agency (BECTA) listed several benefits for IWB for teaching (BECTA 2004:10). Some include the following:

a) Ability to prepare and access saved work:

Graphs, charts, diagrams and text can all be prepared in advance in a suitable software package and accessed during the lesson. This allows teachers to provide models and demonstrate work quickly and efficiently.

b) Access to multimedia files:

Sound, moving and still image files are readily accessible using whiteboard technology. This can be useful as an additional presentation of a concept or scene-setting and helps to bring topics to life

c) Software choice:

The range of software available for curriculum subjects is growing, and specialist software supports learning in various ways. For many topics, teachers now have access to a wide variety of materials, which can be explored on the whiteboard

d) Involvement in the lesson:

Pupils seem to enjoy using the whiteboard technology and quickly acquire the techniques to manipulate the software and actively participate in their learning.

e) Rapid response:

Pupils receive immediate feedback on activity on the board – and they are not afraid to make mistakes.

IWB acts as a focus for learner attention and increases engagement in the classroom because of its flexibility and visual power to engage learners from lower-achieving groups (Alkis 2020:17; OFSTED 2008). The IWB has offered opportunities both for the teacher and learners, one of which is to make lessons more enthusiastic regarding the lessons (Bardakci & Kocadağ 2020:2). The IWB can be used with different learning activity types to complete and review Geography IP activities and show and teach animated geographical features like volcanoes. (Gannon 2015:99-102; Harris & Hofer 2016:2867).

2.8.2.3 How to use PowerPoint for effective Geography teaching

PowerPoint is one of the software programmes that are regularly used by teachers in the classrooms for those who have resources to utilize ICT. According to Onivehu (2018:48), PowerPoint's basic features are easy to utilize, and presentations can be done by simply inputting texts on coloured background templates, pictures, or a more complex option can be employed by adding tables, pictures animation, sound effects and video clips. Onivehu (2018:49) further elaborate that changes can be made easily by way of themes and templates that can be used as a guide, and it is also suitable for large class sizes.

Research from Mayer and Moreno (2003) indicates that it is not just about presenting pictures or words on a PowerPoint slide or by animations, but how will this lead to meaningful multimedia learning. Multimedia learning is described as learning from words and pictures, and multimedia instruction is defined as presenting words and pictures intended to foster meaningful learning (Mayer & Moreno 2003:43; Mayer & Mayer 2005:1; Brunken, Plass & Leutner 2003:53). Learners are using their eyes and ears when watching presentations, which might impact their cognitive ability to process the work and instruction accordingly, leading to cognitive overload (when the learner’s capacity for cognitive processing is severely limited) (Mayer & Moreno 2003:43). The authors describe meaningful learning as a deep understanding of the material. The presenter attends to important aspects of the presented material, for example, to mentally organize it into a coherent cognitive structure to integrate it with relevant existing knowledge.

The research from Mayer and Moreno (2003) gives us some insight into how we need to present, develop, or choose our presentations to better the cognitive capacity of learners to understand better and remember the content longer. Some of their recommendations are as follow: if there are mostly visual channel (eyes), it is better to use narration than as on-screen text; when both channels (eyes and ears) are overloaded, provide pre-training in the names and characteristics of the components or when narrative presentations, present narration and corresponding animation simultaneously to minimize the need to hold presentations in memory.

According to Mayer and Moreno (2003:50), meaningful learning can require a hefty essential cognitive processing for learners. Therefore, instructional designers should design multimedia instruction in ways that minimize any unnecessary cognitive load in the IP.

2.8.2.4 Using of simulations in IP Geography teaching and learning

Although simulations are centuries old, the use of such tools for systematic learning is more recent. In the late 2000s, there has been growing interest in using simulation to support learning in the education setting (De Freitas 2006:343). Simulations are cleverly designed models to engage intelligent, goal-orientated manipulation of reality (Pease, Pérez-Lapeña & Lant 2019:40). Simulations are one of the learning models that can be used to enhance Geography learner's understanding (Gadeng, Maryani & Ningrum 2019:2).

With this method, the classroom will change into a situation as an actual situation. Therefore, this will demand learners and teachers' active role during the learning process (Gadeng *et al.,* 2019:2). Some of the advantages of using simulations in Geography teaching and learning in the IP, as described by Cornwell (1996:9) and Pease *et al*. (2019:40), are the following:

- This, in itself, enhances learning and the retention of information;
- Serve the role of a mental gymnasium, exercising and challenging people's mental capacities;
- Learning that has already occurred through other informal or non-formal methods is reinforced;
- They are playable and overcome the initial obstacle of not knowing what to do;
- Simulation is particularly effective in promoting and practicing Geography skills such as problem-identification, relating cause and effect, identifying alternative courses of action and problem-solving;
- Active learning is more effective than passive learning;

- An excellent opportunity is provided for experiencing situations which, in real life, would be too time-consuming, costly or dangerous; and
- It involves moving away from one-way communication between teacher and learner and becomes an interactive and mutual learning process.

Watson (1993:10) suggested that simulations provide a context for a functional learning environment that capitalized on the role of simulations to both stimulate enquiry and discourse.

2.9 CHALLENGES IN THE TEACHING AND LEARNING OF GEOGRAPHY IN THE INTERMEDIATE PHASE

Teaching Geography in the Intermediate Phase (IP) school curriculum is not as straightforward as it seems. Teachers have the role of guide learners towards the observation, clarification and understanding of diverse socio-territorial realities, and these elements will lead to the discovery of Geography's dynamic and complexity. According to Lache (2011:76), Geography is not just related to the observation and reading processes of different realities and sceneries at school, it also has to deal with a deeper understanding of new expectations and horizons of spatial knowledge.

Geography has a clear target; its learning process must motivate learners to know, understand, read, and assimilate space. In executing the above, different challenges occurs in the teaching and learning of Geography. In this section, the focus will be on the challenges in IP Geography teaching and learning.

2.9.1 Content Knowledge

Hong, Harris, Jo and Keller (2018:26) indicated in literature that it is well known that teaching is a complex activity. It requires multiple, intersecting, and interdependent types of specialized knowledge used in complex recursive processes before, during, and after interactions with learners. Establishing specific parameters of knowledge needed by Intermediate Phase Geography teachers is necessary to attend to content knowledge and pedagogical content knowledge necessary for effective teaching of geographic concepts, skills, and practices to foster geographic literacy (Bednarz, Heffron & Huynh 2013:29).

The core concepts in Geography education are space, place, landscape, and sustainability (Yli-Panula *et al.* 2019:2), and teachers need to understand why and how these topics are easy or more difficult for learners to understand and how to present the topics in ways to help learners to comprehend them effectively in their learning. According to the Geographical Association (2020), it is not about the facts but also the understanding of underlying physical and human processes, systems and interrelationships, geographical terminology, and skills, such as fieldwork and mapping, data handling research.

Findings suggest that due to the high level of integration of environmental and sustainability in the Geography National Curriculum Statement, IP teachers experienced difficulties integrating such concerns in their lessons because of the lack of understanding of the concepts (Raselimo 2014:122). It was revealed that Geography teachers' understanding of environmental education is skewed towards the environment's biophysical dimension. (Raselimo & Wilmot 2013:120; Preston 2015:122). Therefore, teachers must know Geography's core characteristics, which is space and place, and geographic key questions.

Teachers need to teach learners basic Geography competencies: 1) knowledge about world phenomena, processes and distributions, including topography, (2) issues of place and space, such as inequality and sustainable development. And (3) geographic skills, such as map skills (Blankman *et al.* 2016:64). Given the diversity of approaches to the nature of Geography as a subject, it influences how the subject is taught in school (Brooks 2010:144). Teachers consider school Geography different from their studies because the undergrad courses rarely cover all geographical content areas in the school curriculum (Brooks 2010:145).

Therefore, Geography teachers do not have detailed knowledge of all the topics required to teach. Lanche (2011:77) explains that one of the biggest challenges in school is to get rid of isolated contents of Geography and understand a complex and interactive system of objects and actions that must be studied from elementary to high school, keeping in mind students' cognitive stages, intellectual maturity, and socio-cultural contexts. Tambyah (2006:2) stated that the relationship between primary teachers' threshold content knowledge, their conception of professionalism and personal identity raises could create challenges in the quest for quality teaching and learning in Geography.

Geography teachers need to develop a professional identity, especially when teaching geographic issues in context. Teacher's pedagogical content knowledge goes beyond the knowledge of subject matter per se to the dimension of subject matter knowledge for teaching (Shulman 1996:9). Therefore, such knowledge can make the teachers' intuitive, practical know-how and technique into visible, codifiable, professional knowledge for Geography teaching and learning in the IP (Goodson & Hargreaves 1996:6).

2.9.2 Pedagogical Skills

Regarding the necessary skills and teaching methods, not all Intermediate Phase Geography teachers had updated and had rigorous professional training in the subject and pedagogy to carry out solid Geography teaching; which will compromise instruction quality (De Guzman, Olaguer & Novera 2017: 64). The instruction aspect is challenging, necessitating intervention, specifically the need to utilize innovative and more effective teaching strategies.

Van der Westhuizen & Golightly (2015:422) assert that Geography teachers need to possess geographic content knowledge and the pedagogy or teaching methods that best facilitate student learning in Geography. A IP teacher needs to have the general pedagogical knowledge, which refers to broad principles and strategies of classroom management and organization that appear to transcend subject matter" (Shulman 1987:8).

Catling (2013:178) argues that teachers' understanding of Geography and geographical concepts and skills and how they teach it is drawn from their understanding of their school experiences. Catling (2013:169) further explained that in order to help learners comprehend the world, teachers' must develop their awareness of everyday geographies to improve their Geography teaching. This requires that teachers need to have pedagogical skills that require that they have insight into the importance of the subject, the main geographical issues, and how children learn Geography (Blankman *et al.* 2016:61). Hong (2018:39) elaborate that IP teachers need to know general Geography instructional strategies, knowledge to combine general and topic-specific instructional strategies, and knowledge of topic-specific instructional strategies in Geography.

Lambert and Bolderstone (2010:95) provided strategies to improve teachers' pedagogical skills in the Geography classroom. Firstly, teachers can use exposition as a teaching strategy. The purpose is for learners by listening, thinking and responding to what the teacher has to say. The main uses for this strategy are, a) to make clear the structure and purpose of the lesson; b) informing, describing and explaining (or demonstrating); and c) using questions and discussion to facilitate and explore pupil learning. Secondly, make use of questioning in the lesson.

By asking questions and build on learner responses, teachers can skillfully lead and shape learners thinking and learning. Finally, teachers can make use of collaborative learning. Learning for understanding is a social process. Therefore, collaborative learning can enhance comprehension where the intellectual exchange takes place in the IP Geography classroom.

2.9.3 Assessment

Lambert (2003:255) defines assessment as the processes by which teachers on others' learning make judgements of value, and it is a highly skilled activity requiring confidence and competence (William 2011:3). This view is supported by the SA DoE (2012:3) and Drake (2017:155), who claims that assessment is a process of identifying, gathering, and interpreting information about learners' performance using various assessment forms. Wright (2008:3) added that assessment involves four steps: generating and collecting evidence of achievement, evaluating this evidence, recording the findings and using this information to understand and thus assist the learner’s development to improve and guide the process of learning and teaching.

Assessment is seen as a continuous process (Brown 2004:304) that has not only been handled at the end of the learning process (SA DoE 2011:23), but it is central to the entire geographical teaching and learning process (Catling & Willy 2009:156). Hong *et al.* (2018:52) explained that Geography teachers need to know assessment based on two categories: 1) knowledge of which dimensions of Geography learning to assess and; 2) knowledge of methods of assessing Geography learning. Regarding the dimensions of Geography learning to assess, Hong *et al*. (2018:52) assert that the dimensions are based on the nature of geographic literacy, geographic ways of thinking, and geographic skills and all three need to be assessed. The knowledge of methods refers to knowledge of particular methods that can be used to assess specific dimensions and aspects of students' Geography learning in the IP classroom. This includes knowledge of specific instruments, techniques, procedures, approaches, and activities that can be used to assess students' geographic knowledge, skills, and applications of both.

However, teachers have challenges in the execution of the above. The number of activities - marking, assessments and recording - they had to administer while planning for teaching and learning is a challenge for teachers (Mncube 2013:169). Limited support to help teachers provide good assessment opportunities in Geography is also a barrier to teachers (Owen & Ryan 2001:145; SA DoE 2011:49). Regularly feedback to learners regarding their geographical learning, skills, achievements, and needs is limited because of the assessment load (OFSTED 2008:5; Hurry 2017:166).

Catling and Willy (2009:166) suggested different approaches to assessment in Geography to support and develop children's learning. These include sharing learning intentions, effective questioning, providing feedback and marking work, self and peer assessment and recording and reporting geographical learning (Golightly 2020:4).

2.9.4 Resources

Every school's important mission is to provide quality education; however, public schools face diverse problems that hindered the delivery of quality education, and some of these are the inadequacy of facilities and instructional materials (De Guzman *et al.,* 2017:64). Utami (2016:315) states that the function of learning materials is:

1) guidelines for teachers to direct all of its activities in the learning process, as well as a substance competency that students should control

2) guidelines for learners who will direct all activities in the teaching-learning process as well as a substance of competence which should be learned and mastered and;

3) an evaluation tool of learning outcomes achievement/mastery.

However, the challenges of resources for the teaching and learning in the IP of Geography is also widely known, and shortages of modern textbooks, atlases, maps, reference books and globes have a significant impact on geographical work (William & Catling 1985:245; Larangeira & Van der Merwe 2016:120). According to Gokce (2009:6), map reading and the use of the globe are necessary skills that learners must learn and develop, which not all classrooms have, leading to difficulties in teaching space and place concepts.

Maps have been described as the geographer's tool, and the use of these resources is essential to heighten, enliven and extend children's awareness of the world (William & Catling 1985:245; Catling 1999:60). Using atlases and maps frequently in practical activities will enable IP learners to develop appropriate geographical skills and independent learners (OFSTED 2011:9). Furthermore, Wilmot and Dube (2015b:96) assert that map literacy is an important aspect of the curriculum for young learners to interpret complex visual information. Research from De Guzman (2017:67) indicated that teachers agreed that the mastery of using maps, globes and charts was also identified as a problematic aspect of teaching Geography lessons. Not only is it the non-availability and scarcity of funds for resources that are a challenge but also how it must be used in the classroom that is of importance because some teachers did not have the necessary training in their undergrad studies or professional development in the use of Geography resources (Harris, Wirz, Hinde & Libbee 2015:165).

One of the major teaching resources used in the Geography classroom is the textbook because it is an inviolable learning/working tool for learners (Đukičin, Bibić, Lukić & Dubovina 2014:89). Learners depend on their teacher and the textbook they use to access knowledge (Knight 2015:2). Teachers experience various challenges with textbooks. Because of the shortage of textbooks in some schools, the teacher will only use one textbook. The use of only one textbook and out of date will force learners to repeatedly undertake low-order tasks and not use the latest information (Harris *et al.* 2015:164).

Teachers need to choose appropriate textbooks; therefore, Đukičin *et al*. (2014:90) view that illustrations in the textbook are a very efficient and pedagogically favourable tool. Therefore, Geography textbooks cannot be imagined without adequate supplementary illustrations which accompany the instructional content. Some textbooks' narrative style was highlighted in De Guzman's (2017:66) research with no definitive explanations that could enhance learners' understanding of the text. According to Butt (2002:44), the classroom's challenge is not to use the textbook to occupy learners by copying passages, complete low-level exercises, and engaging in repetitive tasks. If the case, learners will not develop the range of geographical skills.

Other text, such as newspapers, cartoons and poems, also has its place in Geography teaching (Şeyihoğlu & Duman 2016:686). Newspapers can be used, for example, for particular events to create geographical themes. However, caution needs to be taken to link to particular themes during the term or semester, and it is up to date information. Learners like, but many are very sophisticated and convey complex ideas and information for younger learners (Şeyihoğlu & Duman 2016:688). Literature, poetry and music are highly stimulus material for the Geography teacher (Butt 2002:46). However, their use's real purpose must be clear to both teacher and learner not to be viewed as entertainment, especially in the IP classroom.

Regarding worksheets, the development thereof can pose a challenge to the Geography teacher to be used effectively in the classroom. Using worksheets in the Geography classroom can develop thinking skills, ask and answer questions, make connections, and assess the improvement in learners' learning outcomes

(Susantini & Lisa 2016:76). Therefore, Geography teachers need to have the skills to develop worksheets with good design and features that can provide information and learning a learning experience (Tomlinson 2012:145).

Mutlu, Ilker, Buket & Ayse (2015:853) argue that learning needs to be designed by learners' life experience to construct geographical knowledge and skills in the IP. Therefore, the worksheet's material also contains facts, data and maps related to the material covered. Worksheets should be laid out, visually engaging, and perhaps include images or data captured from the internet and differentiated to the class's needs (Butt 2002:46; Hunt 2018:125).

2.9.5 Context

Viennet and Pont (2017:34) describe the school context as the institutional setting that comprises the formal and informal social constraints that regulate the implementation process in a given education system. Schools differ in their location, school culture, composition of the teacher team, resources and physical infrastructure (Vanbuel & Van den Branden 2020:2). Therefore, school context is an important component for teacher effectiveness and learner development, either directly or indirectly (Muller 2015:2). The following contextual challenges will be discussed: overcrowding of classrooms, heavy workload, the inefficiency of teaching time and the lack of language.

Mncube (2013:168-171) states that overcrowding classrooms diminish the quantity and quality of teaching geographical knowledge, skills and attitudes. The physical school context influences the classroom context in terms of size, which refer to the number of learners that it may comfortably accommodate from effective learning to take place (Madikizela-Madiya 2018:275). The number of learners in the classroom will influence the Geography teacher's teaching method. For example, an overcrowded classroom often compels a teacher to give individual rather than group activities in the class (Madikizela-Madiya 2018:276). Therefore, according to Rands and Gansemer-Topf (2017:31), it is crucial that the classroom design needs to be useful for Geography teaching and learning and create affordances that will promote student engagement. Rands and Gansemer-Topf (2017) suggest in their research that the use of portable whiteboards and optimal teaching space, which is flexible in terms of access to equipment and the internet, will allow for the use of group work and allowed for rapid assessment of understanding.

The IP Geography teacher's workload is double because they are also teaching History as part of the Social Science subject in primary school (SA DoE 2011). This is creating a heavy workload because they need to develop lessons for both History and Geography. In most cases, they are also teaching other subjects in the school. Other teacher responsibilities, like, assessment, contact with parents, disciplining learners, staff meetings, extramural activities, etc., will eventually increase the Geography teacher's workload (Dlamini & Mbatha 2018:18; Graham, Stols & Kapp 2020:753). These workloads often mean less dedication or less engagement which eventually affect their teaching performance and outcomes (Bettini *et al.* 2018:113; Nasution, 2020:303). In some cases, as indicated in the research from Mwakasangula and Mwita (2020:98), this overloading of work can lead to the increase of stress levels in the workplace, which will have a ripple effect on the performance of the Geography teacher and can lead to a decrease in the quality of Geography education in schools.

De Guzman, Olaguer and Novera (2017:68) also indicate another challenge of the inefficiency of time allocated for Geography in schools. The time allocated for IP Social Science (History and Geography) in the CAPS document (SA DoE 2011) is only three hours per week, translating to one and a half hour for Geography per week. According to De Guzman *et al.* (2017:69), when teaching Social Science, not enough time are allocated in some cases for Geography during the periods. Although curriculum documents state the time allocation clearly, the teacher does not adhere to it all the time, especially in subject classes, where the teacher’s preference is History (Xuan *et al.* 2015:126). According to Madikizela-Madiya (2018:279), this time allocation is inadequate considering Geography content's extent and depth. This relates to a situation that teachers will, in some cases, will not have enough time to complete the curriculum, which makes them select some of the content to teach. Taken the inadequate time allocation into consideration, when teachers are absent, this will also negatively affect the completion of the curriculum and the development of learners (Wilmot & Irwin 2015:140).

Another challenge is the lack of language for the teaching and learning of Geography in the IP classroom. There is a perception that if the language of teaching and learning were poorly developed of learners, the teaching of Geography concepts, ideas and terms would be difficult to achieve (Mncube 2013:169). Geography teachers resort to teaching the subject in their mother tongue to facilitate learning and understand more easily. According to Maduane (2016:40), this practice worsens because the mother tongue scientific corpus of Geography in the IP are underdeveloped. Maduane (2016) asserts that code-switching as a practice has consequences for learners' development and performance.

2.9.6 Teacher perspective and attitudes towards ICT

Many teachers lacked the knowledge and skills to use computers and integrate it into teaching and learning in primary and secondary schools (Bingimlas 2009:238; Pelgrum 2001:172; Balanskat, Blamire & Kefala 2006:50). The lack of knowledge and skills will lead to resistance to change and possible negative attitudes and teachers' perspectives towards ICT's. Research done by Gomes (2005:63), BECTA (2004:7) and Bapela (2015:39) indicated that teacher's resistance to change and confidence could be a significant barrier in the uptake of ICT by teachers in the IP Geography classroom.

Integrating new technologies in the geographical education setting requires change; teachers, however, experience the change differently because beliefs influence what they do in the Geography classroom (Bingimlas 2009:239; Chai & Tsai 2012:1057). Moreover, teachers find it tough to create a technology-enhanced lesson as they presume that it requires time away from real lesson learning (Kafyulilo & Keengwe 2014:45). Limitations on teachers' ICT knowledge make them feel anxious about using ICT and thus not confident to use it in their teaching. It is argued that the lack of confidence and experience with the use of technology will influence teacher's motivation to use ICT in the Geography classroom (Cox, Preston & Cox 1999; Osborne & Hennessy 2003:36; Balanskat *et al.* 2006:36; Gikunda 2016:14; Mahdum, Hadriana & Safriyanti 2019:296). Literature (Subramanien 2013:49; Hong 2016:33) indicates that teachers' attitudes towards new technology will lead to the confidently use of technologies in teaching and learning usefulness of ICT. This suggests that when a teacher is optimistic about a resource, such as a laptop, and can identify its potential uses for classroom and personal purposes, then that teacher would most likely use the resource in the classroom for ICT implementation.

According to Nkula and Krauss (2014:243), every teacher views and perceives a teaching situation differently, bases their pedagogical or traditional beliefs, concludes and decides on the materials to use (Liu 2011:1013). Thus, experienced teachers feel more comfortable with traditional teaching methods and find it challenging to adapt to ICT (Mathipa & Mukhari, 2014:1217).
Buabeng-Andoh (2012:148) argues that IP teachers need to understand how ICT can make teaching and learning more motivating, engaging, and more enjoyable for negative attitudes to changes.

2.9.7 Knowledge of ICT's

Hernandez (2017:340) and Lorenzo and Trujillo (2018:191) describes the knowledge of ICT's as the ability of teachers to use ICT in their teaching and practice. In the context of digital technologies in Geography teaching and learning, IP teachers need to update their knowledge and skills as the school curriculum and technologies are changing (Srivastava & Dey 2018:76). Geography teachers must be equipped with competencies to use digital technology tools for their professional development to execute quality Geography teaching and learning using ICT in the Intermediate Phase (IP).

These competencies need to include, and is not limited to the use of technical skills but also teachers to have knowledge domains that will help them to recognize relevant technology and how to use it to access and present content in the most effective ways (pedagogy) to enhance Geography learners' learning (Subramanien 2013:37; Mbatha 2015:8). Mbatha (2015:9) posits that it is pivotal that Geography teachers need to be equipped with ICT skills to integrate technology into their instructional practices effectively.

A lack of knowledge about technologies automatically results in teachers not using ICTs in the teaching and learning of Geography (Morgan & Tidmarsh 2004:178; Bhero 2012:38; Chisango 2019:127). Furthermore, successful implementation of technology in schools is also not about acquiring ICT skills but assisting teachers in their daily engagement with learners. Thus, the availability of ICTs at primary schools does not necessarily imply that IP teachers will adopt the teaching and learning process technologies however (Srivastava & Dey 2018:78; Chisango 2019:128).

2.9.8 Training in the use of ICT integration

In a study by Pelgrum (2001:172) and Mlambo, Chukwuere & Ndebele (2018:83), it was noted that there were not enough training opportunities for Geography teachers in the use of ICT in a IP classroom environment. The lack of digital literacy training, lack of pedagogic and didactic training and training in specific subject areas are obstacles for using new technologies in classroom practice (Mwapwele, Marais, Dlamini & Van Biljon 2019:4; Umugiraneza, Bansilal & North 2018:4).

The training issue is complex (Chigona 2011:4; Karolčík, Čipková & Mázorová 2016:329) because it is crucial to consider several components, like time for training, pedagogical training, skills training and an ICT use in initial teacher training. Cox *et al.* (1999), Haydn 2014:464, and Dong (2018:636) asserts that training should focus on pedagogical issues if teachers are to be convinced of the value of using ICT in their teaching.

Training programs need to focus on pedagogical practices concerning ICT. Therefore, Newhouse (2002:45), Karolčík *et al.* (2016:329), and Dong (2018:636) states that “teachers” need computer skills, but they also need to develop skills in integrating computer use in their teaching and learning. Pre-service teacher education plays a significant role in providing opportunities for experimentation using ICT of what is available during teaching practice (Walshe 2017:609). There is a need for additional professional development and support because teachers need more training and support for integrating technology in the day-to-day Geography classroom in the Intermediate Phase (Rabah

2015:27; Ghavikfekr 2016:43). The rapidly changing technological environment makes this even more critical because teachers need to be updated about their classroom's latest software. In Rabah's (2015:28) research, participants highlighted that they need specific training related to student's assessment when assessing ICT-related outputs.

Since curricular planning and evaluation are intertwined, there is a necessity to re-examine the evaluation approaches when ICT is integrated into pedagogical programs.

2.9.9 Lack of Resources

A lack of access to resources is also a barrier that can discourage teachers from integrating new technologies in Geography IP teaching and learning (Bingimlas 2009:239; Pombo, Carlos & Loureiro 2017:217). In some cases, the inaccessibility of ICT resources is not due to the non-availability within the school but can result from the poor organization of resources or lack of personal access (BECTA 2004:14; Pombo *et al.* 2017:217; Kamalizeni & Naidoo 2018:126). Other barriers, like infrastructure barriers, are common in South Africa and are one of the main obstacles to implementing ICT in schools (Bingimlas 2009:240; Padayachee 2017:37; Dlamini & Coleman 2017:viiii).

Inconsistent investments in equipment and infrastructure in South African schools are also a challenge for integrating ICT because of the large budgets needed (Rabah 2015:26). According to Chigona (2011:3), one of the challenges is that disadvantaged schools may not afford the programs and expensive hardware and software. This may result in an increased digital divide between the schools in affluent areas and disadvantaged areas. Having no access to the internet, for example, will have an impact on accessing a variety of available geographical, educational software.

Technical problems, such as loss of connection to the internet, slow computers, etc., are also barriers for teachers. This will have impeded the lesson's smooth delivery or the classroom activity's natural flow (Sicilia 2005:43; Lawrence & Tar 2018:90). The lack of technical support will result in technical maintenance not being carried out regularly, which may discourage teachers from using ICT because of the fear of breaking equipment (BECTA 2004:16; Lawrence & Tar 2018:90). In a study done by Rabah (2015:27), he indicated that there could be long delays in solving technical problems and teachers felt that they are not adequately supported.

Hadley and Sheingold (1993: 262) and Ra, Chin & Lim (2016:78); claims that although teachers may not face all of these barriers, any one of these barriers alone can significantly impede the integration of ICT in the classroom. Teachers are the key to the change process in the classroom, and this autonomy provides teachers with choices to adopt, adapt, or reject an instructional reform (Dexter, Anderson & Becker 1999:224; González-Sanmamed, Sangra & Munoz-Carril 2017:634). Although there are considerable benefits in using ICT resources in the IP, teachers' knowledge of using and implementing them can help achieve geographical teaching and learning outcomes. Lambert and Morgan (2010:157) argue that although technologies are not necessarily absent from schools, schools and teachers tend to use them in ways that operate within an old ‘mind-set’. For instance, the web page or PowerPoint slide show stands in for paper, pencil and crayon as a medium for presenting stories or work. Computers enhance teaching and learning through many channels, including ‘presentations’ ‘simulations’, and ‘animations’, and offer learners and teacher the opportunity to practice and analyze (Addam 2014:30; Adefila, Opie, Ball & Bluteau 2020:50). In all these, the text is used extensively in computer and communication technology (Moreno, Mayer, Spires & Lester 2001:178; Bolkan 2019:61) because of its potential to improve human learning because it allows a learner to develop a social relation with technology.

To simple place text materials on an electronic screen and hope that it works in a virtual environment will not enhance learning (De Sousa 2008:42; Naik 2017:146). The text needs to enrich with moving images, video or audio, to bring dull or complicated subjects to life, which is critical to learning and appeals to learners' visual sense (Wellington 2006:90; Ugwuanyi, Okeke, Nnamani, Obochi & Obasi 2020:283). Pictorial and verbal presentations are being regarded by Mayer (2001:67; Naik 2017:147) as more instinctive and closer to the visual experience and will develop deep learning because learners are required to make connections between them. Since animation graphics (images and motion) serve as a memory reminder to make sense of the information (Starr 1996:1; Johnson & Christensen 2011:294; Bolkan 2019:63), caution needs to serve just showing the animation on the screen. Research from ChanLin (1998:2), Chou, Chang & Lu (2015:73), and Ugwuanyi *et al.* (2020:283) indicated that the use of multi-media programs resulted in more in-depth learning when the visual material was combined with auditory explanations by the teachers.

2.10 CONDITIONS FOR THE SUCCESSFUL INTEGRATION OF GEOGRAPHY TEACHING AND LEARNING USING ICT

When planning for implementing ICTs in teacher education, the planning should consider necessary conditions to mitigate the challenges or possible challenges when integrating ICT in the IP Geography classroom (UNESCO 2002:72; Ghavifekr *et al.* 2016:38); Kihoza, Zlotnikova, Bada & Kalegele 2016:108). The following paragraphs will oversee the mitigation factors necessary for the successful integration of Geography teaching and learning using ICT in the Intermediate Phase.

2.10.1 Management and leadership for effective ICT integration

One of the most important conditions for the successful implementation of Geography teaching and learning using ICT in the Intermediate Phase (IP) is that the school management must take the lead in school reform to implement innovations and improve the 21st century. Therefore, schools need a different kind of leadership (Fullan & Langworthy 2014:47). Management, especially the principal, can influence, lead, and motivate Geography teachers to encourage innovative teaching and learning in the IP (Akbaba-Altun 2006:186; Thomas 2006:31).

Walsh (2002:5) argued that without the principal's extended commitment, it is impossible to integrate ICT effectively into schools and therefore, his involvement will determine how ICT will be used by IP Geography teachers and learners (Drago-Severson 2004:xxi; Johnson 2004:xvii; Soule 2003:8; Zepeda

1999:14). Principals and management need to understand ICT integration in the Geography classroom in the IP, take appropriate action and strategies, and which leadership and management style to apply to have a positive influence (Walsh 2002:3). ICT integration is a comprehensive process, teaching methods will change for example, and principals should encourage teachers to use ICT in their instructional practices (Ho 2006:2).

Using ICT in the Geography classroom forms an important component that can inspire IP teachers, assist them with the teaching profession's challenges, and promote lifelong professional development (Dirksen & Tharp 1996:2; Loveless & Dore 2002:154). Therefore, as Clarke (2007:2) suggested, management should communicate a clear vision to the rest of the staff because it creates direction and purpose for the future success of Geography teaching and learning.

The implementation of ICT in Geography can be problematic because of a common understanding of its goals. Therefore, facilitating the integration of technology may require a change in policy or rules, and the decision-makers have to be willing to look at the situation, forge compromises when necessary, and ensure communication among all parties (UNESCO 2002:73). Management and especially principals should motivate Geography teachers towards ICT integration in teaching and learning as it impacts the successful integration of ICT (Woodbridge 2004:1). This will have a change in their perspective attitude towards the use of ICT in the Geography IP classroom. Kovalchick and Dawson (2004:34) stated that motivation is influenced by internal factors: perceptions and personal goals and external factors: opportunities and rewards. Management needs to motivate staff regularly and use different strategies to keep teachers motivated because this will increase their ICT integration skills development (Carlson & Gadio 2002:122).

Intrinsic and extrinsic incentives should be considered by management when a design teacher development program for ICT integration in the Geography classroom. The incentives reward teachers and create favourable conditions to achieve specific ICT integration goals in Geography and support organizational development (Mario 2019:20). Mario (2019:22); and Konstantinidis and Karagiannis (2020:603) explain the incentives as follows:

- Intrinsic incentives exist in the job itself and give individuals personal satisfaction, such as autonomy, reputation, trust, empowerment, and expense preference.
- Extrinsic incentives include elements such as pay and fringe benefits, gifts, promotion and advancement opportunities.

According to UNESCO (2002:70), improved performance is a sufficient intrinsic incentive. Geography teachers will adopt an innovation when they see that it adds value, is easy to use, and provides the time and support they need for learning and practice. Like students, teachers need extrinsic incentives and motivation to persevere in the effort to improve their teaching. UNESCO (2002) suggest that extrinsic motivators can include: stipends for TPD, accreditation or certification and access to new or additional educational resources.

Management needs to contribute to changing school policy that supports integrating Geography in the IP classroom (Tondeur *et al.* 2008:211). They must consider how the policies affect the acquisition of and access to technology (UNESCO 2002:80). Policies related to technical assistance should also support the use of technology in the Geography classroom rather than obstruct it, and also, there are ways to control the internet or WiFi access for teachers and students. Teachers cannot be expected to implement what they have learned about the effective use of ICTs without the presence of essential conditions in their work environment (Bingimlas 2009:240).

Educational leadership in schools should elaborate and develop a plan on ICT policy in school that will strengthen teaching and learning Geography (Moreira, Rivero & Alonso 2019:550). Since Geography teachers are the ones who will have to execute policy in the classroom, they need to be proactive with the management of ICT, including taking part in the design of ICT policy in schools (Mbatha 2015:20). Teachers need to be involved in how the school will utilize the ICT resources and when the school should revise the existing ICT policy. Tondeur *et al.* (2008:213) strongly believe that “if teachers share values expressed within a school-related policy and understand the implications, the policy can influence geographical practice".

2.10.2 Teacher Professional Development (TPD)

Teachers need to be skilled to integrate Geography teaching and learning using ICT in the Intermediate Phase to make a meaningful contribution in the classroom. They must be able to apply technology in lesson presentations and administrative work. It is evident in the literature (Jimoyiannis & Komis 2007; Du Toit 2015:5; Albion *et al.* 2015:656) that inadequate training and experience is one of the main reasons teachers have negative attitudes toward ICT and therefore do not use ICT in their teaching and learning practices. According to Thorburn (2004:6) and Zhao and Bryant (2006:57), when teachers believe they do not have the necessary skills or knowledge to use ICT effectively, they tend to feel uncomfortable in an ICT enabled environment.

Therefore, Geography teachers in the IP need to be exposed to regular professional development opportunities because this is not a once-off event. Professional development programs should create excitement and curiosity for learning Geography and should leave teachers eager and prepared to help students develop rich understandings of Geography (Schell, Roth & Mohan 2013:8). Professional development is extensive, and all deliverable mechanisms, like time, location, distance, and credit options, should be considered (UNESCO 2002:75). Professional development can take place at three levels for the integration of Geography ICT (Edmond & Burns, 2005:15):

- Standardized TPD
  The most centralized approach, best used to disseminate information and skills among large teacher populations.
- Site-based TPD
  Intensive learning by groups of teachers in a school or region, promoting profound and long-term changes in instructional methods.
- Self-directed TPD

Independent learning, sometimes initiated at the learner's discretion, using available resources that may include computers and the Internet.

Professional development for integration of ICT in IP Geography can be at any level. According to Edmond and Burns (2005:22); and Edwards-Groves, Grootenboer, Hardy & Rönnerman (2019:319), site-based TPD can be considered useful when: changing instructional practices is critical; plans call for a significant enhancement of teachers' subject knowledge or of classroom teaching and learning; objectives include ongoing growth toward overall excellence in teaching and learning; there is a core group of teachers from the school to participate in professional development; technology can be used to supplement professional development.

Professional development and a training strategy at the school level should become part of the school culture. In this way, teachers will have their own pre-determined goals and objectives to achieve (Tomlinson 2004:47; Schell *et al.* 2013:8). Teachers will realise the importance of the training and make an effort to make use of every possible training opportunity (Tomlinson 2004:47; Du Toit 2015:6; Dockendorff & Solar 2018:68).

Teacher development for the integration of technology is a long term investment; therefore, it requires more than what the traditional training approaches can offer and must be ongoing in providing support to teachers to enable them to take ownership of the process (Majumdar 2015:2; Darling-Hammond, Hyler & Gardner 2017:11; Li, Yamaguchi & Takada 2018:4). Since teachers do not have enough time in the working day, management can influence teachers' working patterns by ensuring optimal and effective utilisation of available time for TPD (Razzak 2015:305; Rabah 2015:24).

Learning new technologies and integrating them into Geography takes time; therefore, teachers require time to practice their learned skills in day-to-day teaching practices (Woodbridge 2004:2; Rana, Greenwood, Fox-Turnbull & Wise 2018:151; Abrahami & Chukuii 2018:28). Teachers have different skill levels, perceptions, and attitudes towards ICT integration in Geography IP classroom (Ghavifekr *et al.,* 2016:40; Mahdum *et al.,* 2019:295). Therefore, training needs to be flexible to suit all teachers and be comprehensive enough to provide skills and knowledge for all levels and categories (Stojšić *et al.,* 2019:128).

Teacher professional development for integrating Geography teaching and learning using ICT in the IP needs to have a different focus for a broader skills acquisition for teachers. Dalal (2016:26); Kjaergaard & Fougt (2016:378); Tondeur *et al.* (2016:111); Abrahami and Chukuii (2018:48); Dlamini and Mbatha (2018:19-22) and; Kadhim (2020:38); stated that TPD for the integration of Geography teaching and learning using ICT should focus on the following:

a) teacher-related barriers;
b) the improvement of teacher confidence and attitudes;
c) enabling teachers to share their ideas;
d) new approaches to Geography content delivery (PCK);
e) that it is a process of not only innovation but a process of social change in the transaction of pedagogy and content;
f) focus must also be on the systematic change of technology integration;
g) training on the use of different technology software and basic computer skills (TK/TCK);
h) different strategies to integrate ICT;
I) training in particular knowledge of what they teach, a broad sense of diverse methods of teaching, and, more specifically, ways of explaining and representing the specific content they teach; and
J) training in the development of their technological pedagogical knowledge and technological content knowledge and TPACK.

2.10.3 Assistance

Although teachers need to receive extensive training in Geography ICT integration in the Intermediate Phase, this training will not have the necessary impact if it is accompanied by ongoing support. Continuous assistance for improving ICT integration delivery is just as vital as policy changes and working environment (Chigona, Chigona & Davids 2014:2). Successful integration of ICT in the Geography classroom should be well planned and supported by educational principles, which support, is one of (Callaghan, White & Herselman 2008:71). The support needs to be on various levels and must include technical assistance, which is one of the top barriers to use ICT in education and, therefore, in the Geography classroom (Ghavifekr *et al.* 2016:42). Sicilia (2005:43) stated that technical barriers impeded the smooth delivery of the lesson or the classroom activity's natural flow.

Educators need technical assistance to use and maintain technology. The teacher's focus should be on teaching and learning, not maintaining and repairing the technology beyond basic troubleshooting procedures, which will also strengthen their technological knowledge (UNESCO 2002:75). Basic technical procedures include waiting for websites to open, failing to connect to the Internet, printers not printing, malfunctioning computers, and teachers who worked on old computers. ICT integration in Geography teaching needs a technician, and if one is unavailable, the lack of technical support can be an obstacle and can lead to lower confidence levels to use technology in teaching and learning Geography (UNESCO 2002:74; Gomes 2005:4; Ghavifekr *et al.* 2016:42).

UNESCO (2002:75) suggest that one way to obtained technical assistance can be to include community members or student assistants to maintain a technical helpdesk at the school. Not only do teachers need technical assistance, but they also need assistance for the actual integration of ICT in the Geography IP classroom. The school can create an environment for peers to assist each other in integrating Geography teaching and learning. One form of peer assistance in establishing a community of practices (COP) to enhance teaching and learning at the school. The COP structure needs to support the professional development effort and is crucial for teachers to be willing and enthusiastic to integrate ICT into their teaching and learning practices (Day & Sachs 2004:297).

According to Drago-Severson (2004:24) and Nolan, Friesen, Maeers & Couros (2005:4), COP’s enables teachers to collaborate with professionals becoming a critical support element for integrating ICT in teaching and learning. Blasé and

Blasé (1994:23) indicated that supportive environments allow for collaborative practices that include planning and shared decision making to assist teachers' ICT integration. Support and guidance from peers can influence teacher perspectives, and there are numerous benefits to take part in collaborations like this, for example, they share expertise, reflect on teaching and learning practices which in turn leads to cooperation, reduced workload, effective communication and increased teachers' efficiency and confidence (Arnold, Perry, Watson, Minatra & Schwartz 2006:3; Blase & Blase 1994:19; Drago-Severson 2004:18). Not only are there numerous benefits when working in a collaborative environment, but it will also lead to a sustainable use for effective integration of Geography teaching and learning using ICT in the IP (Moonen & Voogt 1998:103).

2.10.4 Resources

The lack of accessibility to resources is another barrier that discourages teachers from integrating ICT in the Geography classroom (Li *et al.,* 2018:106). Although schools do have ICT resources, some teachers do not have regular access to them because they need to share them with colleagues. According to BECTA (2004:8), this may result from the poor organisation of resources and no standard policy on technology integration nor a well-structured procedure to be followed (Ramorola 2014:661). Therefore, Ramorola (2014:661) suggests that schools need to develop their ICT policies based on the White Paper on e-Education to integrate Geography teaching and learning using ICT in the IP successfully. Furthermore, Geography teachers need to be included in the design of ICT policies because successful ICT integration becomes more likely when Geography teachers share the values expressed within the policy and understand their implications (Mbatha 2015:20).

The lack of time influences the use of ICT because although resources are available, there is no time for the teacher to use it for training or planning because they have several lessons in one day (Bingimlas 2009:240). Research from Bingimlas (2009:243) indicated that teachers could prepare themselves for self-training, and teachers should acquire self-organisation skills, which will help them overcome the barrier. This is affirmed by Alfaki and Khamis (2014:136), stating that ICT media can improve training by providing access to educational resources to teachers permanently, breaking the traditional isolation of teachers, and enabling individualized training opportunities.

Madikizela-Madiya (2018:275) suggest that teachers must be included in the decision process regarding the acquisition of Geography resources, improving ownership in developing technological skills. Schools find themselves in an environment where financial resources are not readily available, which will hamper the successful integration of ICT in Geography teaching and learning. School management and the SGB need to implement creative strategies to generate funding, for example, insufficient laptops or software (Drago-Severson 2004:53–54).

Literature suggests that functional technological infrastructure and facilities, such as a technology / computer resource room (with video cameras, CD content packages, computer resources must be available before teachers can integrate ICT regularly (Han 2002:296; Moses 2012:14). This will include laptops and internet access or Wi-Fi. Having ICT resources for Geography teaching and learning in the IP means that proper maintenance is needed for user readiness equipment. Therefore, schools need qualified personnel to manage ICT and maintain ICT software and hardware (Thankgod & Vulasi, 2020:410). However, these staff members with technical skills can be challenging for schools because of the availability and affordability (Wanjikumugo 2016:20). For schools that cannot afford these skilled staff members, findings from Razak, Jalil, Krauss and Ahmad (2018:17) indicates that a division of labour from the school community can work together to keep school ICT resources in shape. Schools also need to budget adequately to maintain resources because these costs remain hidden and impact the school's financial resources (Ramorola, 2014:662).

2.11 CONCLUSION

The chapter first focused on the theoretical framework on Rodgers’ diffusion of innovation. Rogers (1995) explained that the spreading out of innovation is a process by which, through certain channels, novelty is communicated among the members of a social system over time. Rodgers' theory can help explained why teachers do not understand the reasons why innovation is adopted or not, the better they understand, the better they will be prepared and using the theory could result in developing a model of adoption. Rodgers explained that innovation can be communicated through certain channels which contains four main elements, which are, innovation, communication channels, time and the social system. The second part of the chapter focused on TPACK as the conceptual framework, is based on the theory of Koehler and Mishra's (2009) TPACK were used to provide an orientation to this study. Shulman and; Koehler and Mishra's frameworks provided characteristics of what knowledge is needed to improve teaching at both an activity and a professional level. The third part of the chapter gave an overview of the literature related to the study, the integration of Geography teaching and learning using ICT in the Intermediate Phase. The importance of teacher knowledge for integrating technology is highlighted to improve Geography teaching and learning in a technological knowledge society (Tondeur 2007:8). This is followed by a literature review on the different definitions, concepts and explanations with regards to Geography teaching and learning in the classroom and the use of ICT in teaching Geography. These concepts are beneficial for teachers because the education setting is changing fast, and teachers need to adapt their teaching in ways that will be relevant for the 21st-century learner. Further discussions on the use, benefits and challenges of Geography teaching and learning; and ICT in education is important since it will benefit Geography teachers in improving their TPACK. The next chapter focuses on the research design and methodology which was used to generate data to respond to the research questions outlined in the first chapter.

CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY FOR THE INTEGRATION OF GEOGRAPHY TEACHING AND LEARNING USING ICT: A PARTICIPATORY ACTION RESEARCH APPROACH

3.1 INTRODUCTION

The researcher's study aims to seek strategies to enhance Geography teaching and learning using ICT in the Intermediate Phase. This chapter wants to present the method and process used in guiding the study to formulate a strategy to assist in achieving the above goal through participatory action research (PAR). The researcher used participants in the field because they had the best knowledge in designing strategies to improve integrated ICT activities for the Geography classroom in the Intermediate Phase.

The researcher found PAR relevant for his study because the co-researchers was able to respond to challenges currently in their classroom, and as part of a team, we was able to rectify or seek other alternatives for challenges relating to Geography teaching and learning using ICT. To give some structure to this chapter, I divided it as follows: introduction, why PAR as his research approach, ethical considerations, ontology and epistemology, data generation, data generation methods and data analysis. The chapter ends with a conclusion.

3.2 WHY PAR?

According to Kemmis, McTaggart & Nixon (2014:4), PAR's most substantial claims are that participants in social and educational life can research themselves. The reason for this is, participants have special access to how social and educational life work are conducted in local sites by being ‘insiders’. Kemmis *et al.* (2014:5) believe that insiders have unique advantages in doing research in their sites and investigating practices that hold their work and live together in those sites. The above have relevance to the researcher's study because the teachers used in his study are currently teaching Geography and have first-hand experience in the teaching and learning of Geography in the Intermediate Phase. The teachers are familiar with the context of their school and classroom, and therefore, they was in the best position to give valuable feedback regarding their everyday educational life.

Kemmis *et al.* (2014:4) believe that there are five things that only PAR can do:

1. It creates conditions for practitioners to understand and develop how practices are conducted 'from within' the practice traditions that inform and orient them. Therefore, for the researcher's study, the teachers could reflect on their Geography teaching practices in which they participated.

2. PAR creates the conditions for practitioners to speak a shared language, using the interpretive categories, and joining the conversations and critical debates of those whose action constitutes the practice being investigated. Participants involved in evaluating their practices had conversations of their own and that of one another's practices. This entailed how ICT integration could be used in Geography teaching and learning. They could analyze practices for improvement in their teaching Geography.

3. Only PAR creates the conditions for practitioners to participate in and develop the forms of action and interaction in which the practice is conducted. In the project, participants work collectively to understand their practices and, therefore, could take action, for example, in the development of lesson plans in a reflective cyclical manner.

4. It creates the conditions for practitioners to participate in and develop the communities of practice through which the practice is conducted, both in the relationships between different participants in a particular site or setting of practice and (in the case of professional practice) in the relationships between people who are collectively responsible for the practice (whether as members of a professional body or as professional educators or as researchers into the practice). Using PAR in the project allowed the participants to work

collaboratively, which did not happen before starting the school project. Both teachers in the Intermediate Phase could share their knowledge of Geography teaching and learn during the project. This sharing of practice between the teachers happened due to the research's shared power, which opened up criticism and praise in their practices. In this instance, PAR also generated communicative power and solidarity between the participants.

5. PAR creates the conditions for practitioners, individually and collectively, to transform the conduct and consequences of their practice to meet the needs of changing times and circumstances by confronting and overcoming three kinds of *untoward consequences* of their practice, namely, when their practices are:

a. *irrational* because the way participants *understand* the conduct and consequences of their practices are unreasonable, incomprehensible, incoherent, or contradictory, or more generally because the practice unreasonably limits the individual and collective *self-expression* of the people involved and affected by the practice,
b. *unsustainable* because the way the participants *conduct* their practices are ineffective, unproductive, or non-renewable either immediately or in the long term, or more generally because the practice unreasonably limits the individual and collective *self-development* of those involved and affected, or
c. *unjust* because the way participants relate to one another in practice, and to others affected by their practice, serves the interests of some at the expense of others, or causes unreasonable conflict or suffering among them, or more generally because the practice unreasonably limits the individual and collective *self-determination* of those involved and affected.

Using PAR, the participants use their consciousness to reflect on the realities of their practices in the Geography classroom. PAR created this condition for the participants to take action just by this consequential reflection of their practice changes. Not only to shape and change practice for themselves, but they could also understand that their practices will benefit and serve the learners' interest in their Geography classroom.

3.3 PAR AS A RESEARCH DESIGN APPROACH

PAR is a qualitative enquiry that is democratic, equitable, liberating and life-enhancing and gives the voice and directives in generating data (MacDonald 2012:36). Using PAR, qualitative features of an individual's feelings, views, and patterns are revealed without the researcher's control or manipulation. The participant is active in making informed decisions throughout all aspects of the research process for the primary purpose of imparting social change; a specific action (or actions) is the ultimate goal (MacDonald 2012:36).

Furthermore, PAR is a means to address power-sharing and deal with challenges that will lead to particularly underprivileged development. According to Amaya and Yeates (2014:3); Muligan *et al.* (2015:97), PAR is people-centered and community-based, where the research activities will transform all lives involved. This section discusses PAR's definition, its origin, objectives, PAR process, phases of PAR, PAR application, and the evaluation of PAR.

3.3.1 Definition of PAR

PAR is described as an interactive methodology through which participants collaborate to identify questions of concern to the community, which emerges from the critique of conventional social and action research (Brabeck, Lykes, Sibley & Kene 2015:23; McTaggart *et al.* 2017:21). It arises when people share concerns and work together by collect and interpret data and engage in actions informed by these processes (Brabeck *et al.* 2015:24). Guy, Feldman, Cain, Leesman & Hood (2020:142) elaborate that it is a form of engaged, a human inquiry that orients the researcher toward action-centered practice, focus on reflection or feedback and collaboration with participants to bring meaningful change in the context of social justice.

The central element in PAR is the participation of people. Many methodologies have “participants”, and with this term, it merely means “data contributor”. Nevertheless, in PAR, this methodology embraces the idea that members of a community can provide data and member checking and contribute to project goals, design, coordination, analysis, presentation, and implementation (Huffman 2017:2). According to the literature of Brabeck *et al. (*2015:23), participation suggests sharing an activity or process or “to take part in, to become actively involved” through consistent and cyclical iterations of reflecting-researching-acting-observing, core searchers.

However, the degree and types of participation depend on the community's nature and employed methods. The community and scholars could collaborate on the project's goal, the coordination of data collection, and the discussion about how to implement the results (Huffman 2017:2). These engagements in mutual activities will eventually lead to social change and guidance of their future (Anderson 2017:435). This is why PAR is regarded as research “with” rather than research “for” or “on” people, as indicated by Anderson (2017:436). Nutton, Lucero & Ives (2020:100) state that PAR principles are used to ensure participants are in co-learning research relationships, that they are collaborating, and that there is mutual benefit. According to Harrison (2001:44), participatory action research combines three principal activities: research, education (learning) and action. It is a research approach in which people are actively involved in conducting a systematic assessment of a social phenomenon by identifying a specific problem for solving.

3.3.2 Origins of PAR

According to Altamirano (2020:310), PAR's roots lie in the popular education that emerged in the 1960s in Brazil, based on the ideas of Paolo Freire. As an educator, he was opposed to the uneducated oppression, so he developed popular education, which is education for social change. It challenged the way people taught in schools – a way that silenced them and made them conform. Freire felt that for people to be liberated, they had to be assisted to be aware of their problems in their context.

People need to give the opportunity to think, produce and act upon their ideas, rather than absorbing other people's ideas. For Freire (1972:80), it was important for people to reflect on their concrete situation and realized that it will lead to action if people engage in true reflection. Freire felt that as the causes of people's problems became clear (with research), they would analyze and discuss what joint action could be taken to change their situation. Freire's terms for this process are the planning- action-reflection cycle, which leads participants to understand their reality (Towfie 1998:13).

These ideas of thinking of Feire (1972), was incorporated in the action research process. Participatory action research originated from a critique of action research approaches. Action research has been practiced in many diverse fields and has a long history, dating back to the early twentieth century (Kemmis *et al.* 2014:4). Borg (2010:394) describes action research as a form of practitioner research characterized by particular procedures, which broadly involve introducing and evaluating new practices, typically through several cycles.

It is a disciplined process of enquiry conducted by and for those taking action, and it is a manner to assist the "actor" in improving and refining his or her actions (Sager 2000:2). Sager (2000) further stated that action research has this positive effect for many reasons. At first, is that action research is always relevant to the participants; secondly, relevance is guaranteed because the researchers determine the focus of the research project; and finally, is the fact that action research helps educators be more effective at what they care most about—their teaching and the development of their students.

They can see the development of their learners first hand. Furthermore, it involves a self-reflective, critical and systematic approach to exploring one's teaching contexts (Burns 2010:2). Over the years, different kinds of approaches to action research have emerged, depending on the problem's nature. Each of the different approaches, according to Kemmis *et al.* (2014:5), share some key features: the recognition of the capacity of people living and working in particular settings to participate actively in all aspects of the research process; and the research conducted by participants is oriented to making improvements in practice and their settings by participants themselves.

The focus shifts to owning a way of doing research and is seen as a source of empowerment for participants. They questioned how to conduct educational research, what kind of change was envisaged, and there needs to be a rethinking of the relationship between the theory and practice and between the theorist and practitioners (Kemmis *et al.* 2014:4). PAR's content as a whole, with emphasis on grassroots initiative and self-reliance, is decidedly similar to action research. Nevertheless, judging by the language and spirit in which it has been utilized, PAR represents a clear breakaway in revolutionary terms from Action Research and its allied techniques (Kemmis & McTaggat 2000).

The critique of the approaches of action research theory (Kemmis & McTaggat 2000) led to participatory action research. Authors (McTaggart 2000:7) emphasise that a gap between the researchers and the researched needs to be bridged to instil the spirit of togetherness. In this way, PAR is regarded as research that clears the space for people for their action and controls their affairs, and this led to the words of Argyris and Schon (1989:613) that mentioned that "participatory action research is a form of research that involves practitioners as both subjects and researchers".

According to Gaffney (2008:10), PAR has been described in much the same way as action research depending on whom you are reading. Kemmis and McTaggart (2000:595) express that PAR has always been used as an acronym to remember the process link to it: Planning a change, acting and observing the process and consequence of change, reflecting on these processes and consequence, and re-planning, acting and observing and reflecting.

3.3.3 Aims and Objectives of PAR

In PAR, the aim and objective are to describe and understand rather than to test hypotheses. The methodology helps participants explore various explanations and solutions to their problems, thereby building self-confidence and self-reliance (MacDonald 2012:38; Mahlomaholo & Netshandama 2012:4). Therefore, PAR develops and elaborates people's socio-political thought with which popular masses could identify and be transformative of nature (Cameron & Gipson 2005:317; Lybeck 2010:91; Munns, Toye, Hegney, Kickett, Marriott & Walker 2017:595).

With PAR, the aim is to return to the people and the legitimacy of their knowledge they can produce to increase workers' development and the community's understanding of the local situation (Mahlomaholo & Netshandama 2012:4). As Zuber-Skerritt (2018:516) stated, this is to achieve social justice and eradicate inequality by a partnership and often named co-researchers (Cusack, Cohen, Mignone, Chartier & Lutfiyya 2018:1545). Therefore, the researcher respected and incorporate the different kinds of knowledge, backgrounds and contexts of the participants.

With a participant-led inquiry process, the aim is to empower and liberate the participants by researching issues that impact them directly (Rubin, Ayala & Zaal 2017:175). In the research project, the researcher creates deep inquiry and reflection spaces in informal meetings after the training and lesson presentation. Participants could reflect on their practice and contribute to awareness of organisational barriers, learning and a renewed passion for teaching with ICT's.

Because this is premised on the notion that research is not merely to understand but to do – action must be undertaken to address the issue under investigation

(Rubin *et al.* 2017:176). PAR's collaborative nature resulted in knowledge – from co-participant's expertise - that has been co-created and actionable in the Geography classroom (Ntsoane 2001:15; Méndez, Caswell, Gliessman & Cohen 2017:705).

3.3.4 Process in PAR

Kemmis and McTaggart (2005:563) describe PAR as an ongoing process of planning-action-reflection where people are both the subject and object of research, where the investigator shares the reality participates in it as an agent of change. This leads communities to understand planning based on their reflections and new ideas. They continue to reflect on their actions to be able to go forward. This is an actual development process since it takes several PAR iterations to come to terms with the problem they are to solve. Lawson, Caringi, Pyles, Jurkowski & Bozlak (2015:13) stated that the simplest way to describe the PAR research cycle is through four action-orientated words: plan, do study and act.

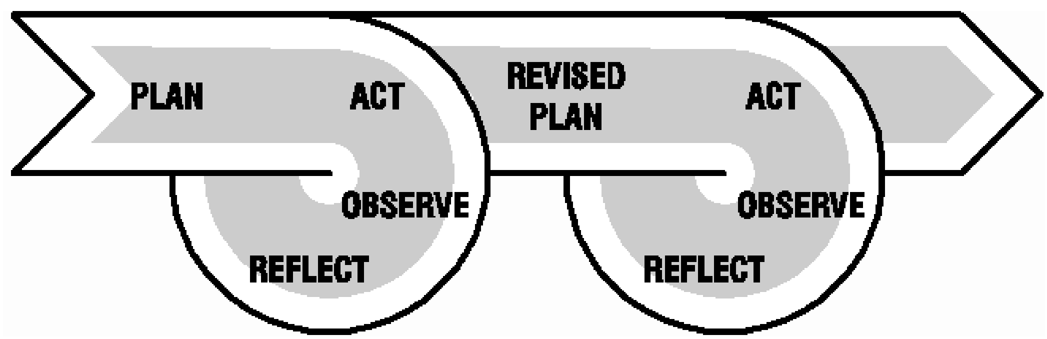


Figure 3.1 PAR research cycle

Lawson *et al.* (2015:14) explain that although some PAR experts present these cycles as a series of steps, there are limitations to this approach. Steps amount to scripted sequences based on linear causal logic and the expectation that rigid compliance is required. This is industrial age thinking. Given the attendant limitations of this industrial age thinking and planning, phases is a better term to describe these inquiry cycles. Phases are non-linear, and they are recommended with due recognition that there is an endemic, desirable "back and forth" when PAR is designed to address vexing problems.

PAR has two defining features: (a) It is an iterative process, which means each cycle builds on the previous one. (b) It is a recursive process. This means each cycle's knowledge contributions provide opportunities to reflect on where they started, taking stock of what they have learned and the knowledge they have produces along the way (Lawson *et al.* 2015:15). Two cycles dominate the literature and PAR practice. Lawson *et al.* (2015:14) explain that the first cycle begins with the problem identification phase, followed by planning (developing a proposed solution), then implementing the solution, and then monitoring and evaluating outcomes, paving the way for reflection on action.

The information is feedback into the action, and the effects are observed. Feedback helps in the correction of action of the whole or certain aspects of the change process (Brabeck *et al.* 2015:24). The second structured cycle builds on the first but augments it with three additional phases: (a) a literature review, (b) data collection, and (c) data interpretation. This emphasis on data is significant in PAR forms conducted following the scientific method, and with the reminder that not all PAR are guided by the scientific method.

According to Lawson *et al.* (2015:14), due to the structure of the PAR cycle, it generates new knowledge and is pertinent to four priorities:

- Determinations of the defining features of the problem(s) being addressed (i.e., the theory of the problem);
- Determinations of efficient and effective problem-solving models and strategies (i.e., the intervention that best fits the problem);
- Determinations of potential, replicable operational pathways to desirable outcomes (often called theories of action or theories of change);

- Determinations of special conditions and unique circumstances in local contexts, which together account for PAR outcomes, perhaps constraining and preventing generalizability of the findings.

PAR is appropriate for improving the likelihood of change being sustained in projects. The groups involved with PAR are engaged in iterative cycles of action and reflection with each cycle. Group decision making is especially effective through collective discovery because group members more readily accept change rather than be resistant (Malcom-Piqueux 2016:85). Members are supposed to be part of the planning, action-taking and reflection process, and if this is encouraged, members learn from their mistakes and come up with ways of correcting them.

According to Huffman (2017:4), there is no single, systematic prescription for PAR because of the radical diversity of methods, approaches, and contexts. What is essential is that the PAR projects remain responsive to changing conditions and that there are important activities required to successfully engage with a PAR project.

Some of these activities are as follows:

- Creating partnerships and building coalitions

  While other methodologies may only require simple access to a site or permission to collect data, a community, Partnerships and participatory approach like PAR requires buy-in from the stakeholders. They rely on partnerships and a sense of shared stake in order to be successful. Partnerships and coalitions are forges by mutual interest, overlapping concerns and share fate.

- Developing relationships

  After establishing shared goals, it is helpful to strengthen the relationship. This can be accomplished by share space and time to investigate the original problem. Deepening these relationships improves the likelihood that will increase the multiple interests. Taking the time to learn the rules of appropriateness in other communities is necessary to avoid missteps, and trust will be the most reliable foundation for action.

- Planning (and re-planning)

  When partnerships and relationships are developing, this lays the foundation for future combined talks of action plans. Although plans are developed and structured, they need to be revisited in both major and minor ways.

- Methods for research and action

  In establishing and deepening relationships, researchers and community members (participants) engage in methods and practices to tap into the collective knowledge and mobilize action. During this stage, the collaboration's research side often engages one or more methods, like qualitative fieldwork, focus groups, and facilitation.

- Ongoing engagement

  Because of the inclusion of more than one stakeholder, assumptions are questioned, multiple criteria have to be met, identities have to be negotiated, and ethical, epistemic, and ontological considerations must be accounted for—all of this manifest through ongoing engagement between the collaborating communities. Continued collaboration is one of the most challenging aspects.

Huffman (2017:7) further elaborates that criteria for good community-based research projects often guide PAR researchers. At first, projects need to be democratic. Projects that are highly democratic consider many voices in the decision-making process, which means that as an ideal, in the process of democracy, valuing all people's insights, not just a few. Equitability in the second criteria needs to be adhered to. Good PAR treads all participants equally valuable for the process of knowing and acting.

Power distance should be negotiated in humanizing ways, and in these criteria, equity does not mean sameness but rather fairness. Thirdly, the research process needs to be a liberating process for all. PAR should strive to enable non-coerced life decisions for all involved. Research projects can promote liberty by giving people choices as to whether or not and how to participate. Finally, the research needs to be life-enhancing. It seeks to guarantee that people have choices and are free to make them and improve the quality of those choices. It can include the provision of material resources or also improving a social relationship.

3.3.5 Phases in PAR

There are numerous models within the literature for conducting participatory research Méndez *et al.* (2017:705), and it becomes clear that researchers do not recommend a set method for conducting research. In studying the implementation of various projects, it is apparent that researchers develop models for participatory research approach; this forms the fundamental premise that the unique conditions of individual projects should determine the methods applied (Penzhorn 2001:52). Although some models in the participatory research process do not display clear distinctive steps or stages, it is an indication that no prescriptive methodologies exist for PAR.

3.3.6 Application of PAR

PAR research models have been adapted over the years. Although the model of Kemmis *et al.* (2014) represents easy and helpful steps for a communicative development process (Altrichter, Kemmis, McTaggart & Zuber-Skerritt 2002), for this research project, an adapted model of Eilks and Ralle (2002) are going to be used (see Figure 3.2).

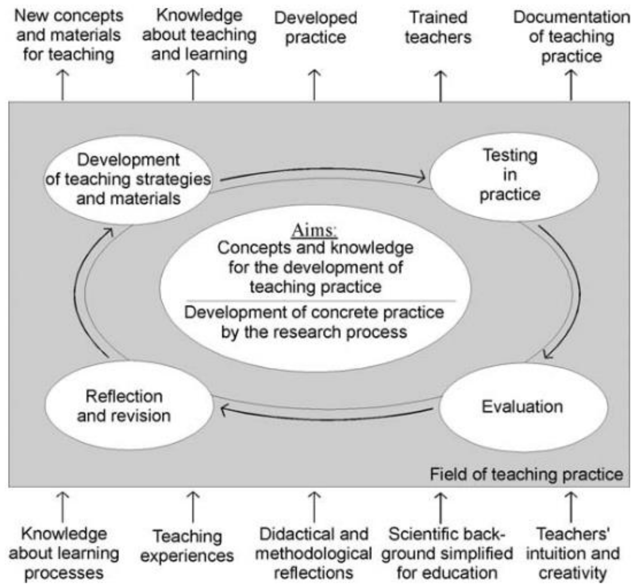


Figure 3.2 Participatory Action Research by Eilks and Ralle (2002:82)

According to Tolsdorf and Markic (2018:92), Eilks and Ralle (2002: 83) model has had success in developing new and innovative teaching material. It is a model for the school context, in which in-service practitioners and experts work together communicatively and equally to better teaching practices. Many materials have been developed over a broad period using this model of Eilks and Ralle (2002:83). Although the literature was general on science education teaching, it was also used in the general education context and started in economics teaching.

For this research project, PAR attempts to better teaching practices through the close-operation of Geography education teachers. It seeks to develop new methodological approaches to integrating ICT activities and analyzing them in authentic situations. The model also aims for continues professional development of the people involved and sustainable change in the practice fields touched by innovation (Eilks & Markic 2011:152). The adapted PAR model for this research project can be seen in Figure 3.3.

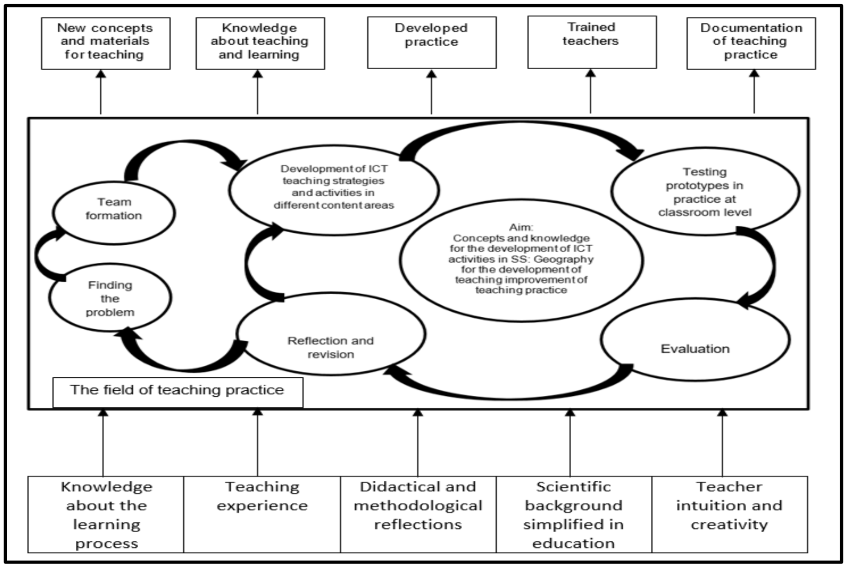


Figure 3.2 Adopted PAR approach from Eilks and Ralle (2002:82)

PAR seems to be the most appropriate method because the objective is to derive widely relevant results based on the empirical observations of teaching and learning. The method intends to improve the teaching of the practitioners involved. This means that activities are developed for real-life practice situations in learning groups and that the teachers who are involved are trained as part of the research process. The PAR model (Figure 3.3) defines five areas of objectives in Geography education. (i) new concepts and materials for teaching, (ii) knowledge about the teaching and learning, (iii) develop practice, (iv) trained teachers, and (v) documentation of teaching practice.

These objectives intend to (Eilks & Ralle 2002:82):

- The development of suitable Geography teaching strategies and materials must have led to improved teaching and learning practice and the evaluation and dissemination of said strategies.
- Attainment of general knowledge about the learning processes and teaching practice,
- The reduction of deficits in concrete teaching practice among teachers involved in the process, and

- The in-service teacher training of the involved practitioners pertains to their awareness of how well they work and improving curriculum development and evaluation of teaching practice.

According to Eilks and Ralle (2002:86), any PAR initiative should stem from both teachers' acknowledgement of any teaching problems or empirical research suggesting deficits in education practice. A specific feature of the model suggests analyzing literature for authentication and relevant in the foreground of teachers' experiences. This discussion was suggested to allow parties to decide whether any given problem is vital to invest in it.

Additionally, background information gathered from Geography and explicitly classroom experiences, plus the intuition and creativity of teachers alike were outlined as important sources for the process. Based on the analysis of the problem, the group jointly designs new approaches and activities. The designs are tested, evaluated and reflected/revised upon to improve teaching practices in the classroom. Initial designs and activities are suggested to be tested as early as possible to estimate whether they can solve the problem. Early testing leads into a cyclical process of development, which will improve practice step-by-step. Research from various literature (Eilks & Ralle 2002; Hacker 2013:76; Malcolm-Piqueux 2015:85) were combined to form the following phases which were used in this research project:

3.3.6.1 First phase: Introduction to and entering the community

During this phase, the researcher will identify the community to collaborate with the research project. This can be done before entering the area as well as during initial visits. It is important that an informal meeting with the participants be held, explaining the investigation's reason and how it will be carried out. Also, during this phase, relationships should be established with participants, leaders and institutions. During the introductory phase, the researcher first had two initial meetings with the principal and management team (SMT) in explaining the project, the processes, and establishing relationships because the researcher was not familiar with the school or the staff.

During this time, a staff member was identified to make use of the necessary appointments, etc., with the teachers and the rest of the research team for visits or meetings. After these initial meetings, a first meeting was conducted to meet the research team (two teachers, an SMT member and an SGB member), explaining the research project and its expectations.

3.3.6.2 Second phase: Identifying the problem

This phase aims to identify and understand the problem under investigation, as perceived by participants. This is a period to listen and getting to know each other because researchers need to take care not to force their ideas on the participants or impose their values on them. The researcher had a meeting with the co-researchers and made sure that they clearly understood the problem. The researcher has also allowed the participants to introduce themselves and give a brief background of their teaching career and involved at the school. The meeting was very informal, and participants also needed to express their understanding of the investigation and had an opportunity to ask questions and give ideas on how the project can be better aligned. During this stage, the researcher did a SWOT analysis to move forward with care to maximize strengths and opportunities and minimize weaknesses and threats.

3.3.6.2.1 SWOT Analysis

SWOT is an acronym for strengths, weaknesses, opportunities and threats. SWOT is a commonly used method for analyzing and positioning organisations' resources and environment for decision-making, planning and building strategies, hence this research project (Phadermrod, Crowder & Wills 2019:194). By doing a SWOT analysis, threats and weaknesses can be identified early and can be eliminated early.

In comparison, the strengths and opportunities can be built on and exploited to increase project sustainability and useful evaluation progress (Gao & Peng 2011:796). As stated in the previous paragraph, the researcher has done a SWOT analysis with the participants, which will be explained in the next paragraphs.

3.3.6.2.2 Strengths

One of the main strengths of the project was the enthusiasm of the participants. The SMT member, teachers, and SGB member were eager to participate in the project right from the start. What stands out for the researcher was that the teachers see this as an opportunity to develop their knowledge and ICT skills. From the outset, the rest of the school staff (administrators) were dedicated to helping the researcher regarding classrooms or a venue to make him comfortable when waiting or needed a different venue for the interviews.

The team identified several strengths, which included the experience of the staff members involved. The experience range from the teaching of Geography to the use of ICT in teaching and learning. Team members indicated that other staff members are also skilled in using ICT in their teaching and learning, and they were willing to help and mentor them if needed.

Along with the above, the staff members supported one another to improve teaching and learning in their general phase. The team also identify resources such as interactive whiteboards, access to the internet and tablets as a strength that will enable them to integrate ICT in their teaching and learning.

3.3.6.2.3 Weaknesses

One of the team members was sceptical regarding the training part. The teacher had a tremendous experience and took part in many different kinds of training sessions in Geography, and she felt that it did not help her that much before. The researcher explained that it would not be just curriculum focus like any other training they previously received. The training which will form part of the project will be directly linked to how and what the teacher can do to teach Geography with technology.

The researcher also supplies her with certain training examples that directly focus on improvement in the classroom. The team identified the following as possible weaknesses: although mentioned previously as a strength, resources availability is not that frequently available. As mentioned by one of the members, the Wi-Fi/internet is not available in all classes and sometimes are not available. The researcher already discussed the internet's availability to teachers, and it will be available to them.

Another weakness that was mentioned, although not related directly to the project, for the long term, was that the school was situated in a low-income area. This meant that the school could not raise sustainable fundraising to buy computers and other Geography resources. One of the members mentioned that it is a drawback that teachers could not use the school laptops for personal use.

Meaning that teachers could not take the laptops home to prepare for their home's comfort because some do not have personal laptops. The researcher indicated to the participants that one of the most important factors for implementing technology is implementing policies that will enhance technology integration. This was also mentioned to the SMT, and teachers could use computers in a room.

3.3.6.2.4 Threats

One of the issues that have been seen as a threat was time for meetings and training. The one teacher, for example, had some commitments regarding her kids after school on some days. The other teacher was living outside town and needed to travel each day. The teacher’s extra-mural activities at the school itself were also seen as a major threat to the project. To minimize the threats mentioned, the participants agreed to give their schedules for two weeks for planning for available dates when all was available.

What also helped during the term was that the normal extra-mural activities (rugby and netball games) ended earlier for the term. What also helped was that the participants were committed to the project and made, in some cases, special arrangements to attend meetings and training sessions. Electricity power cuts was one of the threads mentioned because it was occurring daily in previous months in the area. However, there was not much that could be done with the power cuts, meetings, and training planned around these dates, available from the municipality.

3.3.6.2.5 Opportunities

The teachers were dedicated in a sense, although there will be challenges regarding time frames they offer to make arrangements to meet and for training sessions. They also offer to plan on their own time regarding the activities that are going to be implemented. They also worked very closely with one another and are in regular contact with each other regarding their planning, etc., of their school work. Other opportunities mentioned by the members were that although the learners are coming from poor backgrounds, most of them do have access to their cellphones.

This means that they are in touch with technology all the time or have access to technology. They just need to be guided on how to use it as a learning tool. The members did mention that although learners have access to cellphones, it was not allowed in class or school because of policy. The members indicated that policy changes needs to be made for the use of different ICT's in the school, with particular reference to the use of cell phones in the teaching and learning process.

3.3.6.3 Third Phase: Planning Action

By the end of this phase, researchers and participants should have compiled the questions to investigate and decided on issues such as data collection and ways of analyzing collected information. What is important is that people need to be encouraged and provided with the opportunity to participate in the planning process. During the planning meeting, the researcher and the participants met to plan to start the project to ensure that everything is in place. During this meeting, the researcher made sure that all know the process, vision and revised the aim of the study. Also, the SMT member and teachers assured the researcher that the technological resources, such as the laptops and data projectors, which were needed are ready to be used.

3.3.6.4 Fourth Phase: Implementation of Plans

This is the most crucial phase of the project. The participants become fully involved in their experience after having reflected upon conditions, problems and resources. Researchers and participants need to decide on what action to take to address the problems they have investigated. The participants need to understand their responsibilities in the project and the researcher's role; therefore, this was discussed first. The researcher explained their responsibilities in given consent to research means that they needed to partake in all the activities (interviews, training, etc.) as set. In addition to answering questions, they need to engage in feedback, be reflective and commit themselves to play a meaningful role in transforming reality at their school. Some of the roles allocated to the PAR members were as follow: The SMT member were seen as a perfect candidate to act as the research team coordinator. She needed to organize the team meetings for the visits. The two teachers acted as the data managers, who took notes during some of the discussions, and these roles were reversed in the different meetings. The SGB member acted as the main tech coordinator together with the two teachers that needed to make sure that the technological resources were in working condition. The training was given to the teachers in the use of design thinking and ICT use in the lessons' activities to empower them. The teachers then need to developed lessons collaboratively using design thinking. During this stage, the group also pays attention to the time frames set in the planning phase.

3.3.6.5 Fifth Phase: Reflection and Revision

According to Vaccarino, Comrie, Murray & Sligo (2007:3), reflection provides a chance to correct any observable mistakes and implement changes after reflection occurs again, depending on how various actions were performed in the implementation stage. There were various stages when reflection took part because this is also one of the design thinking features. During the planning of lessons, the teachers could reflect and revise the lessons on paper. The reflections were based on the what their challenges are in the lesson, from the planning. What happened during the lesson, for example, do they think the use of the different pictures helped in the understanding for the learners, etc. Feedback sessions for reflection were also done after the first lessons in class. The feedback sessions were held individually at first, then within the attendance with the other teacher. Therefore, they could make suggestions on their own and on each other's lesson's as part of the PAR and Design Thinking approach. These reflections were repeated during the second planning sessions and lesson presentations. Since the researcher, was in the class during the presentations, he could monitor the lessons pertaining what was done in the training sessions and the respective interviews. Not only did the researcher done this, the co-researchers could monitor and evaluate themselves and one another in the reflective sessions.

3.3.7 Limitations and challenges of PAR

Although PAR has been found relevant for this study as mentioned earlier in the chapter, there are some limitations and challenges associated with PAR. Literature (Fahmi 2007; Manzo & Brightbill 2007; Khan & Chovanec 2010) indicated some of the following limitations and challenges when using PAR.

Fahmi (2007:28) explained that some of the fundamental issues of PAR lies in the ideological foundation of PAR, relating to the notion of power which is central.

Centrally to this, is the power for whom? Which raises the issue on the ownership and sharing of the results. The knowledge accusation of the project needs to be filter back to the participants, and not kept by the researcher. Therefore, the researcher as the co-participant also shared the information with the rest of the participants of the study to also do self-reflection, and for use in their organisation, which in this case, was for their school. Another limitation, is the role of the researcher. This role is often described as a participant, yet the researcher also engaged in building capacity and educating and this lead to the emancipation of the individual and the community, which also can lead to issues of power (Khan & Chovanec 2010:35). In mitigating these challenges, the researcher act as a facilitator and involved the participants collaboratively in the aspects of the research process to developed a trust relationship. The nature as participant of the researcher, also create power challenges of itself. The researcher, as someone coming from a different field and experience, is sometimes seen as a person with authority (whether or not researcher want or realise this) (Manzo & Brightbill 2007:21). To mitigate the challenge, the researcher was introduced as also a teacher for students, and couple this with the need to explore their use of ICT in the Geography classroom (and explain the focus of the research with). This give the participants a sense that their knowledge is honoured and valued and can influence the research topic as such (Dedding, Goedhart, Broerse & Abma 2021:8).

3.4 RESEARCH METHODOLOGY

Research design is defined as the overall strategy that the researcher chooses to develop the study and this is guided by a theory upheld by the researcher in a coherent and logical way (University of Southern California 2017:1; Wacker 1998:361-2). The research design therefore, helps develop the study and thereby ensuring that the research question is adequately addressed. According to Merriam (1998:6) the purpose of the research will determine the research methodology. A qualitative study is defined by Creswell (2009:2), as an “inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of participants, and conducted in a natural setting". The aim is to understand the experience as closely as possible to that which its participants feel it or live it (Burns 2000:13-14). Because of the researcher's close involvement, they can get an insider's view and give a better description of complexities of the phenomena under study (De Gialdino 2009:1). The descriptive and narrative dimension of qualitative research, is of benefit to researchers because they could use the reports to examine different forms of knowledge that might otherwise be unavailable, and therefore, gaining new insights.

Based on the consideration of the principles of the theoretical framework and the aim of this study, a qualitative approach was followed. The aim of the study was to get quality and depth of information from the sampled participants, and therefore, a qualitative approach was suitable (Holloway & Wheeler 1996). Qualitative methodology, as a descriptive design, was used to explore the teaching context for the integration of Geography teaching and learning using ICT's in the Intermediate Phase classroom. The context affects the way teachers teach and since observations of people in their environment is embedded in descriptive design, information of the context was collected without changing the environment (Gravit 2004:262). Qualitative research is interested in the senses, meanings, narratives, experiences and forms of social interactions, hence the researchers wanted to get these characteristics of the participants under study. Qualitative methodology was suitable for this study, because qualitative research enabled the researcher to engage with the participants in their natural settings (in this case, at their school in Kimberley) to evidence their everyday life and experiences (De Gialdino 2009:1). Since the results in a qualitative study is descriptive, the nature of the main aim required rich data in terms attitudes, behaviour and actions and to understand why teachers teach the way they do (Nieuwehuis 2007: 51; Edirisingha 2012:1).

3.5 RESEARCH PARADIGM

3.5.1 Ontology and Epistemology

Their own common beliefs, norms characterize every paradigm, and agreements shared between scientists on how problems should be understood and addressed, referred to as their Ontological and Epistemological assumptions (Scotland 2012:9). According to Scotland (2012:9), Ontological assumptions are concerned with what constitutes reality and “what is there to been know”. Chilisa (2012:40); and Denzin and Lincoln (2011:717) explained that the multiple realities are subjective and differ from person to person and from various experiences in an Ontological view.

Kivunja and Kuyini (2017:27) added that Ontology is concerned with the assumptions we make to believe that something makes sense or is real, or the very nature or essence of the social phenomenon we are investigating. In this research project, the participants could use their individual experiences to make confident decisions that will influence the project because of participatory action research's collaborative nature. Their perspectives could make certain assumptions about the project's essence without being judgemental by peers. Using a SWOT analysis as part of PAR, the research team could identify and mitigate the weaknesses and threats encountered during the project.

On the other hand, Epistemology is concerned with the nature and forms of knowledge and is a way of understanding and explaining how we know what we know (Cohen *et al.* 2007:8). It is concerned with the very bases of knowledge – its nature, type and forms, how it can be acquired, and how it can be communicated to other human beings (Graven 2014:1043; Kivunja & Kuyini 2017:27). In the study, the co-researchers were allowed to give input in the project's roll-out because they have the knowledge and experience of the educational field and, specifically, Geography teaching. The researcher's inputs were not forced on them to shape specific thinking of the problem under investigation.

3.5.2 Constructivism

The research project was situated within a constructivist paradigm because it aims to understand (Hesse-Biber & Leavy, 2011:17) and gather more in-depth insights into the integration of Geography teaching and learning using ICT. A constructivism philosophical paradigm is an approach that asserts that people construct their understanding and knowledge of the world through experiencing things and reflecting on those experiences (Honebein 1996:22; Adom *et al.* 2016:2). To the constructivist, learning occurs when the learner discovers the knowledge through experimentation and doing (Kalender 2007:4).

Learning is a social activity in a constructivist classroom because it is closely associated with learners "connection" with others, such as teachers, peers, family as well as casual acquaintances (Adom *et al.* 2016:5; Edirisingha 2012:1), unlike the traditional classroom where learning is directed towards isolating the learner. Some of the renowned proponents of this philosophical approach include Jerome Bruner, Jean Piaget, Lev Vygotsky, and John Dewey (Adom *et al.* 2016:3). The underlying ontological assumption will be that there is no single reality or truth because individuals create a reality in groups.

The researcher is guided by ontology, which assumes that human beings under research have their thoughts, interpretations, and meanings under investigation. For this reason, the researcher collected data from the participants to understand their views in reality regarding the integration of ICT in the classroom. The researcher wants to understand the multiple social constructions of meaning and knowledge because there is no objective reality (Chilisa 2012:40; Denzin & Lincoln, 2011:717).

The epistemology assumption in using a constructivist paradigm will be that reality needs to be interpreted and is used to discover the underlying meaning of events and activities. The researcher is concerned with the "procedural" knowledge (procedures in the development of ICT activities) rather than the "substantive knowledge" (only deals with content). Therefore, in this research project, the researcher asks the question, “what is there to be known in reality regarding the integration of Geography teaching and learning using ICT”.

3.6 DATA GENERATION

3.6.1 Site

The research site was conducted in a school located in Francis Baardt Municipal district in the Northern Cape Province. The school offered all the subjects from grade R to grade 7 and had about 1 185 learners from very diverse socio-economic backgrounds. The teacher and learner ratio in the school was 1:34, according to the school principal. The school is rich in school resources, and the classrooms had maps and different posters of all the subjects against the walls.

Some of the classes had laptops, data projectors and interactive whiteboards. The school principal indicated that the school also received tablets from the Education Department. The teacher administrative room had desktop computers for teachers to use. One of the reasons for choosing the site was because of its location. The school is near the researcher's home and was therefore very accessible, and travelling cost could be minimized.

3.6.2 Sampling

The population were drawn from one school in the Northern Cape province in South Africa. The sample compromised of two Geography teachers, one member of the school management team (SMT) and one school governing body member (SGB). The reason for the small sample purposive sample, is regarded by Silverman (2010:104) and, Hesse-Biber and Leavy (2011:45) as logic to small samples in a qualitative research design. According to Cohen *et al.* (2003:103) purpose sampling cases are ‘hand-picked’ on the basis of their typicality and that the sample is for a specific purpose. The researcher therefore, picked the participants on the basis that they will be best to provide data for the study under investigation. Cohen *et al*. (2003) added that purposive sampling is a non-probability sample technique which derives from the researcher targeting a particular, as it was for this study.

3.6.3 Researcher and Co-Researchers Profile

The researcher has been a Social Science (Geography) teacher for the past eighteen years and a ‘lead teacher’ for Social Sciences training in the Western Cape district. Currently, the researcher is a lecturer in the Geography Education department. A Curriculum Advisor in the West Coast District invited the researcher to be a ‘lead teacher’. In this capacity, he conducted workshops on the content and pedagogical teaching of Social Science. Over the years, the researcher has assisted many teachers, specifically, to become good practice primary school Geography teachers. The researcher was also one of the ICT teacher trainers for the Western Cape Education Department’s (WCED).

The co-researchers used for the study consist of two Social Science Intermediate Phase (IP) teachers, a member of school management and a member of the school governing body. Table 3.1 gives an overview of the profiles of the co-researchers.

Table 3.1 Co-researchers Profiles

TEACHER 1	
Gender	Female
Age	30
Qualification/s and major subject/s	Bed (English and Social Science)
Years of teaching experience	7 years
Years of Social Science (Geography) experience in IP	7 years
CLASS PROFILE	
Grade currently teaching	Grade 4 / 5

Total number of learners in the class	38
LoLT	English
Resources	IWB, textbooks, Atlases,
TEACHER 2	
Gender	Female
Age	60
Qualification/s and major subject/s	T.HOD (4 years) Geography and Art
Years of teaching experience	29 years
Years of Social Science (Geography) experience in IP	18 years
CLASS PROFILE	
Grades currently teaching	Grade 4 and 6
Total number of learners in the class	38
LoLT	English
Resources	IWB, textbooks, Atlases, Whiteboard
School Management Member	
Gender	Female
Age	56

Qualification/s and major subject/s	Bed (English)
Years of teaching experience	34 years
Years of Social Science (Geography) experience in IP	5 years
CLASS PROFILE	
Grades currently teaching	Gr 4 -7
Total number of learners in the class	41
LoLT	English
Resources	Textbooks, posters, etc.
School Governing Body Member (SGB)	
Gender	Male
Age	49
Qualification/s and major subject/s	BA degree
Years of teaching experience	None
Years of Social Science (Geography) experience in IP	None

3.7 DATA GENERATIONS METHODS (METHODOLOGY)

During this section, I will discuss and elaborate on the activities that were used to generate data. These compromises of the following: Meetings, discussions, brainstorming; workshops; conducting free attitude interviews with participants, and participant observation of lessons. Using a variety of data collection methods enabled the researcher to view the data from different angles.

3.7.1 Meetings and Field Notes

In the meetings, we discussed and agreed on activities that were to take place daily, weekly and monthly (see Table 3.2). Dates were set on a two weekly basis, and co-researchers needed to report in the next meeting. From the onset, the co-researchers were encouraged to speak freely and identify challenges in setting dates, etc. The co-researchers were not hesitant to speak regarding challenges. During the discussions, they included time challenges for meetings after school (when learners left class).

One of these challenges was that they were also involved in different extra-mural school activities. Although they mention this as one of the challenges, the two teachers came up with solutions to overcome the challenges. One other challenge was that the one teacher need to fetch her children at three o'clock, so meetings could not go over that time (she did, however, make other arrangements when we needed to work after three o'clock). Participants were encouraged to make notes during lessons with challenges that they perceived because it will be useful for further reference to identify necessary corrections (Emerson 1995:2).

At the first meeting, which was very informal, the initial project was explained, and participants were asked to give a short introduction to one another. The meeting also was to detail events that need to be done during the interactions with all the co-researchers. The co-researchers were also asked why they want to be part of the research and consider it as relevant to what they are doing currently in school. The researcher also highlighted the benefits of the study and the challenges that will be experienced along the way. We decided on two weekly confirmation of activities for meetings, discussion, interviews, and workshop during our planning session meeting. This could not be realized every time the teachers got sick on different occasions, and time frames needed to be adjusted.

Table 3.2 Timetable of Activities

Month	Week	Activity
February 2019	2	Initial meeting. Introduction to the project. The signing of consent forms, the planning etc.
March 2019	2	First interview
March 2019	3	1st Workshop with participants: Design Thinking approach + Introduction: teaching with ICT's + Reflection
April 2019	1	Second interview
May 2019	2	2nd Workshop, Lesson planning / use of ICT in teaching and learning / PowerPoint / other programmes + Reflection
May 2019	2	Lesson Observations
May 2019	4	3rd Workshop with participants, Planning / Use of ICT in teaching and learning / combine ICT resources with teaching (link to content, skills, etc.)
July 2019	4	Lesson planning / discussion; etc.
Oct 2019	2	Lesson Observation / discussions
Nov 2019	1	Exit meeting 3rd

Note: Two informal meetings were held the previous year with the School Management Team and teachers. The researcher and co-researchers were also in WhatsApp contact with regards to lesson plans for feedback, etc.

3.7.2 Workshops

The three workshops were one of the crucial instruments for generating data and the teachers' actual professional development. Since the research study's problem was centralized over ICT integration problems in their lessons, teachers need to attend workshops to improve their ICT teaching and learning activities. Before the workshop, an analysis questionnaire (Annexure 6) was done to get an idea of the teachers' different knowledge's'. These analysis reveal that their knowledge of the of technology was under-developed. This was especially the case with Teacher 2, who was also the older and more experience one. Overall, the analysis indicated that both teachers need more training to develop their TPK and TPACK. A different approach was used to replace the traditional manner of how these workshops were done. A design thinking (DT) approach was used to improve teachers' development in designing ICT activities in the Geography classroom. This proved useful because the teachers expected the traditional manner in which the workshops were done before (where the facilitator was the only contributor to knowledge). The DT approach was beneficial because teachers could contribute to activities because they had firsthand experience regarding their classrooms and previous knowledge regarding ICT implementation.

During the workshops, teachers were also asked to use their notes from classroom challenges and experiences to discuss. This was done to adapt the training to the specified needs of the teachers. Using these notes was also useful to decrease PAR's cyclical process (meaning the number of workshops needed to improve teacher’s development).

3.7.3 Free-attitude Interviews

The other important instrument was the two free-attitude interviews (see Appendix 5), which were more or less between 20 and 30 minutes each, for data generation in this study. The interviews conducted are regarded as a useful tool for unpacking motives and experiences (Alshenqueeti 2014:39). The interviews were conducted with very limited informality from time-to-time with small groups (teachers mostly together and the management team member and the SGB member). The interviews and conversations were transcribed to make meaning within the parameters of the study.

According to Alshenqueeti (2014:39-40), free attitude interviews offer freedom and flexibility to the interviewer and interviewees to allow discussions on a question and elaborating manner to explore various issues and construct meaning. Listening and asking questions also allows the researcher to be sensitive to the interviewees' cultural norms and beliefs. During the interviews, the interviewer's main task was to make sure that the responses addressed the research study's main aims and objectives.

3.7.4 Participant Observations of Lessons

Munhall (2007:115) describes participant observation as recording human behavior in a social setting in which participants are functioning. Using participant observation in PAR, the researcher gathered rich data sources, including seeing, hearing, and experiencing reality in a particular environment (Katz 2015:132).

During the classroom observations (two lessons each of the teachers), the researcher notes how the lessons unfolded in front of him. The observations' focused on the teaching of the teachers, activities of the learners and how ICT was used in the lesson (see Appendix 6). This information was used to inform discussion and questions during interviews, meetings and workshops to further understanding the problem under investigation.

3.8 DATA ANALYSIS

A key element of qualitative data is data reduction; according to Cohen *et al.* (2007:475), one common procedure for achieving this is with which the ‘many words of texts are classified into much fewer categories’. For this research project to analyze the data, the researcher finds critical discourse analysis (CDA) an appropriate tool to analyze and interpret the data generated by meetings and field notes, workshops, free-attitude interviews and participant observations. CDA aims to explore and emphasize the relationship between language and power; the researcher found CDA to be an appropriate tool for analyzing participants' written and spoken words in broader social and cultural structures, relations and processes (Gee 2011:68; Breeze 2011:495).

Tambunan, Muchtar, Agustian, Salim, Aisyah, Marpaung and Nasution (2018:174) explained that language could be involved and obscure, hence the need for “critical” analysis. CDA is a multi-theoretical framework, and this made CDA an appropriate way of analyzing since this research project uses TPACK to design a strategy to improve teacher's integration of Geography teaching and learning using ICT. For this study, three levels of analysis, textual, sociological and contextual, were used to analyze and interpret the generated data. All these dimensions require a different kind of analysis.

According to Tambunan *et al.* (2018:174), analysis at textual level involves linguistic analysis. Meaning, linguistic analysis in terms of vocabulary, grammar, semantics, the sound system, and cohesion-organization above the sentence level (Wodak 2013:187). According to Tambunan *et al.* (2018:174), any sentence in a text is analyzable in articulating these functions, which he has relabeled representations, relations, and identities. In this study, a textual analysis was used to perform linguistic analysis of representations of participants' (co-researchers) ideologies regarding integrating Geography teaching and learning using ICT. Data generated in interviews, meetings and reflections sessions was analyses textually and focused on the participant's spoken words as representations of their views and experiences of teaching Geography using ICT, teaching methods, support (individual and team), teaching and learning resources and participation of co-researchers during training, feedback and reflections.

Secondly, sociological analysis (explanation) explores the extent to which the text upholds or reproduces hegemonic discursive or social practices (Fairclough 2010:24). Gee (2011:71) also shows text stands concerning certain prevalent conditions, which entail the way materials are used within social environments. Gee (2011:72) explains that these tend to be expressions of attitudes and values that the community or society hold in high esteem. Analysis in this dimension pertains to three aspects of the socio-cultural context of a communicative event: economic (i.e. the economy of the event), political (i.e. power and ideology of the event), and cultural (i.e. issues of values).

Fairclough (2010:25) explained that one does not have to carry out analysis at all levels, but any level that might "be relevant to understanding the particular event. The social analysis focus was conceived as being connected to the teachers' background and the physical environment of the Geography classroom at the school with the community and broader society. They established a connection with the researcher and other co-researchers. Power struggles between the principal researcher and co-researchers (SMT, SGB member and teachers) needed to be addressed cautiously.

Finally, contextual analysis (interpretation), also called discourse practice, analyses text production, distribution, consumption and interpretation. The focus is on how the author of text draws on existing discourse and genres to create text and how receivers of text apply the discourse and genres in communicating and interpreting the text (Jorgensen & Phillips 2002:69). The focus of the analysis was on the text in which the teachers demonstrated and understood what others said about ICT integration and their understanding and implementation of Design Thinking to enhance their TPACK. Doing this also kept in mind the society where co-researchers are coming from analyzing the data because individual backgrounds influence what is said and mean (Rocha-Schmid 2010:355).

According to Frantz (2003:1) the criticism against CDA is that, (1) the approach too easily allows for a researcher to uncover the findings that he or she expects or wants to find, and (2) the approach lacks methodological rigor, specifically the poor application of CDA methodology. With regards to the first limitation, the assumption is that a description and explanation of language could be based on an ideal speaker-listener. Therefore, researchers must remember that language constructs, rather than reveals reality, this applies not just to the language used by the subjects of research, but also the language that is used to write up the research project (Mills 2004:83). Researchers needs to be more reflexive and remove the self when analyzing the data. For this study the discourse is more than the collection of words, it is a set of interrelated statements, that construct a reality and represent a social practice (Phillips & Hardy 2002:86). With regards to point two above, Frantz (2003:1) describe that certain points of interest are common across much of the seminal work in CDA—including verb tense, voice, modality, and nominalization—and methodological guidelines do exist for CDA. Fairclough (1992), who is one of a handful of scholars associated with developing the foundations of CDA, has extensively outlined procedures for carrying out a comprehensive analysis. Therefore, Fairclough (1992) suggested that a rigorous linguistic analysis supported by a richer understanding of the social power dynamic behind the interaction, would result in a fuller, stronger analysis of the data. For this reason, the researcher in analyzing the data, took the words that was spoken and relate that to the context of the study. This means when analyzing the data, the language is not neutral as it is situated in political, social, and institutional structures that inform us about power relations and positions (Fairclough 2015).

3.9 ETHICAL CONSIDERATION

Ethical clearance was first obtained from the University of Free State Ethics Committee (see Appendix 8) to continue with data collection and to seek clearance from other organizations and other parties in the study. Permission to conduct the schools' study, the researcher obtained clearance from the Department of Education in the Northern Cape (see Appendix 2). Permission to interact with the co-researchers was sought and obtained from the principal of the selected school.

The co-researchers were informed about the purpose of the study and that it was for academic purpose. Co-researchers were asked to sign a consent form (See Appendix 4), which indicated that they could withdraw at any time without any consequences.

When following a PAR approach for a research project, specific ethical issues need to be taken into account by the researcher. Pain, Whitman and Milledge (2011:6) explains that the researcher needs to answer certain questions to comply with ethics. They regard the following questions as important when doing PAR:

- Do individuals (or the whole group) want to be anonymous? Depending on the research topic and its sensitivity, one may decide on a blanket policy on this. Often participants may choose for themselves. Anyone who is interview as part of the research should be asked whether they wish to remain anonymous. For this research project, the name of the school and co-researchers are going to be anonymous. In the transcripts and writing up of the thesis, the researcher will use an X for the school, T (1 or 2) for the teachers and SGB and SMT for the other co-researchers.

- How are we going to store information in a way that preserves confidentiality? When one store's data about people, one needs to comply with the Protection of Personal Information (POPI) and respect any sensitivities or concerns that the people involved may have. The researcher will keep data on a laptop and hard drive with a secure password. Data will also be deleted after a certain period.
- How are we going to be accountable? This can be addressed by thinking about recording what is said and what happens during the research process, starting, and deciding who should get to see this information. There may be situations, people or organisations from which it is wise to safeguard certain information; these can be identified early on or become evident as the research progresses. The researcher informed the co-researchers that no data would be distributed to other parties or organisations without their consent.
- What are the potential sorts of harm that the research might cause? How can we avoid these? All research carries risks. For example, research can cause environmental damage, cause distress to people, or inflame local conflicts. Through careful discussion and planning, one can work out how to promote the project without offending or ‘finger-pointing’ individuals. Although the researcher cannot foresee any harm or risk for this research project, he will be mindful of collecting the data and rectifying or intervening early to extend any harm or risk.

- What are the potential benefits the research might lead to? How can we maximize these? One of the main reasons groups use PAR is to see some benefits from the research, so it is worth thinking hard and creatively. Record early on what the group hopes to get out of the research, and revisit/update this regularly.

3.10 METHODOLOGICAL LIMITATIONS OF THE STUDY

There are two limitations to this study, that could be addressed in future research. These were the number of participants (sample size) and the selection of learners (selection bias) used in the study. Although, the small sample is motivated by the kind of study (qualitative study), a larger sample would have given more precise results and the learner voices could have led to possible other themes which could have added or strengthen the findings of the study. To mitigate these limitations, the researcher opted to have different participants and not only two teachers, but also a SMT and SGB member. Furthermore, the researcher used different data collection methods to produce results that are more robust and compelling for the project. For future research, in conducting a similar study the researcher will propose that a larger sample size and selection will be used, to increase the generalization of the findings.

3.11 CONCLUSION

The study aims to suggest ways on how ICT can be integrated into the Geography classroom. Since PAR is a cyclical process with planning, reflecting and action processes, it seems fit to improve success in this study. PAR's collaborative nature brought together a diverse group of individuals to interact and find solutions for the investigative problem. Since PAR is also a means of combining the generation of knowledge with practitioners' professional development in the field, this chapter provides a background to the presentation of data that will follow in the next chapter. Thus, the following chapter presents and discusses the data generated during the activities discussed in this chapter.

CHAPTER 4

DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF RESULTS TOWARDS A STRATEGY FOR THE INTEGRATION OF GEOGRAPHY TEACHING AND LEARNING USING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

4.1 INTRODUCTION

The study aims to investigate strategies to improve the integration of Geography teaching and learning using ICT. In this chapter, data are presented, analyzed, and interpreted according to the study's four objectives, gathered with the interviews, lesson observations, questionnaires, discussions, and training sessions. Thus the chapter analyses the perspective of Geography teachers when integrating Geography teaching and learning using ICT; secondly, to determine how Geography teachers are using ICT; thirdly, the challenges when using Geography teaching and learning with ICT and finally; the conditions that are needed when implementing ICT in Geography teaching and learning. The chapter ends with a conclusion.

The above objectives are also being done with the frame of mind to establish possible solutions and strategies that can be developed, adopted or adapted to answer the main research question. The opening paragraph will consist of an open discussion of good practice, policy-related issues, previous research findings and theory. This will be followed by extracts as evidence from empirical data, and finally, a deeper meaning of the data will be analyzed in line with TPACK (conceptual framework) to provide relevance to the main research question.

4.2 DATA ANALYSIS ADDRESSING THE OBJECTIVE TO IDENTIFY GEOGRAPHY TEACHER'S PERSPECTIVE WHEN USING INTEGRATED GEOGRAPHY TEACHING AND LEARNING USING ICT

In this section, the data will be discussed related to Geography teacher's perspective to investigate strategies to improve the integration of Geography teaching and learning using ICT in the intermediate classroom. The data presentation process in the preceding chapter culminated in the following emergent themes related to teacher perspectives on integrating Geography teaching and learning using ICT. The following views were identified: the value of ICT as a resource; ICT's as a visual learning tool; and ICT can improve quality teaching and learning.

4.2.1 Value of ICT as a Geographical Resource

The purpose of the section is to discuss the teacher's perspectives on how they see ICT's as a valuable resource in contributing to Geography's teaching and learning. It is evident from the literature that teachers' attitudes towards new technology will lead to the confidently use of technologies in Geography teaching and learning, and they will also understand the usefulness of ICT (Bingimlas 2009:238; Subramanien 2013:49).

Teacher attitudes towards new technology will lead to the confidently use of technologies in the Geography classroom, and they will understand the usefulness of ICT. This suggests that when a teacher is positive about a resource and can identify its potential uses for classroom and personal purposes, it would most likely use the classroom resource for ICT implementation (Liu 2011:1013). This was evident during the researcher's interviews and informal discussions with Teacher 1, 2 and the SMT member, for example, T1 stated:

> *"Yes, because it will benefit us by using different programs and materials that we can use in the classroom for us as teachers and school and learners, and there are more fantastic that can be done."*

Not only was she positive in her communication regarding the benefit of using ICT in Geography***,*** *"us as teachers and school and learners"* suggest that using ICT will benefit herself as a teacher and the learners and the school, which indicates that in her thoughts of the usefulness of ICT, are much broader than only confine it to her classroom. Also, this indicates that she is already mindful that using ICT as a geographical resource can be beneficial to her learners in the Geography classroom. This asserts with Rodgers's (2003), element of adopting innovation. Whereas, individuals should be informed about its advantages and disadvantages to make them aware of all its consequences in accepting innovations (Sahin 2006:14).

Furthermore, in the context of the study, Teacher 1 and Teacher 2 indicates the valuableness of ICT in saying how it could be beneficial in the phrase "*using different programs and materials"* (Teacher1) and "*there are more fantastic things that can be done with technology"* (Teacher 2)*.* This suggests that they not only show a positive view about ICT as a resource but can identify its potential uses for classroom and personal purposes (Subramanien 2013:49) and therefore, the evidence support Liu's (2011:1013) theory that if teachers are positive and know the potential of the resource that they would use in the classroom.

4.2.2 Access to a variety of Geography materials

Teacher perceptions will change towards ICT if the resource supports Geography teachers and learners provision to access different resources (Cener, Acun & Demirhan 2015:192; Chang & Wu 2018:35).

Teacher 1 responded that ICT could be used as follows:

> *"You can use it for showing a political map (with the use of a data projector), and this can happen immediately on the screen."*

[Teacher 1 elaborates that with the textbook, the learners need to look for pages in the textbook, and it takes time]

From the above extract, it is evident that the teacher knows that when using ICT, the Geography teacher will be able to *"show"* learner's different digital maps with the use of the data projector and laptop. This is very important as a Geography teacher because maps are one form of communication that geographers can use to investigate a place (Daugherty 1989:30).

Not only will the Geography teacher have access to different maps, but with the use of ICT, the teacher will be able to access and show the maps *"immediately".* As indicated by the teacher and in her elaboration, using ICT instead of the textbook in the Geography classroom will save time (Van der Schee 2003:209). The teacher's responses confirm a theory from Osborne and Hennessy (2003:36) that teachers will have a positive attitude and an increase in confidence if they realize the ICT resource's value.

4.2.3 Value as a resource for learners

Teacher's perspectives will change if they see the value of ICT for their learners. It is evident that learners are used to the internet and know their value (Shepherd 1998:35; Wellington 2006:109). Therefore, the teacher's value lies in using ICT to enhance Geography teaching and learning. Learners can use information and data from various sources and transform the way Geography knowledge is accessed and delivered (Van der Westhuizen 2007:41; Fu 2013:113). It is apparent in the statement of T2 below that ICT can benefit learners:

> *"Any school will want to do that because learners can benefit from that"*

The phrase *"to do that"* refers to the use of ICT in Geography. She indicated the practical value of ICT for all the learners by saying, *"learners can benefit from that".* However, although teachers may understand the value of ICT, the phrase *"any school will want to do it"* suggests that at their school, all the teachers do not make use of the integration of ICT in their Geography teaching and learning in the Intermediate Phase. This was also confirmed by the SGB member in an informal discussion. This is contrary to Madlela (2015:352) and Fu (2013:112), who states that ICT is considered a powerful tool for educational change and reform, and the school is an important environment in which learners can participate in a wide range of computer activities. The school as part of the social system, will influence the social system because of the social norms, role of opinion leaders, type of innovation decisions and the consequences of innovation (Rodgers 1995:23).

She elaborated on the value of ICT in Geography teaching and learning as follows:

> *"……when I ask them that they must find out something. They say it is easy and fast to get it. They just Google it on the internet."*

It is clear from the phrase above that the teacher knows that learners are used to working with ICT when she uses the phrase, "*they say it is easy"*. This is an indication that in using ICT's not only teachers will be able to have immediate access to resources and learners, which is evident in the phrase *"easy and fast".* The internet gives learners immediate access to richer source Geography materials (Leask 1999:41 & Van der Schee 2003:209).

It is also evident that learners already have skills in using some tools of ICT's in the phrase "*They just Google it".* This indicates that learners are using ICT as a geographical resource and can access and use information from various sources (Fu 2013:113). This also coincides with the response from the SGB member when replied:

> *"Children are exposed to technology because they know how gadgets work."*

From the above extract, it is evident that ICT as a resource is valuable for young Geography learners from a management point of view because of their natural curiosity. They want to find out how things work in real life and explore new things, such as technology. This will be valuable for learners because they can now be more frequently engaged and build new geographical knowledge on their own by using their geographical enquiry skills (Lea *et al.* 2003:322; Hassel 2000:81). This is also an indication that learners do not need to be motivated to use ICT in their teaching and learning because they are also used in real-life, which will raise geographical, educational quality (Weert & Tatnall 2005; Lowther *et al.* 2008; Crawford 2013:1).

In using the word *"gadgets",* the member refers to games that learners are exposed to at home or on their phones. This is evident in the response of the SGB member when saying:

> *"By using ICT in teaching children, they can see that this technology is not only for gaming purposes, but they can use it to learn."*

According to the SGB member, the learners will see the value of ICT on a more academic level when referring to "they can use it to learn" instead of just recreational activity. By using technology in their teaching and learning, learners will optimize their creativity (which they see in games), and this will lead to the discovering of new geographical multimedia tools which are already available to them through games (Gee 2007:4). Teachers need to take advantages of this curiosity of learners to explore ICT's in the Intermediate Phase classroom, because this can motivate the learner to learn more about new innovations. This especially are explained by Rodgers (1995, 2003) in explaining the time element and the aspect of the innovation-decision process. The learners will already have the awareness-knowledge of the use of ICT's because they are already exposed to it.

From the discussion above, it is evident that the research team believe that using ICT will be valuable to learners. Whether they are using it on their own or in cases where they will be exposed to it, this concurs with literature from Buabeng-Andoh (2012:148) that teachers will have a positive attitude and an increase in their confidence when they understand how ICT can make teaching and learning more motivating, exciting and more enjoyable for learners.

4.2.4 ICT can transform resources

Teachers will have more confidence in using ICT because they know that technological tools can be used to increase the quality of resources for teaching and learning in the Geography classroom (Chang & Wu, 2018:35). At this stage, in the time element, the how-to-knowledge, contains information how to use technology correctly (Rodgers 1995:24). Resources can be digitally transformed to meet the learners' needs in a cost-effective and time-effective manner by using the internet and other programmes (Van der Westhuizen 2007:41; De Sousa 2008:31).

Teacher 2, which was older, also responded positively to the value of ICT as a transformable resource, and it was significant when she refers to the transparency resources that she used all the years.

> *"There are lots of things that is advanced now - those (transparencies) are flat things - and I think that will be very old fashion, more things can be done with ICTs."*

This is significant because although she is an older teacher, she has a sense that using ICT as a resource can transform current resources when she mentions that her transparencies were "*old fashion".* This concurs with Rodgers and Streluk (2002:2), which states that out-of-date resources no longer inhibit teachers. She acknowledges in the extract above that the advancement of ICT as a resource can transform regular resources (flat things) to more visually attractive resources when she refers to, "*those are flat things…more things can be done with ICTs*". For example, when teachers want to teach physical features in Geography, it will be more conducive to the learning experience to show the mountain in three dimensional (3D) forms.

This evidence above supports the literature from Chang and Wu (2018:35), Van der Westhuizen (2007:41), and De Sousa (2008:31) that ICT's can be a transformational tool and that teachers understanding of it will increase their confidence in the value of technology as a resource tool. According to Rodgers (2003:22) this will lead to the time of adoption in the innovativeness of an individual.

4.2.5 Resistance to change resources

The lack of knowledge and skills will lead to resistance to change and possible negative attitudes and teachers' perspectives towards ICT's. Research done by Gomes (2005:63), BECTA (2004:7) and Bapela (2015:39) indicated that teacher's resistance to change and confidence could be a significant barrier in the uptake of ICT by teachers in the Geography classroom. Integrating new technologies in the geographical education setting requires change, teachers, however, experience the change differently because beliefs influence what they do in the Geography classroom (Bingimlas 2009:239; Chai & Tsai 2012:1057).

Both teachers used Geography resources from the school or made their own. Contrary to Larangeira & Van der Merwe 2016:120), which states that the shortages of resources in the teaching and learning of Geography are widely known, it is not the case in the school used for the study. Both participants had evidence of self-made resources because they know that the use of resources is essential to heighten, enliven and extend children's awareness of the world (Larangeira & Van der Merwe 2016:120).

Although Teacher 2 has a positive perspective with regards to the use of integrated Geography teaching and learning using ICT, she was expressing her attachment with her developed resources over the years when she stated that:

> *"I use transparencies all my life and have a lot of files I really went to a lot of trouble to make transparencies and the children enjoyed it."*

This statement of hers can be interpreted that she will not necessarily use ICT in her lessons, even if she will be trained, because there will be a possibility that she might "fall back" to her hard-working, developed resources over the years. This will also be increased by her sense of knowing that the learners *"enjoyed it"* over the years. Therefore, this will influence her beliefs on integrating ICT in teaching and learning in the Intermediate Phase. She views and perceives her self-made resources as important and liked; therefore, she will base her decision on using ICT on her traditional beliefs (Liu 2011:1013; Nkula & Krauss 2014:243).

4.2.6 Opportunity to Learn

Schools that do not use ICT resources in their Geography teaching and learning in the Intermediate Phase, are losing out on learners' skills and a huge opportunity to narrow the gap between the privileged and underprivileged learner at school as part of the social system (Rodgers (2003). This is evident in the response from the SGB member that said:

> *"Children who are not privileged to have this technology at home can be given the opportunity to learn how to operate the technology or by observation, the child can also learn."*

Schools offering ICT's to learners in the Geography classroom will widen technology access, especially underprivileged learners. The teachers had similar responses. These learners will have access to Geography resources and will benefit from enabling teachers to obtain peer support for those learners (Cener, Acun & Demirhan 2015:192; Chang & Wu 2018:35). The phrase "*opportunity to learn how to operate the technology* "indicates that ICT can accelerate the Geography educational process to allow learners to extend high-level educational opportunities (Ei Morabit 2018:3; Tripathi 2019:10).

4.2.7 ICT is as a visual learning tool

Geography is seen as a visual subject, and the use of ICT will improve the visual literacy skills and learners' learning experience (Weeden 2003:168; Daniels 2018:2). Using the different visual forms of ICT will improve learners' graphicacy skills and ultimately improve geographical spatial perceptual skills (Clifford *et al.,* 2016:350). The study respondents view ICT as an important visual tool because it connects the learner with the teaching experience. Mayer (2001:67) states that a visual experience will develop deep learning because learners must make a connection with the content.

In the response of the T2, to elaborate on why she regards ICT as important in the teaching and learning, she replied:

> *"...I also think of the new generation (children) we are dealing with, they (learners) rather will watch, for example, three little pigs instead of reading it."*

In the phrase above, *"I think of the new generation",* T2 admits that the learners in their school will be open for adaption to new technologies because they form part of the new generation who are used to technology, and she understands the impact that ICT will have on their learning. This also reflects that she wants to give learners opportunities in ICT because of the kind of learner she has in a class. Learners prefer more audiovisual presentation of content rather than static content, and this is evident in her stating that *"they will rather watch*.… *instead of reading".* This will especially will be the case for map work. Learners need special skills in Geography, called graphicacy, for them to be able to interpret maps.

This was also evident in the response from T1 when she responded:

> *"Learners like to visually see information and interpret it and if maybe engage with it."*

The extract, *"learners like to visually see the information",* confirm that learners prefer more visual information of whatever kind. Using visual information in the Geography classroom will allow the learners to conceptualize concepts in map work better. In conceptualizing the concepts, learners will be enabled to interpret the information on a higher-order thinking level.

T2 also confirms the benefit of using ICT as a visual tool when she elaborates in added, *“I think the children are more willing to follow and are more interested”*. This is also a testimony that by using ICT in the Geography classroom, learners will be more self-motivated, and this is evident in the phrase, *“more willing”.* They do not need the teacher's motivation for their learning, which will lead to self-directed learning. The response from T2 above was coincided by the SGB member when using the phrase *“more interested”* in their elaboration, suggests that ICT as a visual learning tool will stimulate learning and improve learners' attention span in the Geography classroom. This will ultimately lead to an improved Geography lesson because learners are stimulated in the learning process and will remember more parts of the lesson because of their more lasting attention span (Sangrà & Gonzalez-Sanmamed, 2010:214).

4.2.8 Enhanced Geography teaching and learning

Teachers who have a positive attitude towards ICT can enhance Geography teaching and learning in the Intermediate Phase in many ways (Freeman 2003:205). A positive attitude towards ICT will increase the disciplinary knowledge of geographical thinking and enhance Geography teaching and learning in the classroom. According to Leask and Meadows (2000:1) and Killen (2010:18), ICT will encourage learners to engage in problem-solving and communication, which will enhance Geography teaching and learning. Using ICT as a media tool will lead to an extended attention span, which will help productivity in the Geography classroom (Sangrà & Gonzalez-Sanmamed 2010:214). In the response of T2 on an elaborated question with regards to ICT that will improve quality teaching and learning, she responded:

> *“Yes, this is their language ……to make learning more productive…”*

In her response, *“this is their language”* indicates that she acknowledges the learner’s ability and understanding of ICT use in Geography. The use of the word *“their”* also indicates ownership. This will also be a testimony of the fact the learners will take ownership of their learning because they will feel that when teachers integrate ICT in their Geography teaching and learning, this will be something that they already know. Although learners are open to change for the use of UCT, this will not necessarily lead to teachers using ICT in the Geography classroom. Using this phrase is testimony that learners are bringing prior knowledge to the Geography classroom. This will enhance the learning process because teachers can build knowledge more constructively.

In her response, it is evident that ICT can make teaching and learning more productive in the classroom. This can happen if teachers make learning activities more attractive to learners. This can be done when using ICT as a visual tool, and the learner's attention span will increase during the lesson (Sangrà & Gonzalez-Sanmamed 2010:214). However, this can only happen if the learning environment in the Geography classroom will allow learners to be more creative and not defined by only content (Spree 2014:4).

From the responses received from the participants, they are confident that using integrated Geography teaching and learning using ICT can improve teaching and learning in the classroom. The discussions above confirm that the vast majority of the research team concluded that ICT resources could add value to Geography teaching and learning. Therefore, it can be concluded that the participants have a positive perspective on the use of technology in the Geography classroom and these consequences can have, according to Rodgers (2003), a desirable outcome in the adoption of innovation. Although the responses were reasonably positive regarding their ICT perspectives, this will not necessarily lead to integrating Geography teaching and learning using ICT (Osborne & Hennessy 2003:36; Rodgers 2003; Balanskat *et al.* 2006:36).

4.3 DATA ANALYSIS ADDRESSING THE OBJECTIVE TO DETERMINE HOW TEACHERS ARE USING INTEGRATED GEOGRAPHY TEACHING AND LEARNING USING ICT

Over the years, there has been much literature indicating the value and application of ICT's in the teaching and learning process (Fullan & Langworthy 2014:11; Artvinli 2017:10). According to Bindu (2016:27), ICT helps transform a teacher-centred teaching environment into a learner-centred one. Furthermore, Fullan and Langworthy (2014:11) emphasized that the frequent use of digital tools in the classroom and resources will accelerate deep geographical learning and improve the quality of technology to support teaching and learning. Therefore, teachers need to know ICT and how to use it in meaningful learning in the Geography classroom, which concludes that the pedagogy of technology is essential: the how rather than the what.

In deciding on how a Geography teacher will "approach" a lesson, the question of which teaching strategy or method you are going to use is of utmost importance. They also need to be confined in the approach from a geographical perspective. Lanche (2011:77) explained that one of the challenges in schools is to get rid of isolated content of Geography and treat it as an interactive system. ICT can be a tool to discard the isolation of content, and that it can be taught as an integrated and interactive system.

4.3.1 Use of pictures (from google)

Using ICT's can be a promising way of creating a creative learning Geography environment. The use of pictures can be one way of establishing a creative environment because learners like to see visual presentations in pictures (Beaudry 2015:86). The visual learning resources will enable learners to be more involved in the lesson presentation because of their longer attention span. This will also lead to the improvement of their visual literacy skills and their graphical skills, which is necessary to create a foundation of quality Geography teaching and learning (Treves, Mansell & France 2020:6).

Not only are there considerable benefits in using pictures for teaching and learning Geography, but they are also easily accessible through the internet (Draper 2010:36). Showing a picture on a flat surface with no colour (as in a textbook) can sometimes be difficult for the learners to grasp. Showing them a colour picture and possibly a 3D picture from the internet can be more meaningful for their thinking and visual understanding (Baylak's 2016:65).

The use of pictures in the integration of Geography teaching and learning using ICT is evident in the comment from one of the teachers (T1):

> *"Visual learners are enjoying working with ICT. I can show my learners a picture from google how a bay is looking on the internet."*

This comment from the teacher indicates that learners do like visual presentations when she used the word "*enjoying"*. More visual learners orientated in their learning will experience this helpful for their teaching and learning in Geography. They will be able to see the bay when the teacher is explaining it visually. This is evident that learners like seeing visual presentations of content, which will increase their willingness to learn. However, this is not an indication that they are *"working"* with the actual ICT's using.

They engage with the content on a low level (just by seeing what the teacher shows them on the screen, for example). With this way of teaching, no deep-learning are establishing a better understanding of Geography concepts. Visual literacy will have propelled into new prominence for learning and increase their graphicacy skills (Beaudry 2015:86).

Teacher 1 and 2 gave other examples of how pictures can be used in the integration of Geography teaching and learning to better learner's understanding of the content:

T2: "Yes. I think the physical features where you can show them how it looks."

T1: "I also think the inside of the earth. To them you can't say this is the earth. Children think its hollow inside."

T2: "Maybe the composition of the earth, which will be interesting to show them the layers."

Although the teachers were able to give examples of how they can use picture in the content, which is relevant, they did not explain how it will be done in the learning process while teaching it.

It was also clear from the data that both teachers are knowledgeable about where and how to get the resources by downloading pictures from the internet:

T1: "…. picture from google…."

T2: "Yes. I just google and show them some pictures."

This confirms that these teachers foster their autonomy by creating their material, thus providing control over content than in a traditional Geography classroom setting (Fu 2013:115). This is also evident that ICT's will support Geography teachers by providing access (Google) to different resources and will create a possibility to enable them to exchange good ideas. It is clear from their responses that the teachers have technological knowledge (TK) and technological content knowledge (TCK) to use ICT in the Geography classroom. Indicated in their responses, the teachers understand certain technologies (pictures from google) and how best suited for the content (Koehler and Mishra 2009:65; Cox 2013:16). Furthermore, because the teachers have the skills to incorporate pictures from Google, their adoption to innovation will have the desirable consequences to the teacher, as well as direct consequences because there is an immediate response in how to use the pictures (Rogers 2003).

4.3.2 Use of interactive whiteboard IWB) and data projector

A wide variety of tools are currently used for the integration of ICT's in Geography teaching and learning in the Intermediate Phase (Pathak & Manoj, 2018:44). The tools are used in a variety of ways to stimulate learning in the Geography classroom. For example, the interactive whiteboard (IWB) and data projector to develop different content presentations were used in the lessons. What is important is that not what tools are used, but how they are used in the classroom, this is evident in the research from Ncube (2018:63), when teachers were using the tools only for illustrations.

PowerPoint presentation enriches the Geography teaching and learning environment because it can convey textbook concepts in a more visually appealing way (Priya 2017:1).

T1 and T2 indicated in their interviews that they are using an interactive whiteboard (IWB) and data projector. The following is an excerpt of T1

> *"I am using the whiteboard and data projector and showing the learners, e.g. map work- show the cardinal points and physically show them how to use and identify natural features in Africa like the Sahara Desert."*

T1 uses ICT resources that can improve the understanding of certain geographical concepts, such as the IWB and data projector, to show them pictures of the cardinal points and natural features in Africa. In the phrase *"show them how to use natural features",* it is worrying that the teacher uses the phrase *"how to use"* because this is unclear that these was the intended skills and content that needs to be taught according to the CAPS Gr.4-6 (SA DoE 2011:26) document, nothing is indicating that this is part of the curriculum.

This indicates the teacher's lack of content knowledge of Geography or proper planning (Hofer & Bell, 2015:3). What further raises how teachers are using ICT in the Geography classroom is the use of the word *"show"* in her phrase. This indicates that Teacher 1 uses the IWB or projector for only illustration purposes, as indicated by the literature from Ncube (2018:63), which is not the best way of integrating ICT's in Geography teaching and learning.

When using ICT in teaching and learning, there must be an underlying teaching method that is used with it to maximize learning and can be used as a cognitive tool, which means that when we teach with ICT's it is not just to show a picture, etc. but also to contribute to the construction of the concept for learner's cognitive development in the learning process. This is aligned what Rodgers (1995:21) is referring to as the innovation decision process as an element of time. Although, the teacher is adopting the innovation and implement it, there will still be uncertainty about the outcomes of the innovation and can still be a problem at this stage.

Teachers need to have Pedagogical knowledge to understand the processes and mechanisms for Geography teaching (Bell 2015:3 & Grossman 1990:6). The IWB is also underutilizing in her classroom as a resource because IWB can be used for more interaction with the learners in a lesson and be more enthusiastic (Bardakci & Kocadağ 2020:2). Instead of just showing them the cardinal points, she could develop or design a lesson with the IWB software, which will support learning (BECTA 2004:10) to allow learners to engage in a collaborative experience when using, for example, the touchscreen. Although having the resources in their classroom, the teachers could also not have been trained in using IWB or integrating Geography teaching and learning using ICT in the Intermediate Phase (Alkis 2020:19).

4.3.3 Use of Simulation Software

Since Geography is a highly visual subject, according to Treves, Mansell, and France (2020:6), multimedia will compliment geographical learning. The use of simulation software in Geography lessons will enable the teacher to make the classroom environment more creative and interactive. Simulation software can explain difficult concepts and have the potential to improve enquiry (Lambert &

Balderstone 2000:110). With simulation software, the concepts can be taught 'live', and some of the features of the model would not be hidden (Gadeng *et al.,* 2019:2).

Using simulation software allows learners to see models in 3D format, which will improve their visual literacy skills. T1 used simulation software in her classroom when she replied:

> *"I use simulations which was downloaded from internet of a volcano."*

When asking participants to elaborate on how they were using ICT's in their lessons, the explanations were superficial, as can see in the phrase above. Teacher 2 lacked technology skills when she admitted that she has not used simulation software before and that she does not know how to download the software because she was never exposed to training on how to do it.

Teacher 1 elaborated that she learned herself by downloading simulation software. The teacher, however, did not explain how she was using it in a lesson. From the above extract, it is clear that the teacher makes regular use of simulations which is indicated by using the word *"simulations"* in its plural form. Using the phrase *"downloaded from the internet"* confirms that T1 has the technical knowledge to download simulations more than once because she understands the use of the computer and the internet (Cox 2013:16).

Using simulations such as *"volcanoes"*, which link to the relevant content, shows an understanding of the technologies that are suited for addressing the content (which relates to the LAT's of Harris & Hofer 2016:2867) and shows competency in her technological content knowledge (TCK) (Koehler & Mishra 2009:65).

4.3.4 Lesson presentations (with the use of PowerPoint)

4.3.4.1 Context

Both teachers 1 and 2 give classroom presentations of Geography lessons. Teacher 1 taught Climate and Vegetation for a Grade 5 class, and Teacher 2 gave a lesson on Food and Farming for a grade 4 class. According to the time-table, these lessons lasts for 30 minutes. Both teachers use PowerPoint presentations as ICT resources in their lessons. The use of lesson presentation as the methodology was useful for this study because this will give the researcher first-hand experience on how teachers integrate Geography teaching and learning using ICT. This was also seen as an opportunity to describe the teacher's TPACK for further teacher training and development (Mishra & Koehler 2006:1028; Baran, Chuang & Thompson 2011:371). The lessons were digitally (audio) captured and personally observed. Table 4.1 is an example of Teacher 1's lesson presentation.

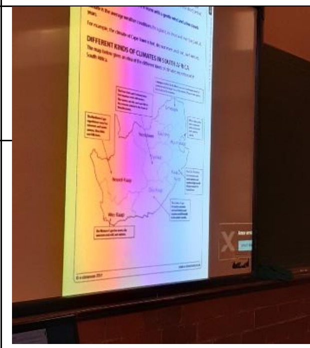
When observing the lessons presentations, the teachers used the IWB in different ways. As for T2, she used it with a teacher assistant who was helping in her class. When she was teaching and want to move to another slide, the teacher assistant would change the slide. This can also be evident that the T2's technological knowledge is lacking (Cox 2013:16) when she said that *"the assistant helped me a lot with the computer and IWB".* Teacher 1 could use the IWB on her own.

Table 4.1 Lesson presentation: Teacher 1 (Weather and Climate)

	LESSON PRESENTATION	COMMENTS
Teacher	Good day class.	
Learner/s	Good morning mam	
Teacher	We did the weather yesterday, what is the weather?	Do not give learners a chance to answer

	Open your textbook and read the definition what is weather. Teacher gives the page number to learners.	Learners still busy looking for the correct page in the textbook
Learners	All read out loud the definition of weather from textbook.	
Teacher	So what did we learn about weather?	Teacher repeat the definition of what learners read.
Teacher	(The condition of atmosphere for that specific day of the day. Conditions can change during the time of the day. Continues to give an example from the previous day's weather).	
	Ask questions about the weather of the previous days. Explain that weather changes over time.	
	Who can tell me what is the elements of weather again?	
Learner/s	Group of learners gave teacher the answer (temperature, rainfall, cloud cover and wind speed)	
Teacher	Explain the link between the elements and the definition of weather.	
	We did climate. What is climate?	
Learner/s	Group of learners in class read out the answer aloud	
	And we made a research example need to be done to determine the climate of a specific	

	place. Different places had different climates. Asks one learner that what did he find out yesterday about Sutherland.	
Learner/s	It was snowing in Sutherland	
Teacher	Was it snowing here by us?	
Learner/s	Whole class, No mam	
Teacher	We do not have snow here in Kimberley because our climate is different from that of Sutherland.	
	Now we are just going to do an overview to check what I have explained about the difference between climate and weather before we go on.	
	We will do vegetation and therefore you need to know why we are doing vegetation and why certain types of vegetation grow in a certain or different climate. We will focus on South Africa.	
Learner/s	Learners watch the video	Teacher plays a video on the IWB about the difference between weather and climate. Video give a detail description of the development of weather elements and explanation of climate in the form of visual presentations on the level of the learners.

		The video lasts for about 4 minutes.
Teacher	So open your textbook, and we are going to do activity 9. You are going to see how that relates to the activity of today. Ask learners to start with activity.	Teacher gives no explanation of how learners must do the activity
Learner/s	Learners turn to the page in the textbook	
Teacher	Now we are just going to revising again. You need to take a look at the two maps that I am going to show you.	Teachers show maps on the IWB.
	She directed learners to the page in the textbook of the maps on the board.	
	This map shows the climate of different South Africa places [shows them the maps on the board]. I am going to give you a copy of this page (map) on the board.	
	On top [shows to the map on board]. When did they receive the information of the this? Teacher give answer herself.	
	They observe the information and then they discover, they research this information [information on the map] they combine the information [temperature and rainfall], what the climate is like in a specific area.	
	[She read an excerpt from the textbook: Cape Town of climate is hot in the summer and cold, wet winters. All the summers will be like	

	that]. They observe this through research over the years.	
	Different types of climates, and in front of you, you have the map on page 61.	
	Focus on the NC. Describe the NC' climate for me?	This was from the textbook's map
Learner/s	One of the learners answers the question by describing the information he sees on the map.	
	This is most probably the driest part of SA. Winters are warm, but the nights can be cold and frosty—Winters warm, dry cold.	
Teacher	Is that true? Yes, that is. Did you ever experience any weather during the summer or winter here?	
Teacher	Ok, but now you travel to Durban, for example. Where is Durban, and in what province?	
Learner/s	One of learners give answer.	
	Kwazulu Natal.	
Teacher	Look on the map and find it. What do they have there?	
	[Teacher help one of learners to find it on the map] That area there.	
Learner/s	One learner read from the textbook about the climate in that area.	

Teacher	What is the difference between the Drakensberg mountains, where it is and where Durban is?	
Teacher	[Learners do not know the answer. The teacher explains on the board where the Drakensberg mountains are]	
Learner/s	Learner answer that we call it the escarpment.	
Teacher	There is the Drakensberg mountain; what is an escarpment?	Show Drakensberg on the map
Learner/s	One of the learners started to explain the answer slowly….it is a high area….and then the teacher completes the sentence.	
Teacher	So Durban is more on the coastal plain of Kwazulu Natal. So Durban here [shows on the map] and the Drakensberg here [shows on the map]	
	So now the weather conditions here are different.	
	Now we are going to Mpumalanga, which they call the Lowveld. How is the climate in the Lowveld?	
Learner/s	One of the learners read from the textbook, how the climate is in the Lowveld.	
Teacher	So now we are going to focus on our climate. We now it is hot. Which were the four words that we know how our climate describe?	

	Teacher direct learners where they can get the answer.	
Learner/s	It does not rain much here, really hot in summer...learner read on.	The bell rang for the end of the period.
	[Teacher stop learner and end the lesson]	

4.3.4.2 Presentations

ICT needs to be used in conjunction with an appropriate teaching method that will stimulate the classroom environment to increase learners' higher-order thinking Geography skills. Both lessons of teachers use the traditional lecture and question and answer method incorporated with the PowerPoint. Using PowerPoint slides as an ICT tool reveals the opportunity to increase learners' higher-order thinking skills (Dalal 2016:25; Ganapathy *et al.* 2017:76). To increase higher-order thinking skills using PowerPoint, they could add images, drawings, visuals and graphs, realia and natural resources, etc., to enrich the Geography teaching environment (Onivehu 2018:49).

Research from Mayer and Moreno (2003), however, indicates that it is not just about presenting pictures or words on a PowerPoint slide or by animations, but how will this lead to meaningful multimedia learning (Mayer & Moreno 2003:43; Mayer & Mayer 2005:1; Brunken, Plass & Leutner 2003:53). Following the lesson of both Teacher 1 and 2, both started with introduction questions to start the lessons. Teacher 1 asking a question about the current weather for the specific day, and Teacher 2 about processes and unprocessed food. Teacher 1 continued by asking learners to read the textbook definitions, and the teacher repeated the definition.

In contrast, Teacher 2 (her assistant shows raw food pictures on the slides) asked questions like…*" what do you see and where does it come from?"* In asking the question, each picture will be shown on the slide (one after the other), as seen in Figure 4.1 below.

Figure 4. 1 Slide on Processed Foods from Teacher 2

It was evident that Teacher 2 engaged the learners with the PowerPoint slides' pictures (Onivehu 2018:49). She continued with different pictures on the slides and asked them questions about each picture. By asking it, she incorporated meaningful learning, as suggested by Brunken *et al.* (2003:53).

These introductory questions could also be put on the PowerPoint slides to save time developing the lesson. After questions about climate, Teacher 1 played an animation video on the Interactive White Board (IWB), giving a detailed description of the development of weather elements. The teacher gives a revision explanation of the concepts that was played in the animation video. The teacher did not ask any questions with regards to the animation video that was played. After that, she asks learners to do a short activity in the textbook.

Next, Teacher 1 showed a map (as seen in Table 2.1) of the different climate regions in South Africa on the IWB. She also asks learners to go to the page in the textbook. She then asks questions, like "*describe the Northern Cape climate?"*. At first glance, it seems like a higher-order question and can be regarded as a suitable geographical question, but then she asks the learners to read the textbook's answer, which was linked to the map of the Northern Cape. One of the learners then read the answer from the textbook. The teacher then shows another province on the same slide and repeats the question or asks a different question that the learners look for the textbook's answers. Although using a textbook is not wrong, the use of technology was limited to showing a map on the PowerPoint and did not allow the learners to appreciate the content's distinctive features on the slide (Onivehu & Ohawuiro 2018:49). Since the map was on the PowerPoint slide and clear to see for all in the classroom, the teacher could have engaged the learners more with the Geography content. This was also not in line in how they were trained in the workshop sessions.

Teacher 1 needed to engage the learners more with the PowerPoint slide on the IWB. Whenever she referred them to the textbook, although the slide was still open on the IWB or slide, she would ask learners to *"look at the map and find it".* Using the slides like this, the teacher missed an opportunity to engage the learners and let them collaborate in the Geography lesson, which would have promoted learner interaction as a social activity (Adom *et al.* 2016:5).

What T1 did well was when learners did not know; for example, when she asked learners, *"What is the difference between the Drakensberg mountains, where it is and where Durban is?"* she made use of the map on the slide to show them where it was. When the teacher asked the question, *"what is an escarpment?"* learners could not answer the question. In these instances, a picture of the Drakensberg escarpment in 3D mode would be a good option because pictures allow us to make cognitive understanding better for the learners.

The execution of the rest of T2's lesson with PowerPoint has more advantages for integrating Geography teaching and learning using ICT. T2 had a PowerPoint presentation of 10 slides which consisted of pictures of processes and unprocessed foods, where meat comes from, where fruit and vegetables come from, and the types of farming. T2 also has slides of text on the definition of substance and commercial farming. T2's slides were also interactive with the use of animation. On reflection, this teacher, incorporated most of the skills that was done in the training sessions. She integrated these with the using question and answer teaching method. When asking questions like *"I wonder if someone can tell me, where do the butcher get the meat?"* she will then follow it up with the show of the slide (pictures) of where we get our meat. This is typically what Sagar and Pandey (2014:77) describe as the concretization of abstract concepts in the teaching-learning process of Geography. What she could have done differently is when she refers the learners to the textbook to look at pictures of substance and commercial farming rather than added the pictures on the slides.

It was evident from the lesson observation that the teachers increase the learner higher-order skills by adding images and drawings to their PowerPoints (Onivehu 2018:49). However, how the lesson was executed using PowerPoint is far from what constitutes meaningful learning (Mayer & Moreno 2003:43; Mayer & Mayer, 2005:1). The teachers could have attended to important aspects of the presented material by mentally organize all the content into a coherent cognitive structure without using the textbook (Mayer & Moreno 2003:43). Execute the presentation as was observed. It is evident in the teacher's lack of TPACK knowledge (Koehler & Mishra 2009:66).

This was evident in the presentation that they did not understand how to use the technologies in constructive ways and how technology can be used to build on existing knowledge of the lessons.

4.3.4.3 Teacher-centred and Learner-centred teaching methods

ICT provides teachers with an opportunity to shift from a teacher-centred method to a new learner-centred method. As Van der Westhuizen *et al.* (2012:192) stated, this new learner-centred paradigm constitutes active and interactive instruction modes and collaborative and cooperative work. In this learner-centred environment, profound learning experiences and creative thinking in Geography teaching and learning will occur (Fullan & Langworthy 2014:1). Incorporate strategies like these will enable teachers to deliver geographical knowledge, skills, and values, enabling them to function effectively and responsibly (Van Harmelen 1999:1).

Observations from the lesson presentations confirm that the teachers used a more teacher-centred approach towards teaching the Geography lesson. The teacher's instruction was limited to short blocks of instruction, and in most of the lesson, it was a passive or one-way mode of instruction. The instruction was limited to the teacher's question and waiting for an answer from the learners. This limited the skills and need to be taught and for meaningful geographical understanding (SA DoE 2011:18).

Since the lessons were more teacher-centred, it confirms literature from Van Harmelen's (1999:1) that there was no deliverance of geographical knowledge, skills and values in the lessons.

4.3.4.4 Assessment

Lambert (2003:255) defines assessment as the processes by which teachers judge value on others' learning, and it is a highly skilled activity requiring confidence and competence (William 2011:3). An assessment has always been an aspect of ICT use in education, although it was limited to relatively straightforward testing of content as a learner progressed through a program (Malyuga 2016:320). New developments in ICT opened up the interest in how teachers can use ICT's to assess learners' capabilities, whether for formative or summative assessment. McCormick (2004:20) considers why ICT might be used: to improve the learning experience; where it is of necessity part of the learning experience (using ICT); where it might improve the efficiency of assessment or cope with large numbers (expediency).

Unfortunately, the researcher observed limited assessment. At the end of the lesson, the assessment was observed when the teacher asks learners to do an activity from the textbook. The learners informally did the assessment. In the lesson of T2, the bell rang before she could give them an activity. The assessment was not done with the use of ICT and was more traditional from the textbook. Therefore, the teacher could not make a judgement of the learner's progression.

In these lessons, it would have been suitable to use ICT for assessment, especially as Redecker (2013:5) states, where it is part of the learning experience using ICT or cope with large numbers (as was the cases in the classes). The assessment could have been done by the use of a PowerPoint slide after the lessons. This could have been in the form of a couple of questions which learners need to answer in their books. This means that the teachers would not need the textbook or to write anything on the board.

4.4 DATA ANALYSIS ADDRESSING THE OBJECTIVE TO DETERMINE THE CHALLENGES WHEN GEOGRAPHY TEACHERS ARE USING INTEGRATED GEOGRAPHY TEACHING AND LEARNING USING ICT

The research team identified the following challenges; a lack of resources, lack of training for integrated Geography teaching and learning using ICT in the Intermediate Phase, lack of preparation and a lack of confidence to use ICT integration. These challenges were derived and confirmed by data from the interviews and lesson presentations of the team. The team members share their points of view, irrespective of their status, which is in line with participatory action research.

Since the coming of the digital revolution (computers, internet) in the classroom, most teachers have seen this as the most significant change in the recent past and as the biggest challenge for the Geography teacher in the future, and as stated by Solari *et al.* (2015:2); that these innovative tools can make a good learning experience in the classroom. The school's characteristic and context can cause some challenges in integrating ICT in Geography teaching and learning in the Intermediate Phase. Tondeur (2007:10) claims that school-related policies and management might affect the integration of ICT in the classroom, and an essential factor is the development of a shared vision to accomplish a common goal in the social society (Rodgers 1995,2003).

4.4.1 Challenges related to the lack of technology resources

This section focusses on describing the challenges associated with ICT tools that can enhance integrated Geography teaching and learning using ICT in the IP classroom. The shortage or inadequacy of instructional materials can hinder quality education delivery, as stated by De Guzman, Olaguer and Novera (2017:64). Furthermore, the challenges of traditional resources like textbooks and atlases, are widely known in the education system (William & Catling, 1985:245). For this reason, Fullan and Langworthy (2014:11) emphasized the use of digital tools as resources that will accelerate deep learning and improve the quality of technology to support Geography teaching and learning (Koh, Chia & Tsai 2014:185).

Teachers' common challenges were the lack of time to plan technology lessons, explore different internet sites, or look for educational software (Bingimlas 2009:239). These are because of the teachers' busy schedules because they teach different subjects and do extramural activities and administration (Jung 2005:94; Dlamini & Mbatha 2018:18; Graham, Stols & Kapp 2020:753). Although this issue was raised by both T1 and T2, the explanation of T1 with regards to challenges was as follows:

> *"The teachers only get the laptops at school and need to hand it in at the end of the day. We cannot use it at home for planning, etc. because you do most of your planning at home. This hinder my development because I only have an old computer. It does not have the same programs on it."*

Although the specific school do have physical resources, like computers and IWB, the specific challenges were that the laptops belong to the school, and the teachers can only use them at the school, this was confirmed by the SMT and SGB member. This was evident from the phrase "*only get the laptops at school"*. This means that the teachers must do their preparation on another device or laptop and bring it to school, maybe in the form of a memory stick.

This can be a major challenge for teachers, especially in T1, who "have an old computer", which will also have compatibility challenges because it does not have *"the same programs".* This challenge will also impact the lesson's quality or the planning of integrated Geography teaching and learning using ICT. This is evident in the phrase of T1 when she stated that "*we cannot use it at home for planning".* Planning the use of ICT in Geography is not easy and cannot be done in a concise space of time. This means that teachers can only do planning after school. This will be a challenge because teachers have other obligations at the school (extramural activities) that need to be taken care of (Dlamini & Mbatha 2018:18; Graham, Stols & Kapp 2020:753).

Furthermore, and one of the crucial remarks from the extract was the use of the phrase: "*This hinder my development".* This indicates that the teacher acknowledges her lack of skills and wants to improve her skill through professional development, but these challenges hinder her. Also, she has technological knowledge when she states that "It does not have the same programs on it." This refers to different software programs on computers. Teachers not been able to have access to the laptop during school's hours indicate that the school's policies are hindering teachers from using laptops for preparation and planning for the use of ICT. This confirms the literature from Tondeur (2007:10) that school policies can affect the integration of ICT in the Geography classroom. In one of the informal discussions the SMT and SGB member confirm that the school does not have adequate ICT policies to increase the effective use of technology resources.

Having these challenges, will also have an effect on the time that teachers will adopt an innovation, because the innovativeness of an individual will prolong the rate of adoption if they do not have access to certain resources (Rodgers 2003:22).

Not having access to laptops during school time or personal use hinders teachers' development from implementing ICT in their Geography classrooms. They do not have the proper time to plan or prepare in their own time for their Geography lessons. These challenges will harm the acceleration of improving the quality of technology integration in the Geography classroom, which was indicated as imperative in Koh, Chia and Tsai (2014:185) literature Bingimlas (2009:239).

4.4.2 Challenges related to the lack of internet / WiFi resources

The development of technology, especially access to the internet, has let teachers and learners have a wide variety of access to incorporate visual teaching and learning in Geography resources (Daniels 2018:2; Draper 2010:36). Especially in the case with atlases, there are many national and international boundaries and these challenges are widely known (William & Catling 1985:245). ICT can bring these maps alive, turning them into places with similarities and differences to places pupils know and live. The internet disseminates high-quality materials at almost no cost and allows Geography students to experience a learning environment rich in knowledge and experiences (Kamenetz 2009:3; Tucker & Courts, 2010:38).

Having no access to the internet will impact access to a variety of available geographical, educational software. According to Chigona (2011:3), one of the challenges is that disadvantaged schools may not afford the programs and expensive hardware and software. This may result in an increased digital divide between the schools in affluent areas and disadvantaged areas. Technical problems, such as loss of connection to the internet, slow computers, etc., are also barriers for teachers. Teacher 1 and 2 admitted that they did not have access to the internet or WiFi during school hours when they stated that "*the WiFi are available but not to the teachers and not in our classes".*

This phrase indicated that the school do have access to the internet or WiFi, but it was used, for example, for admin purposes and not for teaching and learning in the classroom. The SGB member added that prior decisions were made regarding this dew to "*financial constraints"* of the school budget, and these improve in the future. Although, the SMT member indicated that their school are in a low-income area, this policy hinders teachers the use of the internet for developing and planning for ICT integration in the classroom. This will enhance teachers' challenge not to access the internet for downloading pictures or maps for the Geography classroom. This will hinder the learners' geographical skills development because the teachers do not have maps in the classroom.

This was indicated by T2, which states that:

> *"Maps are not available in all classes. I want to have my own class so that I can make the class full of resources."*

This indicates that the teacher understands the need and the importance of maps for the teaching and learning of Geography in the Intermediate Phase (Content Knowledge). This will influence her learning environment, which is not conducive to creating a rich learning experience (Kamenetz 2009:3; Tucker & Courts, 2010:38). Using the words *"my own class"* indicates that the teacher wants to make her class geographical friendly for her students and don not want to go from class to class at different periods as was indicated on the time-table.

The use of the internet or WiFi will also allow access to necessary Geography resources like web-based programs available on the internet. This was stated by T1 when she indicates that there is a *"non-availability of web-based programs"*. These programs need to be downloaded from the internet, and the teacher shows that she does have technological knowledge, which also indicates that she knows different resources from the internet that can be used for Geography integration. These programs can be used by the teacher on the IWB or just downloaded on the laptop.

Confirmation that the teacher does consist of technological knowledge is when she refers to the software that needs to be *"updating those things here we have, but its outdated."* This indicates that they do need internet or WiFi access to access resources, like maps, etc. The interviews' data indicates that the teachers cannot use the internet to disseminate high-quality Geography materials and let learners experience-rich learning environments that Kamenetz (2009:3) and; Tucker and Courts (2010:38) are referring to in their literature.

4.4.3 Challenges related to the lack of financial resources

It was clear from the research team that the school have challenges with funding to support the integration of Geography teaching and learning using ICT. This is evident in the response from T1 and SMT member when stated:

> *"We have to do the maintenance and all. It is an expensive thing probably to have in schools that does not have the funds."*

The teacher, as well as the SMT and SGB member indicates that because of the lack of financial resources, they cannot do maintenance of the technology, which is necessary to keep up to date with new developments of programs and software of computers. Using the phrase "*schools that does not have the funds"* indicates that the use of technology can burden the school, which will also hinder the use or implementation of technology in the subjects. When the teacher refers to the word *"we",* she also indicated that the maintenance needs to be done by the teachers themselves and that they do not have a specialized person to do that. This will also take time away from teachers to focus on the planning and preparation of the lesson.

This view was also shared by the SGB member when stated that the:

> *"financial challenges for management is the cost of installing ICT in Geography classroom, updating of Geography software and security".*

From the above dialogue, the school management does know that there is a lack of resources mentioned previously which will have a negative effect on the school as a social system to adopt innovation for their teachers (Rodgers 1995, 2003). All the classrooms do not have the necessary ICT's, which was why teachers have to move from one class to another. The cost of installing laptops, IWB, data projectors, etc., are indeed expensive for schools. The school needs to develop creative ways to generate funding for the school (Drago-Severson 2004:53–54). Also, management acknowledges that *"updating software and security"* can be expensive for a school of its caliber.

The challenge of financial resources was also indicated by T2 when she stated:

> *"Any school will want to do, because learners can benefit from that, but if we have no funds available, the SMT or SGB can do nothing to implement this. The problem came down to funds".*

The *"school will want to do"* indicates that everyone at the school, including the management, teachers, and SGB, is willing to integrate ICT into the Geography classrooms. The school community sees the benefits for learners in integrating Geography teaching and learning using ICT in the phrase, "*learners can benefit from that"*. However, the phrase "*SMT or SGB can do nothing to implement this"* contradicts what has been observed by the researcher.

The school does have ICT resources used by the rest of the research team, and it was indicated that the school do have, for example, WiFi, but it is not available for staff. This indicates that the SMT and SGB have challenges on the "how" to implement ICT integration in the school. The SMT and SGB need to develop policies for the school on the implementation of ICT integration. This is confirmed by the SGB member's words that *“ICT’s in classroom is not used to its full potential”.*

This expresses that there are ICT’s in the classroom, and they are used, but not every day or in every period or as much as needed, which will impact the Geography teaching and learning with the use of the phrase “*to its full potential”.* This also correlates with what the SGB member said: *“Biggest challenge is to get some educators to use the technology”.* The word *“biggest”* confirms that management acknowledged that, although they do have ICT resources, teachers are not using them regularly.

This can be because of many reasons, which can include that they are not adequately trained to use it or because the school do not have ICT resources in all the classrooms.

4.4.4 Lack of training to integrate Geography teaching and learning using ICT

Evidence from research confirms that there is a lack in teacher training to integrate Geography teaching and learning using ICT in the Intermediate Phase (Rani & Kant 2016:3329; Wilmot & Dube 2016:337). This is also echoed in the research from Rabah (2015:27) that teachers need more training as part of professional development to support teachers for integrating technology in the day-to-day Geography classroom. Which will also increase their TPACK and adoption to innovation (Rabah 2015:27; Rodgers 2003). This is one of the challenges that will have a considerable impact on learners' learning when teaching with ICT. Without the proper knowledge to teach with technology, it can lead to the teacher being neither sufficiently prepared nor sufficiently confident to fully integrate ICT in the Geography classroom (Balanskat *et al.* 2006).

Evidence from the data indicated that teachers did not have any training in integrating Geography teaching and learning using ICT in the IP. Not from the

Education Department or the school itself. On the question of whether they were trained, their responses were as follows:

> *T1: "None. I taught myself in the basics."*
>
> *T2: "My son taught me a little bit how to operate the computer."*
>
> *Interviewer: "And from the Education Department or school?"*
>
> *T1/T2: "No… nothing."*

It was clear from the teachers' responses that they did not have any training in "how" to teach with technology or how to integrate it in their Geography classroom or lessons. The phrase of T1, "*I taught myself in the basics",* confirms that the teacher has the technological knowledge because she could teach herself in using the technology. However, it is also an indication that the teacher only has knowledge of the "basics" of technology, and this does not necessarily mean that she has the knowledge to teach with technology or how to integrate ICT in the teaching and learning of Geography. The response from T2 is a clear indication that her technological knowledge is not on a very high level, which is indicated by the use of the phrase *"little bit"*. This proves that the teachers also need the training to improve their skills in technology as well. The SMT member also confirmed the lack of training when saying that teachers experience challenges in integrating ICT in Geography because they are not *"technologically trained"*. Some teachers also did not have training in using the internet, the phrase from T2, *"It takes me a long time to try to work with the internet",* confessed that she needs training.

If teachers are not adequately trained in using ICT, they will not be able to use it in their day-to-day lessons (Rabah 2015:27), strengthening their TPACK. This will have an impact on the classroom. The SGB member confirmed this:

> *"ICT's in classroom not using to its full potential. Programs bought are becoming outdated within a few years and not use to its full potential".*

Using the phrase *"full potential"* indicates that using ICT in the Geography lesson will not have the necessary impact on improving teaching and learning. Therefore, teachers need to be trained to maximize the investment return if they are bought and used. Using the word *"outdated"* also suggests that the programs will be old in a couple of years, and there will be a possibility that they cannot be used or will not be relevant in the Geography classroom.

It is evident from the data that the teachers are not adequately trained to use ICT in the Geography classroom, and therefore they will have negative attitudes towards the use of ICT (Subramanien 2013:49; Bapela 2015:39). This will result in teachers taking a longer time in the innovation decision process, to adopt or reject the innovation, then to its implementation, and finally to confirmation of this decision (Rodgers 1995:21). The teachers at school will also feel uncomfortable in the ICT-enabled environment at the school because of the lack of training (Mahdum *et al.,* 2019:296). However, the responses from the teachers after the training, was that they feel a "*little bit confident*" indicated that a much more comprehensive training intervention is needed to have the proper results for the integration of ICT.

4.4.5 Lack of Preparation

Successful integration of ICT will depend on effective planning for using ICT in Geography teaching and learning by teachers. Commons (2020:1) explains that the preparation lies in facilitating access to content and developing Geography assignments and learning activities that help the students take responsibility for their learning for learner-centered teaching. For this reason, ICT's will support Geography teachers and learners by providing access to different resources, enabling teachers to exchange good ideas and obtain peer support (Freeman 2003:203; Cener, Acun & Demirhan 2015:192; Hassel 2000:90; Chang & Wu 2018:35). Therefore, ICT can transform how geographical knowledge is packaged, delivered, and acquired to alter educators' core production and delivery process (Van der Westhuizen 2007:41).

Certain factors will play a role in how one, as the teacher, will execute the Geography lesson. This includes personal characteristics (such as the teacher's educational philosophy), educational experience and preparation (including subject knowledge), and context (Muhammed 2019:2). Preparation includes the way one was taught, one's preferred ways of learning, one's preferred ways of teaching, one's proficiency in the chosen teaching or academic field, and the kind and the amount of teaching preparation one have received.

Lack of preparation was one of the challenges noted by the SMT member, the SGB and the teachers.

The SMT member noted that:

> *"lessons with ICT need to be well planned and prepared in advance. A teacher will not be able to just walk in class and teach".*

At first glance of the phrase, the SMT member notes the importance of preparation. If you plan your lesson in advance you as the teacher will have a better-executed lesson. Not only do you have to plan your lesson, but you also need to be "*prepared"* for the lesson. You need to plan and prepare for unforeseen circumstances, as was indicated by the SGB member:

> "*Teachers are preparing material and when in class the equipment has a glitch. You end up wasting period trying to get equipment to work".*

The lack of preparation for teaching with ICT can jeopardize learners' learning opportunity because they will lose a period or part of a period. After all, the teacher needs *"to get the equipment to work"* for the planned lesson. Depending on the *"glitch"*, it might take a long time to make the equipment work again. Teachers who do not have the technological knowledge will, for example, need help to solve the problem. As a teacher, you need to be prepared for cases like this as well.

Prepare for lessons using ICT will take some time depending on the skills of the teachers. This was indicated by the T1 when she responded:

> *"It takes me a very long time to grasp. I have to sit and write down. Take this, put this in there, take that there, put it in there."*

As indicated in the use of the phrase, *“sit and write down”*, the teacher indicates that she is comfortable when first writing things down. Although this will take up her time a bit longer, she is thinking it out thoroughly. She thinks about what needs to be done in the lesson when she uses the phrase, “*Take this, put this in there, take that there, put it in there.”* She is thinking pedagogical about the lesson and thinking about the best use of ICT for that specific content of the lesson. This in essence will also have an effect on the the innovativeness of an individual, as a time element, because the individual’s rate of adoption can be prolonged over time (Rodgers 2003:22).

4.4.6 Lack of confidence of teachers

Some teachers will not have the confidence to use technology in the classroom because of the lack of training or other reasons. They need to have the confidence to overcome the challenges and to teach satisfactorily enough to excite and stretch learners learning. Bapela (2015:39) indicated that teachers' confidence could be a major barrier in the uptake of ICT teachers by teachers in the Geography classroom. The lack of confidence with the use of ICT will also influence teacher motivation to use ICT in the Geography classroom (Gikunda 2016:14).

Subramanien (2013:49) states that teachers' attitudes towards new technology will lead to the confidently use of technologies in teaching and learning will also understand the usefulness of ICT. This suggests that when a teacher is optimistic about a resource, such as a laptop, and can identify its potential uses for classroom and personal purposes, the teacher would most likely use the resource in the classroom for ICT implementation. Therefore, as an element of time, and in the innovation decision process, the teacher’s attitude lean more towards positive and the user will be more sensitively with the innovation (Rodgers 2003:176)

In the data collected, it was evident that T1 was more confident in using ICT in the Geography teaching and learning classroom than T2 when they responded to a follow-up question about their confidence at the beginning of the data collection process:

T1: "I feel reasonably confident sometimes."

T2: "I don't feel that confident at all because we did not have any training on it for people like me."

Applying Fairclough's (2010:5) textual analysis, T1 and T2 make use of the words and phrase of *"reasonable"* and *"at all"* to emphasize the measurement of their confidence. In the case of T1, her confidence level can be described as someone who has the knowledge and skills to integrate ICT in Geography but not in all the content or the use of specific tools for integration when she uses the word *"sometimes"*. This will be typical of the third level stage of teacher acceptance for integrating technology to implement TPACK (Niess 2017:12).

At this level, which Niess (2017) call the adapting level, the teacher is beginning to incorporate technology in their teaching and adopt or reject teaching and learning subject matter topics with specific technologies. T2, which have low confidence in integrating Geography teaching and learning using ICT, she did not have any training to improve her TPACK. Her expression of the phrase "*people like me"* indicates that her acceptance level could be at level one, referred to as recognizing (Niess 2017:12). At this level, she is ready to consider technology use, but then she needs training. This teacher will be at the implementation stage at the innovation decision process in adopting innovation according to Rodgers (2003:177), because the implementer may still need assistance.

4.5 DATA ANALYSIS ADDRESSING THE OBJECTIVE TO ESTABLISH CONDITIONS THAT ARE CONDUCIVE FOR GEOGRAPHY TEACHERS WHEN INTEGRATING GEOGRAPHY TEACHING AND LEARNING USING ICT

As discussed in the literature in previous sections, the impact of ICT in the Geography classroom can have immense benefits for teaching and learning for the Geography learner. It can bring educational change and reform the school environment, leading to a wide variety of student participation (Fu 2013:112; Madlela 2015:352). However, in saying this, integrating Geography teaching and learning using ICT in the Intermediate Phase (IP) classroom, certain conditions are needed to execute this successfully. This section considers conditions that could conducive to the implementation of it.

4.5.1 Availability of resources

The multimedia nature of ICT resources offer opportunities for the improvement of geographical skills, which will lead to the improvement of Geography teaching and learning (Rodgers & Streluk, 2002:1). If IP Geography teachers have access to laptops, they will have access to different resources from the internet, enabling teachers to exchange good ideas and obtain peer support (Cener, Acun & Demirhan 2015:192; Chang & Wu 2018:35). This will lead to strengthening the communication channels, and create or change strong attitudes held by an individual in adopting innovation (Sahin 2006:14).

Having resources like the following will undoubtedly play a role in establishing a conducive condition in the IP Geography classroom, as stated by the SMT member, when saying:

> *"… most importantly, the tools for ICT, i.e. laptop, software, internet access".*

As indicated in the above phrase, the teachers will benefit from the laptop and internet access. The availability of these technology tools will improve technology quality to support teaching and learning (Fullan & Langworthy, 2014:11).

Making these resources available to teachers regularly and available in their classes will have various benefits, which include what T2 was saying:

> *"Permanently leave laptops in class so that I can just put my stick in and start with the lesson. This will be helpful."*

This is a clear indication of when the laptops are ready and available; this will allow the teacher to *"just put in my stick"* and start the lesson. This will save time in the classroom because the teacher already came prepared for her lesson. This is indicated by the use of the word *"my".* This condition that can be set will help increase the teacher's confidence and preparation because an environment is set for the teacher to excel in her classroom skill (Cruickshank *et al.,* 2009:3 & Muhammed 2019:2). Asserted by Rodgers (1995:23), opinion leaders or management, needs to take into account the type of innovation decisions that will positvely influence the social environment for the integration of technology. The teacher sees this as a barrier that can discourage teachers from integrating technologies in Geography teaching and learning (Bingimlas 2009:239).

Not only must the resources be available in the IP classroom, it also needs to be updated regularly. This was stated by the SMT member when mentioned in the conversations that *"their needs to be an improvement in classroom facilities"*. The word *"improvement"* indicates that there are resources available, but it is outdated and needs to be upgraded for functional use in the classroom. However, these improvements can be a challenge for a school like this because they can be expensive, depending on the resource (Rabah 2015:26). However, it will be better to have staff check to ensure that the class resources are in a good state for use.

This was echoed by the SGB member stating that *"equipment must be checked regularly and be in working condition".* These analysis indicators are very important because the school needs to create an environment conducive to integrating technology for the teachers. Although infrastructure barriers are common in South Africa (Bingimlas 2009:240), the poor organization of resources or lack of personal access has a more significant effect on ICT integration in the Geography classroom (BECTA 2004:14).

The SGB member who is part of the management of the school confirmed that the school lacked in the management of ICT resources:

> *"ICT can be managed in the school. We need to appoint a person who has the skill to assist other members to be in charge of ICT. This person must be given time-off to check the equipment is working and is handled properly".*

In *"appointing"* a staff member or someone from outside who has the necessary technological skills, will create a conducive environment in the school or classrooms for the teachers to focus on their preparedness to integrate ICT in the Geography classroom. This specific staff member will be able to "*check the equipment is working",* and when the teachers come into class, will not have time to delay the lesson which needs to be started on time.

4.5.2 Training in the use of ICT

Intermediate Phase teachers need to be trained adequately for the integration of Geography teaching and learning using ICT. As part of their professional development, the training will support teachers in integrating technology in the day-to-day Geography classroom (Rabah 2015:27; Rani & Kant 2016:3329; Wilmot & Dube 2016:337). According to Rodgers (2003), this will also have a positive effect on the adoption of innovation by the teachers. Although teachers are sometimes trained, the pedagogical aspects of ICT integration in Geography teaching received insufficient attention (Rani & Kant 2016:3329; Wilmot & Dube 2016:337).

There are, however, several components to consider when training IP teachers in the use of ICT in the Geography classroom. Some of these are like time for training, pedagogical training and skills training (Chigona 2011:4; BECTA 2004:8). Proper training has several benefits for the Geography teacher and its learners. Teachers who are properly trained will have the confidence to implement the training in their respective classrooms, as stated by T2 when stated during the start of the training session that:

> *T2: "I don't feel that confident at all because we did not have any training on it for people like me".*

It is clear from the phrase that the teacher's confidence level will increase when proper training is given to her. In indicating, *"for people like me,"* she acknowledges that she does not have the technological pedagogical knowledge necessary to integrate Geography teaching and learning using ICT. In strengthening her

TPACK, she will gain confidence in using ICT integration in the Geography IP classroom and there is a possibility that the teacher will adopt the innovation (Rodgers 2003). The training needs to focus on her technological pedagogical skills to strengthen her TPACK.

The team also had training sessions with the researcher as the facilitator. The sessions took place before and after the lesson presentation. It was clear that both teachers, although they did not have any training before, increased their confidence levels when both stated that: *"now we are ready".* This is indicated with the use of the word *"ready".* This means that they were not ready to integrate ICT before the training but after the training. Not only is this an indication of their confidence levels, but also their attitude towards ICT teaching. A positive attitude can contribute to the successful implementation of Geography teaching and learning using ICT. The training sessions gave the teachers an opportunity to get their how-to-knowledge to use the innovation correctly in their innovation decision process (Rodgers 2003).

Although a couple of sessions will not make them experts in using ICT integration in the Geography classroom, this will give a foundation in using ICT in the classroom. Once off training, however, is not ideal. Improving the TPACK for integrating Geography teaching and learning is strengthening the different skills for integrating technology in the Geography classroom. Therefore, as stated by the SMT member they need, *"ongoing training in technology changes and upgrades".* Since technology is rapidly changing, training is needed regularly to make the necessary changes in using different technologies to improve their technological pedagogical skills.

Although the member indicates that this relates to technological skill, the integration approach is about implementing the right use of ICT in particular subject areas that involved complex concepts and skills, like Geography (Ghavifekr & Athirah 2015:176). However, according to Rodgers (1995; 2003), the improved skills in the use of technology do not transpire in integrating technology in the Geography IP classroom automatically.

For successful integration of ICT in Geography teaching and learning, ongoing support is vital for Geography IP teachers. Non-support for teachers can lead to the non-use of ICT in the classroom. The SMT member supported this claim stated that *"follow up support are important during the process of changes when starting to use ICT. It is easy for humans to give up and revert back to their comfort zone"*. Using the words *"follow up"* suggest that when teachers are trained, it must not be once-off, and follow-up training will lend the necessary support for teachers to integrate ICT in the Geography IP classroom.

This is very important, especially for teachers who will be the first time using ICT because it will be a "process of change" from their traditional teaching mode. They are not used in teaching with ICT, and their lack of TPACK will have a further drawback in implementing ICT in the Geography classroom. It is not only a possible drawback to implementing it in the classroom or using the ICT's, but they will also *"give up"* because they are struggling to learn the skill of teaching with technology. Some will also *"revert back to their comfort zone"* if they do not have the necessary support. Teachers will revert back to what they know and how they do it previously if they do not get support. Teachers feel comfortable knowing and do not want to be a challenge outside their comfort zone, although it can be for the learners' good.

A variety of strategies need to be provided for further professional development for teachers because all teachers should know the significance and advantage of ICT to conduct a meaningful lesson using ICT. The SMT member stated in an informal meeting that *"training needs to be for all staff",* and the SGB member added that training *"needs to be compulsory".* All this was related to the professional development of teachers. This is very important for the implementation of ICT in a school. All staff members must have the same insight into the school's future directions for improving teaching and learning. In joining in the vision, it will be best suited for all to be trained and be part of a team member in the school. This is typically which Rodgers (2003:5) is referring to as the communication channel, which is describe as a process in which participants create and share information with one another in order to reach a mutual understanding. This will allow staff to learn and support one another in the learning process, which is in line with the views of Vygotsky in describing a social constructivism approach to learning.

According to the SMT member, the only staff member who was trained in the use of technology was the school's principal. This is not an ideal situation because management, although also need to be trained, will not be the ones who will give realization in ICT integration in the Geography classroom. Management needs to play a big role in creating the environment for implementing ICT in the school and classroom (Tondeur 2007:10). Chigona (2011:4) and BECTA (2004:8) stated that there are several components to consider when to train teachers in using ICT in the Geography classroom. Several suggestions were made by the research team on what will be the appropriate time for training.

The research team suggest the following times, which will be conducive for training:

> *T1: "Maybe we have to do training during school from 7:30-2:00pm on certain days when learners are not there, but after school on normal days, I am exhausted".*
>
> *SMT member: "training needs to be more often after school when learners are away".*
>
> *T2: "Maybe holidays. When you are teaching at a school it is such an inconvenience to go to a workshop after school. You are exhausted not even focussed and then you just want to go home. Weekends it's my resting time".*

At first, there needs to distinguish between initial training and on-going training for support. Initial training will most probably need more time per session and support training less time per session. Since more time is needed for initial training, the timeframe of T2, *"maybe in holidays",* will be best suited as stated in one of the training sessions. The initial training will need to cover technological skills, pedagogical skills and technological pedagogical skill. Some days can be set aside for this type of training for the teachers. These initial training will not be suitable for teachers because this has its challenges because teachers are *“exhausted”*, as indicated by T1 and over weekends, teachers want to rest as indicated by T2 when stated it *“is my resting time”.* Since training time for on-going training and support needs less time per session, the SMT member must be more *“often after school when learners are away”.*

This will be a better option for this type of training because it can be individual or in small groups in a short period on specific days. Although the teachers indicated that the training after school is not the best option, this will not happen every day and need to be appropriately managed to let teachers see the value of the training and support to integrate Geography teaching and learning using ICT. As indicated by the teachers, that it will be difficult for the teachers after school, because of extra-mural activities or being exhausted, what will help them to build their attitude is to give also some reward system for the participation as was stated by the SGB member:

> *“Training must be compulsory and offer a reward to those making maximum use of ICT”.*

Although this is a very creative way for teachers to attend training and use ICT, the best will be to make sure that teachers understand the value that ICT will bring to the IP Geography classroom for teaching and learning. A reward system can be an add on for participation and use of ICT to motivate teachers.

During the initial phase of the project, it was evident that the teachers need training on how to integrate Geography teaching and learning using ICT. The SWOT analysis data indicated that the teachers need the training to integrate ICT in their Geography lessons. Therefore, they were introduced to the concept of Design Thinking for proper planning. Design thinking was found suitable because teachers can learn from one another and work collaboratively on a specific problem. This will also have a positive influence in their adoption of innovation, because this had the opportunity to improve their communication channels; to lessen their time in adopting innovation and subsequently improve their practices in their Geography social system at the school (Rodgers 2003). Also, to support each other in the planning and preparation of integrating the Geography activities and allow them to be involved with problem-solving approaches that can best be achieved through collaborative and human-centered activities (Aflatoony & Wakkary 2015:1; Lor 2017:6). Since Design Thinking activities involve all forms of Bloom's revised taxonomies, in the design features, it offers the possibility for teachers to improve their TPACK (Lor 2017:7).

The researcher facilitates training of the teachers on how to use Design Thinking to strengthen their TPACK. The teachers then work collaboratively on their own time to develop their Geography activities (see Figure 4.2 below) while supporting each other.

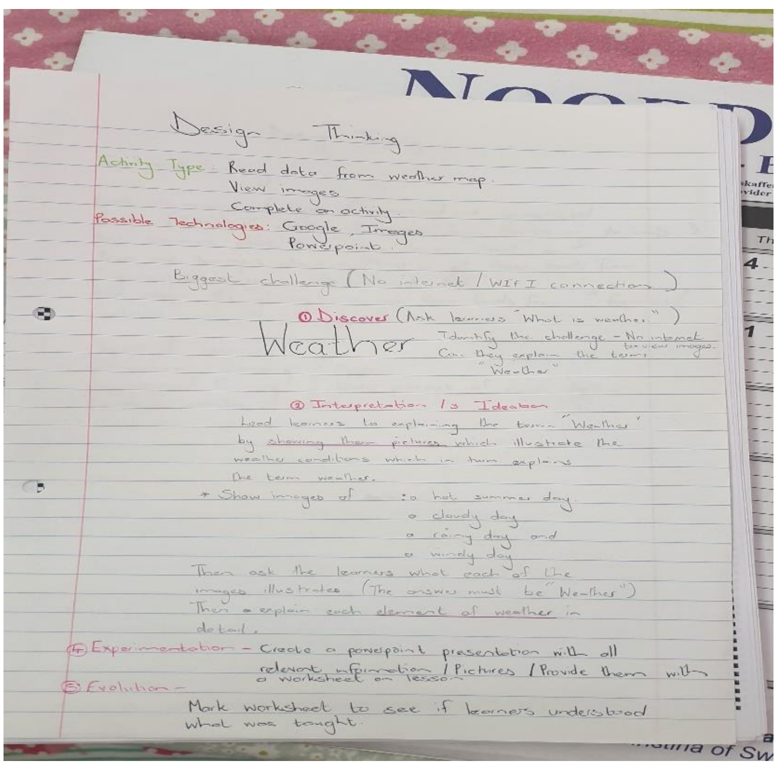


Figure 4.2 Design Thinking Lesson Activity

Using a Design Thinking approach to the training was helpful for the teachers because they could support each other in developing the lessons. They also find the Design Thinking training valuable and supportive in strengthening their Geography TPACK skills. Their responses were as follow when they were asked if it was useful during and after the training session:

> *T1: "This was nice and in depth. It did help. We could work together. You don't have to do the planning over again. You are doing more research on the Geography topic and the ICT's when using DT."*
>
> *T2: What I like best, is that we can work together. You know I am a bit slow. We have done all the steps, and you could see the development of the lesson. You need to think what you are doing."*

Design Thinking (DT) was useful for the teachers because they could "work together" to plan the lessons and socially construct their knowledge, which is in line with the notion of Vygotsky theory. Using DT by the researcher provided the teachers with an opportunity to think cognitively on a higher geographical level. This was evident when T1 uses the phrase *"in-depth",* and T2 uses the phrase, *"you need to think"*. In DT, there are five steps; discovery, interpretation, ideation, experimentation and evolution, and these steps are linked to Bloom's taxonomy (Lor 2017:7).

Since the teachers *"has done all the steps"* they were exposed in each step to different higher-order geographical thinking skills. In using DT, the teachers could improve their content knowledge and technological knowledge as well. This was indicated in the phrase by T1, "*You are doing more research on the Geography topic and the ICT's when using DT."* With DT, you need to know the topic and sub-topics as well as the content related to it. The team then needs to decide what will be the best approaches for the Geography topic.

The team also needed to decide which technologies (from the Activity Types) will be best suited for the Geography topic. The team must decide on the technology tools and how to execute it in a lesson (TPACK). This means that the team *"needs* *to think about what you are doing"* while developing the lesson, which will improve their cognitive skills. Using DT, the team could also see how the lesson evolved when T2 stated: "*you could see the development of the lesson".* This will give the Geography teacher confidence to use the approach again.

4.5.3 Peer assistance

Teaching with ICT in the Geography IP classroom can be a daunting experience for teachers if we consider the challenges that come with it (Hendriksen *et al.* 2017:140). Although peer assistance also links to training, teachers will be working closely with a peer teacher (who is not necessarily an expert) to execute ICT integration on a broader level. Since teachers have various challenges in integrating ICT, peer learning is an essential and useful pedagogical practice (Hanson, Trolian, Paulsen & Pascarella 2016:3). With peer assistance, the interpersonal communication channels, will be powerful in change strong attitudes in adopting innovation for the benefit of the individual (Sahin 2006:14).

These peers will benefit from one another by adopting the cognitive processes embedded in their interactions and communications related to the social constructivist approach (Vygotsky 1978). Vygotsky (1978) elaborate that with the more knowledgeable person's help, the other, less knowledgeable person has the potentialities to accomplish tasks that they cannot complete independently (Hossain *et al.* 2019:130). The importance of assistance for a conducive environment for the integration of ICT in Geography was highlighted by the SMT and SGB member in the interviews when they stated:

> *SMT: "… appointment of an ICT coordinator. Someone who teaches the subject but also has time to assist other educators."*
>
> *SGB: "Identify staff members who are skilled in ICT. Identified skilled member need to assist teachers after training. Only through practice will you gain confidence."*

Appointing an ICT coordinator for the school is very important because it will give a specific person or staff member the responsibility to assist the rest of the staff and will increase the adoption of innovation for the whole school as the social system (Rodgers 2003). Staff will know where and whom to go to at the school, if necessary when they experience challenges. This will give the staff a sense that someone is immediately available, improving their confidence to use ICT's in the Geography classroom. Using someone from the staff will also have a sense that it is someone that they are familiar with, and it will be easier for communication purposes with members. However, to have someone in each subject, when the SMT member stated, *"who teaches the subject",* it will not be possible, because not in all the subjects you will get a staff member who does have the TPACK or technical knowledge to be able to help the teachers. What is important for the assistance is that the ICT skilled staff member "need to assist teachers after training," as indicated by the SGB member. What is of importance is the use of the word *"after".* This is an indication that teachers need support or assistance after the training and not a once-off. The support needs to be continuous and regularly. This kind of peer support will enhance the teachers' professional development and will have the advantage not only to support with regards to technology but also personal and emotional support related to ICT integration in the Geography IP classroom (Lee 2007:28).

During the initial phase of the project, the teachers need training on integrating Geography teaching and learning using ICT. The SWOT analysis data indicated that *"IP teachers are very supportive to one another",* and the researcher took this strength of the team to convert it into meaningful support between the peer teachers. Design Thinking was also used to support the teachers in the planning and preparing the integration of the Geography activities and allowing them to be involved with problem-solving approaches that can best achieve through collaborative and human-centered activities (Aflatoony & Wakkary 2015:1; Lor 2017:6).

The support that the teachers give to one another in designing the lesson in Figure 5.1 was of vital importance to both teachers. On a question with regards to the value of the assistance using Design Thinking the response from the teachers were as follow:

> *T1: "The assistance was good from my peers. I did not feel alone. It boosts my confidence when working with it …"*
>
> *T2: It helps both of us in working together."*

The assistance from the more knowledge teacher (T1) was well received by the less knowledge teacher (T1) when she states that the assistance was *"good"* about the help from her peer teacher. Most importantly is that T1 *"did not feel alone"* when preparing for the lesson with the peer, and as indicated, the support improves her confidence in using ICT in the Geography classroom (Rodgers 2003). With Design Thinking, a process has to be followed to develop the lesson with peers in a step by step manner.

Therefore, the teachers indicated that they need to work from easy to more challenging activities or programmes in both their phrases. Although the design process is not easy; as a facilitator, the researcher trained them in developing the lesson when using Design Thinking. The use of a Design Thinking approach will strengthen teachers' TPACK while working collaboratively with peers and increase the support that is needed for the teachers.

Assistance in any form will have a massive impact on the successful implementation of Geography teaching and learning using ICT in the IP classroom. Having assistance in the classroom will be ideal for teachers. The assistant can help on any level, as was indicated by T2:

> *T2: "The student also helped me a lot, and with the development of the PowerPoints. She helped during the lesson as well. When the laptop is standing on the table it was easy for her to move the up and down buttons while I was teaching."*
>
> *T2: "She was very skillful. If I was struggling this could have an effect on discipline."*

The assistants can help teachers develop their PowerPoint lesson presentations, as in the case of T2. The teacher had pictures on her slides, and the assistant can help with, for example, the collection of the pictures from google. This will save teachers much time in developing the lesson. Assistance in the classroom will have a positive impact on teaching and learning in the Geography classroom. As in T2, the student-teacher assisted the teacher with the PowerPoint by *"move the up and down buttons"* to go to the next slide.

This provided the teacher with the opportunity to focus on the learners and make the Geography classroom more learner-centered. The assistant had the technological knowledge to help the teacher in the classroom; this was evident in the teacher's words, *"she was very skillful".* Not only will assist in the classroom affect the teaching and learning of the Geography but also positively contribute to classroom management. The phrase from T2, "*If I was struggling, this could affect discipline, " is evident in the Geography classroom's contribution*. This indicates that if the teacher did not have the assistance and did not have the technological knowledge, it could lead to disruptive classroom discipline. She used the assistant because she knows how to manage the classroom to promote student achievement (Sothayapetch *et al.* 2013:86).

4.5.4 Management and leadership in the use of Geography ICT integration

The role of school management in curriculum delivery is widely known. The Geography CAPS document (SA DoE 2011) gives specific guidelines on how the teaching and learning in the Geography classroom must be taught to optimize learner performance. However, there are no specific operational guidelines on how school management needs to operate to enhance technology integration in the Geography IP classroom. School management is one of the school's essential stakeholders for successfully implementing integrated Geography teaching and learning using ICT. School management is responsible for the policy and setting a conducive environment for teachers and learning to implement ICT integration at the school.

The SGB member also confirms this:

> *"We need to provide for technology integration in the Geography classroom and school. We need to provide training on how to operate prescribed Geography ICT's. Training must be compulsory. We can offer a reward to those making maximum use of ICT."*

The management team needs to *"provide",* indicated that management needs to avail the necessary technology resources and infrastructure for staff. Although management cannot buy staff, for example, laptops, etc., they can set the necessary guidelines and protocols for the school's use and maintain the infrastructure. Teachers are using their internet, for example, whereas the school do have internet or WiFi available. In this way the management team, as part of the opinion leaders, will influence the social system jointly by solving problems to accomplish the common goal to diffuse the adoption of innovation (Rodgers 2003).

The SGB member also eluded that management need to take responsibility for the training of teachers. Regular in-house training will strengthen Geography teachers' TPACK skills and link to each teacher's professional development. A knowledgeable staff member can be training the rest of the staff and develop their own ICT's tools for Geography because there is not *"prescribe"* ICT's for Geography. However, literature is available on tools in activity types (Harris *et al.* 2010:575; Harris & Hofer 2016:2867) for Geography that can be used.

Rewards are always encouraged in all spheres of life. A reward system for educators at a school will positively influence the challenges that teachers will face. As indicated by the SGB member, to increase the use of ICT in the Geography is to "*offer a reward to those making maximum use of ICT."* This is a well-thought initiative for teachers by management to increase the integration of ICT in Geography. However, this will not be the optimal solution for integrating technology because teachers need to discover or come to terms with the ICT value in teaching and learning sustainably.

According to the SMT, member management needs to:

> *"Promote and setting the trend of ICT. Showing how it should be done. Initially doing the preparation of a lesson and then showing the teacher how to do it."*

For the SGB member, it is vital that management set an example in using ICT in Geography teaching, which means that they also need to implement ICT integration in their classrooms to set the example. What is important is that management needs to *"promote"* the use of ICT integration in the Geography classroom. This can be articulated that management set up a policy with the teachers (Tondeur *et al.* 2008:213) to change the current "ways of doing" and encourage staff to use ICT and support ICT use.

4.5.5 Teacher attitude

The teachers' attitude in using ICT in Geography play a vital role in the sustainable use of ICT in Geography teaching and learning. Not only will this lead to the use of its sustainability, but it will change the attitudes. Bingimlas (2009:238) and Subramanien (2013:49) states that teachers' attitudes towards new technology will lead to the confidently use of technologies in teaching and learning Geography and understanding the usefulness of ICT. This will lead to a major improvement in the diffusion process, in the especially the time element. Teachers will move faster between the different categories in the innovation-decision process, the innovativeness of an individual, and the innovation rate of adoption (Rodgers 1995; 2003).

As was stated by T2 during the beginning of one of the training sessions:

> *T2: I don't feel that confident at all, because we did not have any training on it for people like me.*

The teachers' confidence will also influence the attitudes of the teachers and vice versa. If teachers have a positive attitude towards ICT integration, this will increase the confidence to use ICT. This will lead to a conducive environment for integrating ICT because their positive attitude will have them thinking of using ICT and its benefits for teaching and learning (Buabeng-Andoh 2012:148). The negative attitude of teachers will lead to the misuse of unused resources, as was stated by the SMT member during an informal conversation:

> *“if teachers are not interested or technologically trained. Schools go to great expenses to install smartboards or projectors but teachers do not incline to use it.”*

Therefore, teachers' attitude toward ICT is of vital importance because it will not only impact the teaching of learning in the Geography classroom but also waste expenses of Geography ICT resources in not being used (BECTA 2004:7; Bapela 2015:39). To create a conducive environment, one of the first or important things is to change teacher attitudes by highlighting the importance or value of using ICT in Geography (Subramanien 2013:49).

4.5.6 Teacher preparation

Teacher preparation is vital for quality teaching and learning in Geography and more with the use of technology. Teachers are not skilled in preparing or planning for teaching with technology (Newhouse 2002:45). Planning ensures learning progression in Geography, and teachers will manage student boredom in the classroom. The use of ICT in the classroom is one way to make the boredom in the classroom less and link to reality to make teaching more real-life (Crawford 2013:1).

Meaning that if IP teachers are not prepared, they will lose out on the learners' authentic teaching and learning experience. Management and teachers need to make provision for different challenges currently in the school system to make ICT a reality in the IP Geography classroom. Challenges like the following as was stated by the SMT member and teachers:

SMT: "teachers should be given enough free time in afternoons to research and prepare."

T1: "You're teaching 8 subjects so you can't do all, not even half of that. So I'm taking home books and because we're travelling and the bell is ringing, I just want to go home."

Teachers' free time can be done by managing the training and preparation times in groups or collaboratively between staff members. This will depend on the extra-mural activities of the school. The teachers do have a heavy workload regarding their subjects, as indicated by the teacher when using the phrase "*You're teaching 8 subjects so you can't do all"*. Making time to prepare will be a challenge for all teachers and management. What can be done is to use the fundamentals of Geography ICT integration and use it in other subjects. This is also an indication that working collaboratively will greatly impact teacher preparation from a social constructivist lens.

4.5.7 Finances

The finances of schools are a heavy burden upon them to accomplish quality teaching and learning in the education sector. School finances for ICT integration are among the biggest challenges for schools, which do not have ICT resources are very expensive (Drago-Severson 2004:53). A school like a project school do not receive much money from the department and are a no-fee school. Schools that do not have the money to buy ICT equipment will not do it just with the department's help. Schools need to plan their budget for ICT. Some schools need to restructure their budget to provide ICT resources or maintenance to make the teaching and learning environment conducive for teachers to implement ICT in Geography. The SMT member and teachers confirmed this:

SMT: "Financial support from government and the SGB. Should include IT training and upgrading of curriculum resources, i.e. government making policies and textbooks/curriculum resources available on EBooks for example."

T1: "Parents lack in paying school fees. Even if the department donate it's the infrastructure also at school. Is there a system?"

Although the team indicate that financial resources are important, there are other issues that are beyond just to receive the money for the ICT's and infrastructure. The SMT member indicates that the SGB (school) should contribute to the resources and training. Budgets of school can make provision for teachers' professional development, and therefore they can make provision of it or budget for it. The Education department can supply schools with e-books which will cover the safe cost for the school. All of this comes to management procedures for the integration of ICT.

Although the finance and budgeting of new ICT resources are essential, the most important issue is to utilize the current resources in the school. This is indicating by the teacher is asking: *"Is there a system?"* If current systems at the schools do not add to a conducive ICT integration environment, new resources will not impact the development of Geography teaching and learning using ICT.

4.6 CONCLUSION

The chapter presented, analyzed, and discussed and interpreted the empirical data collected from the different research methods. The chapter analyzes four objectives underlying the study: the teacher perspectives, how Geography teachers are using ICT, challenges ICT integration of Geography and the conducive conditions needed for teachers to integrate Geography teaching and learning using ICT. In doing this, the researcher and team understood the importance and use of ICT in Geography teaching and learning. The findings of the study are summarized and presented in Chapter 6.

CHAPTER 5

DISCUSSION OF FINDINGS AND RECOMMENDATIONS FOR THE INTEGRATION OF GEOGRAPHY TEACHING AND LEARNING USING ICT IN THE INTERMEDATE PHASE

5.1 INTRODUCTION

The study's purpose was to determine a strategy for integrating Geography teaching and learning using ICT in the Intermediate Phase (IP) classroom. This chapter summarizes the study's findings to give meaning to the study's purpose by responding to the study's objectives, which transpired from the data analysis in the previous chapter. First I will do this with a summary of the study's background to give a reflective background for the informative discussions that will follow.

A revisit of the problem statement, aims and objectives will follow. After that, a discussion of the findings will be presented as organized by the objectives. This will be followed by the recommendations which are linked to the aim of the study, the recommendation for future research, and finally, the limitations of the study will be highlighted.

5.2 BACKGROUND OF THE STUDY

The fast pace of ICT development has changed the way we live and work and has burst onto the educational scene during the past two decades. The internet brought new educational technologies opportunities because of the computer's great capabilities to provide a rich and wide array of learning opportunities (Wario 2014:23; Majumdar 2015:6). Therefore, Fullan and Langworthy (2014:1) argue that the 21st century's learning environment needs to encourage learners to engage in profound learning experiences in Geography because these learners are seen as problem solvers, critical thinkers, effective collaborators and communicators. Artvinli (2017:10) concur with Fullan and Langworthy (2014) by claiming that Geography in the Intermediate Phase needs to be learned in an environment that supports free and creative thinking and a learner-centred environment to encourage profound learning experiences creative thinking in Geography teaching and learning. Therefore, as Fullan and Langworthy (2014:2) stated, “new pedagogies which implies a new model of learning partnership between and among students and teachers, aiming towards deep learning goals and enabled by pervasive digital access”.

These new pedagogies let teachers and learners discover and master content together in the world outside the classroom. Bindu (2016:26) asserts that information and communication technology (ICT) can transform a teaching environment into a learner-centered one that will contribute to deep learning. Furthermore, Fullan and Langworthy (2014:11) emphasized that the frequent use of digital tools and resources will accelerate deep learning and improve the quality of technology to support teaching and learning. According to Bindu (2016:24), educational technology's primary goal applied to pedagogical contexts is to facilitate the teaching and learning process, moving away from a teacher-centred approach to a more learner-centered approach.

Since the coming of the digital revolution (computers, internet) in the classroom, most teachers have seen this as the most significant change in the recent past and as the biggest challenge for the Geography teacher in the future, and as stated by Solari *et al.* (2015:2); that these innovative tools can make a good learning experience in the classroom. These innovations influence everyday local, distant, and global spaces in a geographical context (Inga & Thomas, 2018:44). Teaching with technology is a complex, integrated process since it involves people and procedures (Bester & Brand, 2013:3). Wallington (in Bester & Brand 2013:21) define the use of technology in a teaching context as “a complex, integrated process involving people, procedures and devices in situations in which learning is purposive and controlled”.

Due to the advantages of using ICTs in the IP, integrating them in the teaching and learning process, the teacher and learners will have several benefits. According to Lache (2011:78), technology implementation in the Intermediate Phase Geography classroom offers interesting didactical alternatives for teaching various spatial sceneries in Geography. ICT provides teachers and learners with immediate access to up-to-date, topical Geography information and our highly interconnected world. According to Smith *et al.* (2015:27), the development of ICT creates many opportunities for Geography teachers to collect geographical data and develop learners' conceptual knowledge and understanding.

Furthermore, ICT can create a more in-depth and pedagogically sound knowledge of Geography and has the potential to help prepare learners by developing their cognitive skills and critical thinking skills, giving them access to information, and promoting skills required for evaluation and synthesis in Geography classrooms (Arnseth and Hatlevik 2012:57; Chigona & Chigona 2014:3). Hassel (2000:77) indicates that with the use of ICT, learner's geographical enquiry skills will enhanced, it will provide them access to a wide range of geographical knowledge and information sources, it will deepen the understanding of environmental and spatial relationships, provide an experience of alternative images of people, place and environment.

However, according to Ghavifekr *et al.* (2014:26), ICT could not be used for instructional delivery before ensuring that IP teachers are competent and have mastered appropriate ICT integration skills. Other challenges facing the integration of ICT in Geography teaching include; inadequate ICT integration knowledge and skills of teachers, teacher's beliefs that ICT can improve teaching and learning, challenges relating to language and content (a large portion of educational software and online content is in English) and practices involving the integration of educational technology, resources and software that do not notably improve education and instruction (Shradha & Budhedeo 2016:4764).

Literature searches reveal that research on integrating ICT in Geography teaching and learning in South Africa has primarily focused on secondary school, especially on geographical information systems (GIS) (Fleischmann & Van der Westhuizen 2016; Britz & Webb 2016). This may suggest that not enough research has been done on ICT integration in primary school Geography teaching, especially in the Intermediate Phase. A focus on only one part of Geography teaching may suggest little information about integrating ICT in the Intermediate Phase curriculum in South African schools.

The IP is seen as the phase during which a foundation is laid for the development of Geography skills which are needed to improve achievement in Geography in the higher grades (Felix 2015:1). Furthermore, considering that the integration of ICT in primary school Geography teaching can have pedagogical benefits for the teaching and learning process, this study investigates strategies to improve the integration of Geography teaching and learning using ICT in the IP classroom.

5.3 STATEMENT OF THE PROBLEM

There are reports that teachers are not adequately skilled to achieve the benefits of using ICT to improve education and instruction of Geography in the Intermediate Phase (Mndzebele 2013:409; Shradha & Budhedeo 2016:4762). The pedagogical aspects of ICT integration, knowledge regarding the application of ICT skills, and utilising technologies effectively in the Geography classrooms have received little attention in teacher training (Mndzebele 2013:409; Rani & Kant 2016:3329; Wilmot & Dube 2016:337).

Van der Westhuizen, Richter and Nel (2012:191) elaborate further that a lack of training on how to make effective use of technologies is one of the challenges for Geography teachers. Meaning that this research project's problem constitutes the teacher's inability to teach Geography in an integrated manner using ICT's, and teachers are not skilled in how to integrate ICT in the IP Geography classroom.

There is not enough evidence available to show which comprehensive strategy can be used to integrate ICTs into school and classroom activities (Constance & Musarurwa 2016:57) to supports the teaching and learning of Geography in South African primary schools. Therefore, this study seeks to investigate strategies to improve the integration of Geography teaching and learning using ICT in the Intermediate Phase classroom. This will be done by exploring ways of integrating Geography teaching and learning through the use of ICT in the IP.

5.4 RESEARCH QUESTIONS

5.4.1 Primary research question:

How can integrated Geography teaching and learning be achieved through the use of ICT in the Intermediate Phase of South African schools?

5.4.2 Sub questions:

What are the Geography teachers' perspectives on integrating Geography teaching and learning using information and communication technology (ICT)?

How are Geography teachers using integrated teaching and learning through the use of ICT?

What are the challenges experienced by Geography teachers in integrating teaching and learning through the use of ICT?

Which conditions are needed for Geography teachers to apply integrated teaching and learning through the use of ICT?

5.5 AIMS AND OBJECTIVES

In response to the above research questions, the research investigates strategies to improve the integration of Geography teaching and learning using ICT in the Intermediate Phase of South African schools. To elaborate on the aim, the following objectives were being realised for this study:

- To identify Geography teachers' perspectives on integrating Geography teaching and learning using information and communication technology (ICT).
- To determine how Geography teachers are using integrated teaching and learning through the use of ICT.
- To determine the challenges when Geography teachers are using integrated teaching and learning through the use of ICT.
- To establish the conditions conducive for Geography teachers when integrating teaching and learning through the use of ICT.

5.6 FINDINGS

The following section explains how each of the objectives helped reach the study's aim: to investigate strategies to improve the integration of Geography teaching and learning with the use of ICT.

5.6.1 TO IDENTIFY GEOGRAPHY TEACHER'S PERSPECTIVE ON INTEGRATING GEOGRAPHY TEACHING AND LEARNING USING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT).

Integrating technology in teaching and learning Geography is not just about starting to train teachers, but first to indicate their attitude towards using technology because this will impact technology in the classroom. Therefore, it is important to identify teachers' perspectives on technology integration in the Geography classroom.

The following factors were identified in influencing teacher perspectives towards the integration of Geography teaching and learning using ICT:

5.6.1.1 Access to a variety of Geography materials

Indicated by the participants' responses, it was evident that the teacher's perception is that ICT can add value to teaching and learning resources of Geography. Teachers will be able to access various Geography materials like maps and programmes for use in the Geography classroom (Cener *et al.* 2015:192; Chang & Wu 2018:35). Not only will they be able to access Geography materials, but they can be immediately available with the use of the internet. The internet or presentations will save them time in the classroom because the teachers can show the maps' images, for example, immediately and will save time in the classroom. Since the learners are already capable of using ICT's because they are dealing with them daily by using the cellphone and other technologies. According to the teachers, this can be valuable because they know to operate the tool for learning purposes and access Geography materials. The teachers' view is that they believe that technologies can transform and increase resources in the Geography classroom (Chang & Wu, 2018:35). The one teacher indicated that she likes to work with transparencies, but she can transform her resources from 1D to 3D with the available technology. This can be done by using different programmes or searching for 3D simulations available on the internet for use in the Geography classroom. The teacher has indicated that ICT's can be a transformable tool (De Sousa 2008:31 and Chang & Wu 2018:35).

5.6.1.2 Resistance to change

The lack of knowledge about ICT or technology will lead to negative attitudes towards ICT integration (Becta 2004:7; Bapela 2015:39). The participants indicated that a barrier is to change all her hard work developed resources to a "new" way of doing. In developing her resources over the years and using them in the Geography classroom, she needs to change all of them and relate to a negative response to change. This teacher's response can be regarded as a negative perspective towards ICT and will hinder its use in the Geography classroom.

5.6.1.3 Opportunity to learn

Teacher perspectives will change or positively influence technology in the Geography classroom if they see it as an opportunity to learn for their learner and them as teachers. The SGB member and the teacher participants indicated that using ICT in the Geography classroom will give learners from fewer privileges backgrounds an opportunity to access technology with the more privileged learners in a classroom. Using ICT in the Geography classroom, the less privilege has the opportunity to work with peers to gain access to those who are most fortunate and will be able to assist them (Cener *et al.* 2015:192; Chang & Wu 2018:35).

5.6.1.4 ICT as a visual learning tool

Teachers wanted to see and experienced the value of ICT to make a judgement in using it. The data indicated that the teachers see the value of ICT as a visual learning tool. They confirmed that learners want to experience more visual experiences, which could be done by using ICT. The teachers confirmed that since this is a new generation they are dealing with, they need to expose them to new technologies, which will improve the teaching and learning of Geography. The teachers were confident that technology would allow learners to be visual learn and be more interested in the lesson (Sangrà & Gonzalez-Sanmamed, 2010:214).

5.6.1.5 Enhance Geography teaching and learning

Freeman (2003:205) stated that teachers who have a positive attitude towards ICT could enhance Geography teaching and learning in many ways. The data indicated that the teachers value ICT for its progression toward enhancing Geography teaching and learning. The team indicated that using ICT will make learning more productive because learners understood technology. The learner will, therefore, take responsibility for their learning. By “bringing” their prior knowledge, they will build their geographical content knowledge more constructively (Sangrà &

Gonzalez-Sanmamed 2010:214). The participants indicated that ICT would make teaching and learning more appealing because they are open to change in using ICT in the Geography Intermediate Phase classroom.

5.6.2 TO DETERMINE HOW GEOGRAPHY TEACHERS ARE USING INTEGRATED TEACHING AND LEARNING THROUGH THE USE OF ICT.

It is necessary to determine how Geography teachers are using integrated teaching and learning using ICT in the classroom. Using ICT's will assist in transforming the Geography teaching environment from a teacher-centred to a learner-centred one. They frequently use ICT in the Geography classroom to accelerate deep learning and approve the quality to support teaching and learning (Fullan & Langworthy 2014:11).

5.6.2.1 Use of interactive whiteboard (IWB) and data projector

The teachers had an IWB and data projector available in the classroom for Geography lesson presentations. In their interviews, the teachers indicated that they use the IWB and data projector to teach map work and show learners how to identify natural features in Africa. The teachers did not utilise the IWB to its full capacity because they did not use the available software. The pictures were only used for illustration purposes which is ineffective in teaching Geography skills (Ncube 2018:63). The IWB is also underutilizing in her classroom as a resource because IWB can be used for more interaction with the learners in a lesson and be more enthusiastic (Bardakci & Kocadağ 2020:2). During the lesson presentations, the teachers also did not use the IWB effectively. It was used for reflecting the PowerPoint presentations.

Both teachers use PowerPoint on the IWB in their lesson presentations. The teaching methods used with the teachers' presentations were the lecture method and the question and answer method. Both teachers add images of the content on the PowerPoint slides. Teacher 1, although she had appropriate pictures about the content, she did not engage the learners while showing the pictures. Teacher 2, however, engages the learners with the slides by asking them questions and waiting for their responses before she goes onto the next slide. Using it in this way, she incorporates meaningful Geography learning as suggested by Mayer and Moreno (2003:43) and; Mayer and Mayer (2005:1). For example, teacher 1 showed a map on the IWB but then revert the learners to the textbook. The teacher could have used the PowerPoint map and asked them different questions while drawing attention on the map. The information which was in the textbook could have been incorporated in the map on the slide. By doing it in this way, the learners could have the opportunity to appreciate the distinctive features of the content on the slides (Bartsch & Cobern 2003:77).

5.6.2.2 Use of simulations

One of the teachers uses a simulation of the development of weather in her Geography lesson. However, the use of simulations is very creative by the teacher and would stimulate the classroom environment (Treves, Mansell & France 2020:4), she did not teach some of the concepts which were shown in the simulation (Lambert & Balderstone 2000:110). The simulation was shown, but the teacher did not reflect or refer to it again in the lesson. The teacher could have shown the simulation and explained the problematic concepts by stopping and starting the simulation to improve learners' cognitive skills. One of the teachers lacks technological skills because she did not have any training in downloading simulations.

5.6.2.3 Teacher-centred and learner-centred teaching methods

With the use of ICT in the Geography Intermediate Phase classroom, teachers got an opportunity to have a more learner-centred approach to the lesson (Van der Westhuizen *et al.* 2012:192). The teachers in both lessons use a more teacher-centred approach in their lessons. The teacher’s instructions were limited to short instruction blocks and in a passive one-way mode of instruction. Using a more learner-centred approach, the teachers could have used interactive instruction modes and collaboration between the learners.

5.6.2.4 Assessment

During the lesson presentations, the researcher observed a limited amount of assessment. The one teacher gave the learners an activity after the lesson from the textbook. Although this was an informal assessment (Assessment for learning) activity the teacher could have used other assessment tools, for example self, group or peer assessment, to get immediate feedback on the learning process. Also, ICT tools could have been used to plan for assessment because it needs to part of the learning experience (McCormick 2004:20).

5.6.3 TO DETERMINE THE CHALLENGES WHEN GEOGRAPHY TEACHERS ARE USING INTEGRATED TEACHING AND LEARNING THROUGH THE USE OF ICT.

For the successful implementation of integrating Geography teaching and learning using ICT, it is necessary to identify the challenges teachers will face. Challenges related to integrating ICT need to be mitigated to support teachers in using ICT in the Geography classroom. The following findings relate to the challenges for ICT integration in the Geography classroom.

5.6.3.1 Challenges related to the lack of technological resources

The shortage or inadequacy of instructional technology tools can hinder quality Geography education, as stated by De Guzman *et al.* (2017:64). It was evident from the data that the teachers did not have access to computers and laptops regularly. They only get the laptops at the beginning of a school day and need to hand them in at the end of the day. This will hinder the development of their TPACK because they do not have access to it to do some planning and preparation for their Geography lessons.

Although the teachers have computers at home, it has outdated software which is not all compatible with the ones at school. This hinders them because they need to use a memory stick to transfer their work onto the school's laptop, and sometimes the programmes do not work on it, and the lessons start late. Challenges regarding technological resources like this will negatively impact the acceleration of improving the quality of ICT integration in the Geography classroom (Koh *et al.* 2014:185).

Access to the internet has let teachers and learners have a wide variety of access to incorporate visual teaching and learning in Geography resources (Daniels 2018:2). The teachers at the school do not have access to the internet. Although the school do have WiFi, it was limited to the use of administrative purposes. Only the principal and administrative staff has access to the internet at the school. Therefore, the teachers cannot access electronic materials for their lessons, which will affect the Geography learning environment (Tucker & Courts 2010:38). The lack of internet impacts the resources' sustainability because the teachers cannot update software.

The availability of resources will lead to the improvement of Geography teaching and learning (Rodgers & Streluk, 2002:1). The participants indicate that resources, such as laptops and the internet, need to be available for teachers to integrate ICT in the Geography classroom. Laptops need to be permanently available in the classroom because this will allow the teacher to start the lessons on time, and you can just put your memory stick on the laptop to start (Cruickshank *et al.* 2009:3; Muhammed 2019:2). The resources must also be maintained regularly and must be in working condition. This can be done by appointing a person or a teacher that is skilled enough. This will also help to handle the equipment properly.

5.6.3.2 Challenges related to the lack of financial resources

The school used in the study is categorised as a no-fee school and is situated in a disadvantaged area of Kimberley. It was clear from the participants, especially the SMT and SGB member that the lack of funds hindered the implementation of ICT in the Geography classroom. Since ICT can be an expensive resource, the participants indicated that the school does not have funds to buy laptops or maintain existing resources. The participants, indicate that technological resources are the issue; you also need to plan for the resources' security because they can get stolen from the school.

5.6.3.3 Lack of preparation

ICT can transform how geographical knowledge is packaged, delivered and acquired to alter educators' core production and delivery process (Van der Westhuizen 2007:41). To execute the lesson successfully in Geography, require proper planning and preparation. The teachers and SMT member value the importance of planning and preparation of the ICT integrated lessons. Teachers need to plan for the technology or LATs that will be used, which teaching method they will be using, etc., for the lesson execution.

The research findings indicated that teachers not only need to plan for the lesson itself but also the technology. Technology is not foolproof, so sometimes there will be challenges with the technology itself. Therefore, teachers need to prepare for these challenges as well.

5.6.3.4 Lack of teacher confidence

Bingimlas (2009:238) and Subramanien (2013:49) states that teachers' attitudes towards new technology will lead to the confidently use of technologies in teaching and learning. The lack of confidence will influence the teacher motivation to use ICT in the Geography classroom (Osborne & Hennessy 2003:36; Balanskat *et al.* 2006:36). Teacher 1 has more confidence than T2 in using ICT in the Geography classroom. The teacher's confidence level is because T1 taught herself, and T2 did not have any training. Therefore, T2’s has a lower level of motivation for ICT integration. Since the teachers did not have any training, they lack confidence in using it in the classroom.

5.6.4 TO ESTABLISH THE CONDITIONS THAT ARE CONDUCIVE FOR GEOGRAPHY TEACHERS WHEN INTEGRATING TEACHING AND LEARNING THROUGH THE USE OF ICT.

The integration of ICT in Geography is complex. One way of mitigating challenges is to create a conducive environment for ICT integration in the Geography Intermediate Phase classroom. The following will be a discussion of these findings.

5.6.4.1 Training in the use of ICT

Teachers need to be adequately trained to use technology and integrate it into Geography teaching and learning. This will help teachers integrate technology in the day-to-day Geography classroom (Rabah 2015:27; Rani & Kant 2016:3329 and Wilmot & Dube 2016:337). The teachers and SMT member indicated that if teachers receive proper training it will accumulate at a higher level of confidence of the teachers to use ICT. The training must not be a once-off; it must be ongoing and regularly provide the necessary support to teachers. Ongoing training is important because technology changes or some programmes have upgrades. The ongoing training will make sure that the teachers do not revert to their old habits.

Training needs to be compulsory for all staff. Everybody will then be on board in the way the school wants to improve quality teaching and learning. Not only must the training be compulsory, but a reward must also be offered to those making maximum use of ICT integration as motivation. The researcher trained the teachers in the planning and preparation of their lessons. The researcher introduces them to Design Thinking for the integration of ICT in their Geography lessons. The teachers found the training of design thinking useful (Lor 2017:7) because it was in-depth, they could work together, do more research on Geography topics, and use the Design Thinking steps. They could see the evolution of the lesson.

5.6.4.2 Peer Assistance

Integrating ICT can be a daunting experience for the Geography teacher (Hendriksen *et al.* 2017:140). Knowing that help is near in the form of a peer staff member will decrease the fear and boost confidence, and therefore the peers can benefit from one another (Vygotsky 1978). The teachers, SGB and SMT member indicated that an appointment of an ICT co-ordinator would assist the school a lot. The person needs to teach the subject but need to have the time to assist others as well. The person needs to skilled in technology and integration of ICT.

Assistants can help in the classroom with the lesson. Even if it is just by clicking from one slide to another. The teacher can then focus on the teaching and the learners (Sothayapetch *et al.* 2013:86).

5.6.4.3 Management and leadership

The management and leadership of a school need to establish an environment that will support ICT integration in the Intermediate Phase Geography teaching and learning classroom. The school principal needs to play a leading role because his involvement will determine how ICT will be used by IP teachers and learners (Mbatha 2015:20; Moreira *et al.* 2019:550).

According to the teachers, management of the school needs to provide technology in Geography classrooms. This will set the scene for the teachers to use the technology. The school need to provide training for the teachers, although they can use external service providers. In this way, the school decides internally to improve their teaching and learning and does not come from outside and be forced on the school. Management needs to promote the use of ICT and set the trend for others to follow. This will bring change to the current ways of working and encourage staff to use ICT and support ICT use (Tondeur *et al.* 2008:213).

5.7 RECOMMENDATIONS FOR THE FORMULATION OF A STRATEGY FOR USING INTEGRATED GEOGRAPHY TEACHING AND LEARNING USING ICT IN THE INTERMEDIATE PHASE CLASSROOM

The following discussions relate to the study's aim: to investigate strategies to improve the integration of Geography teaching and learning using ICT in the Intermediate Phase. The development of the strategy is realised from findings that were discussed in the previous chapter. The strategy encompasses the recommendations for the findings.

5.7.1 Collective perspective on the value of ICT as a resource

Before a school starts integrating Geography teaching and learning using ICT, it is essential to agree on the value of ICT as a resource. Teacher perspectives on the use of ICT will influence their attitude and motivation in the use of ICT’s. They will value ICT if they understand that with ICT, the teachers will have an opportunity to have access to a variety of Geography materials, the value as a resource for learners, ICT can transform the use of resources, it provides an opportunity to learn for learners, ICT has value because it is a visual tool and it enhances Geography teaching and learning in the IP. Although it can be said that even if the teacher's attitude is positive, it does not necessarily mean that they will use ICT’s in their Geography Intermediate Phase classrooms.

5.7.2 Management

a) Management needs to make time for training at the school because teachers must also participate in extra-mural activities. They need to plan for professional development opportunities because sometimes teachers are exhausted after the day’s work. Set times for teacher development can be planned for by management. The training must also be compulsory for all teachers because it all plays a role in the school's overall development and not only Geography teachers. Management can introduce a reward system to motivate teachers to take part in developmental sessions. This can take on various forms such as book rewards, etc.

b) Management must set a conducive environment to accelerate the ICT integration of Geography. They must revisit or set up ICT policies for the use of technology integration in the school. This need to be in conjunction with the teachers because they are part of the role players. These policies must focus on the use of ICT resources or equipment, internet usage, etc. Management must take the lead to have systems in place that align with the policies and utilize the maximum capacity of the resources.

c) The principal must take the lead in developing a strategy for ICT implementation because the principal can influence, lead, and motivate teachers to encourage innovative change in teaching and learning. They need to take appropriate action and strategies to have a positive influence. A clear vision should be communicated to staff because it creates direction and purpose for future success for integrating ICT in the Geography classroom. They must consider how the policies affect the acquisition of and access to technology. If teachers share values within a school-related policy and understand the implications, the policy can influence practice.

5.7.3 Resources

Teachers need to have access to relevant resources before they can integrate ICT in Geography Intermediate Phase classroom. Laptops or computers need to be available all the time to them for lesson preparation, etc. Since there is a lack of time for planning purposes, it will make sense to avail laptops to teachers more regularly to plan in their own time. It will even make it more suitable for them if the resources are available in all the classrooms. This will help teachers to start with the lesson on time because they can just put in their memory sticks and start with the lesson. Outdated resources need to be replaced or upgrade to have access to proper resources. Enough cannot be said that the resources need to be well maintained for proper use. Although maintenance is expensive, the school need to make funds available for this.

Teachers need to have access to the internet / WiFi to have access to various resources to incorporate visual teaching and learning in the Geography classroom. This is especially important in Geography because we make use of maps. With ICT, there is a possibility to bring these maps alive, turning them into places with similarities and differences to places pupils know and live. Having access to the internet in the classroom, teachers can expose learners, so map software like Google Earth to make the maps live for the learner. Having access to the internet allows teachers to disseminate high-quality materials at almost no cost and allow Geography students to experience a learning environment rich in knowledge and experiences.

School need to plan for the integration of ICT because resources are expensive. Especially in the disadvantages schools, they do not have the funding to buy or maintain these resources. Therefore, management needs to plan for these expenses and come up with creative ways to source funding. In planning for financial resources, for ICT integration, they must also plan for the security of the resources and other things that go with it. Human resources are also a component of the successful integration of ICT in the IP.

Appoint a skilled staff member or someone from the community to be the ICT co-ordinator can be of assistance to the educators for integrating ICT in the Geography classroom. Some of the responsibilities could be to assist with the equipment, update or download software needed. This person will also need to assist teachers with integrating ICT in the teachers' Geography lessons.

5.7.4 Training

Teachers need extensive training in the use of ICT to integrate it successfully in Geography teaching and learning. The training needs to be part of the teacher's professional development in the Intermediate Phase. Training needs to include the following:

a) How to work with the internet, especially how to download or access Geography resources like pictures, simulations, and other software programmes. The pictures can allow teachers to show how real-life Geography situations look like. Showing a 3D picture, for example, of the country's physical features, will be meaningful for the cognitive thinking of the Geography learner. Train them in the use of the internet will strengthen their technological skills.

b) In some cases, teachers do have access to IWB in some of their classrooms. Unfortunately, they do not know how to operate with it in a meaningful pedagogical way. Therefore, teachers need to be trained in the operational use of IWB's, which means how to use the software installed on the IWB. They need the training to use the IWB and develop Geography lessons with the IWB to strengthen their TPACK skills.

c) Teachers need training on how to use simulations in the Geography classroom. Simulations are useful in the IP Geography classroom because they can explain difficult concepts and improve inquiry. Teachers still need to understand that simulations are tools for enhancing the cognitive thinking of the learner. They must also have an idea of how to make use of it optimally in the classroom.

d) PowerPoint lesson presentation is widely used in Geography ICT lessons. Teachers need technological knowledge of how the software is working for them to design proper Geography lessons. The training needs to include how to put pictures on your slides and how to add animation. In knowing to do this, teachers can enrich the Geography teaching environment in the classroom. What is more, importance is how to use PowerPoint in lesson presentation for meaningful Geography learning. It is not just for presenting word or pictures on the slides because this will not lead to meaningful learning for the Geography learner. With the slides, the teacher needs to think about the teaching method that will go along with the slides to incorporate the content, pedagogy and technology (TPACK). The learners, therefore, need to engage in the lesson and not passive one-way communication. The classroom needs to shift from a teacher-centred to a learner-centred classroom. This means that teachers make use of active and interactive modes of instruction and collaborative and cooperative work. Teaching the learners will be exposed to in-depth learning experiences and creative thinking in Geography teaching. Teachers need to expose to methods of using ICT to assess learners learning in the Geography classroom. The training needs to focus on which assessment methods can be used and which technologies will be best suited for using those methods. The training should focus on how the technology tool can best be utilized in a Geography lesson's whole teaching process. For example, teachers can use slides to introduce the content presentation and teaching and their assessment. This will optimize the use of the ICT tool for Geography teaching and learning.

e) Teachers need training on technological tools to improve their technological skills. Although they do not need extensive training on it, they must know the basics. The need to know how laptops or computers are working, how projectors are working and any other tool they most probably will work with to integrate ICT in Geography teaching and learning. They need to know the basics of these to solve challenges that might occur during the lesson in a quick way.

f) Training needs to be on-going. Once-off training in the use of ICT integration in the Geography classroom will not lead to the sustainable use of ICT. ICT training needs to be incorporated into the professional development program of the teachers. On-going training can increase a teacher’s confidence in the use of ICT in the Geography classroom.

g) Teachers need training on how to prepare for ICT integration of Geography classroom. If teachers do not know how to prepare for ICT lessons, they will not know how to execute Geography teaching and learning. Preparation includes the way you were taught, your preferred ways of learning, your preferred ways of teaching, your proficiency in your chosen teaching or academic field, and the kind and the amount of teaching preparation you have received. Design Thinking in ICT lesson has proved to be suitable for teachers because they could work collaboratively, incorporate activity types for Geography, and see how they develop.

5.8 A STRATEGY FOR USING INTEGRATED GEOGRAPHY TEACHING AND LEARNING USING ICT IN THE INTERMEDIATE PHASE CLASSROOM

PURPOSE

The purpose of this report is to provide a strategy for the implementation of integrating Geography teaching and learning using ICT in the Intermediate Phase in a South African school. The report is a result of a research project which were done for the fulfilment of the requirement for the degree Philosophiae Doctor in Education. The strategy has derived from the recommendation that was proposed from the above study.

AIM

The aim therefore, is to provide a strategy that can be used for the integration of Geography teaching and learning using ICT in a South African context. These strategies will be discussed at four levels of the curriculum namely, macro, meso, macro and nano level.

DEFINITIONS

According to Van den Akker (2003:2) a country's official curriculum distinguishes between various levels:

• Macro Level - a system/ society/ nation/ state.

• Meso Level - the school/ institution.

• Micro Level – classroom.

• Nano Level - individual/ personal.

• ICT – Information and Communication Technology

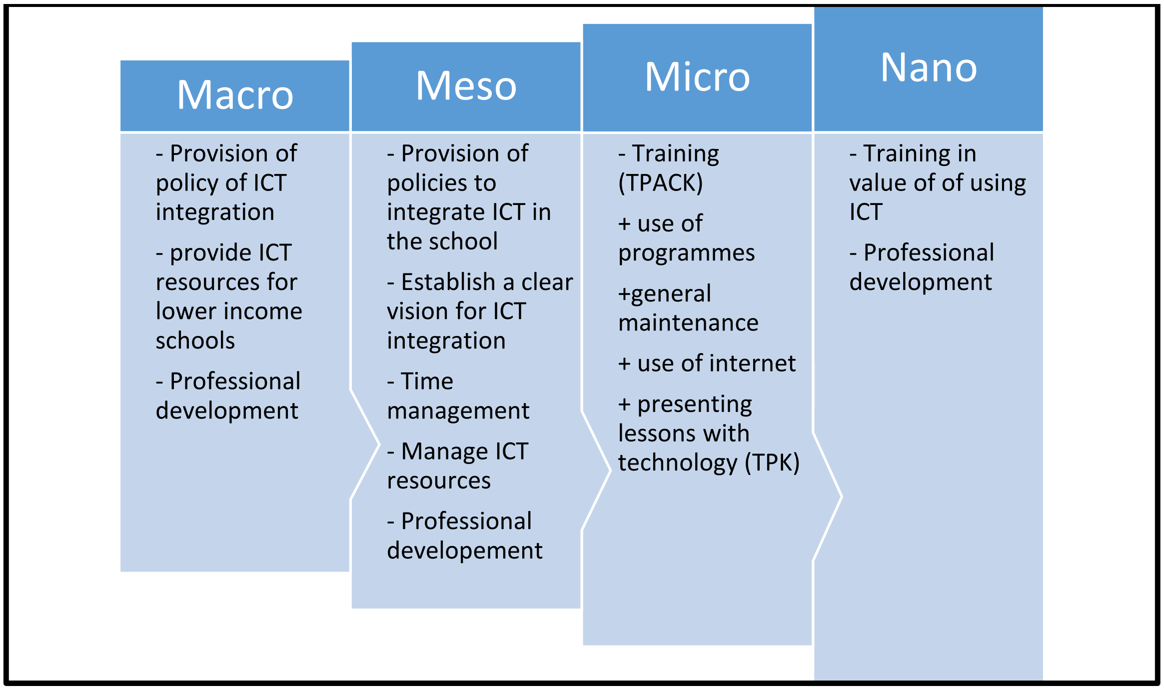


Figure 5.1 Issues related to inform strategy on different curriculum levels

1. MACRO LEVEL

At this level, government policies need to be more adequately structured to make provision for a more focused strategy that will improve Geography teacher's ICT skills in the classroom. Although there are current policies (White Paper on E-Education), this does not provide a more detailed structure in how schools can implement ICT integration in the school and the classroom. Furthermore, government need to support schools, especially lower income schools, with regards to the provision of technology resources. Although some schools did receive technology resources, this was not enough. They provided schools for example with only 15 tablets or laptops. This is clearly not enough because this need then to be carefully managed by schools. The Education department need to provide schools with adequate training when schools received technology resources from the department. This can be a huge barrier for schools because they sometimes do not have the necessary skilled staff to offer the training. Resources are ending up in the save and are not being used.

2. MESO LEVEL

At meso level, schools, and in particular the management of the school, must play a larger role in the integration of ICT in Geography teaching and learning using ICT. School leaders (SMT and SGB) complement mechanisms (goal-setting, etc.) with cultural tools (vision, values, etc.) for school improvement. They make decisions that affect the development and management of the school. This can be done by at first, developed a clear vision for future success. This can be done in conjunction with the provision of a clearly defined policy. This policy need to give guidance on the maximum utilization of technological resources for teachers and learners. These can include, but not limited, management of resources during lesson time (especially when not all classes have resources), maintenance of resources and also the acquisition of technology resources. One important strategy that needs to be implemented is the one of training in the integration of Geography teaching and learning using ICT. Although this is expected from the education government, schools need to implement their own professional development opportunities because this is expected from schools or management. This will provide schools of an opportunity to manage the training themselves, since teachers are also involved with other school related activities (and that training will not be a once off exercise). For this, school can appoint an assistant that could help with training and can assist teachers, especially in the early stages, in the classroom. Furthermore, school management can introduce reward systems to motivate teachers in various ways to continuously use ICT's in the Geography classroom.

3. MICRO LEVEL

Teachers need to have a favourable learning environment, that can be created by the individuals at the meso level. This environment plays and important role in the school and at micro level, it includes the teacher and his working environment. Different strategies can be followed, but the one of importance is to empower the Geography teacher for their classroom to integrate ICT. This will increase a favourable teaching and learning environment. Teachers need to have different knowledge's to integrate ICT in Geography teaching and learning, therefore, the training needs to be extensive and focused, which will improve teachers' confidence. This training needs to be focused around the following:

- The use of general computer programmes (Word, Excel, PowerPoint, etc.)
- Use of the internet and related programmes
- General maintenance/problem solving (to solve minor computer and data projector problems themselves in class – too save time)
- Software programmes related to Geography content (simulations, map ware, etc.)
- Planning and preparation for ICT integrated lessons (use of Design Thinking)
- Geography and ICT related pedagogies
- How to teach with ICT's in the Geography classroom

These training opportunities must not be a once off, but as stated earlier, it needs to be on a continuous basis that teachers can strengthen their competencies in using ICT's in the Geography classroom.

4. NONO LEVEL

At the nano level of the curriculum the focus is on the individual and in this case on the teacher. This level relates to the individual's responsibility for (life-long) learning and development. Geography teachers have a responsibility for their own development to improve teaching and learning in their classroom. Therefore, they need to participate in the training opportunities that will be on offer to them to improve the use of ICT integration in the Geography classroom. In improving their skills their perspectives will influence their attitude and motivation towards the use of ICT in the classroom. There is a possibility that they will realize the value of using ICT as a tool to enhance Geography teaching and learning.

CONCLUSION

The use of ICT in the teaching and learning is complex. These strategies provide a guideline for the integration of ICT in teaching and learning using ICT in a South African school. Using these strategies also needs some form of flexibility in schools and classrooms to be successful.

5.9 RECOMMENDATIONS FOR FUTURE RESEARCH

Research asserts that there is no long-term research publication on integrating Geography teaching and learning using ICT. This limitation can cause doubt and uncertainty about the effectiveness over a longer period. However, the study's findings suggest great potential for further research areas relating to the study.

The possibility exists to conduct further research in the following areas relating to the study:

- Integration of Geography teaching and learning using ICT of pre-service teachers.
- A similar study over a longer period will give further insight.
- Impact of management in the integration of ICT in the Geography classroom.
- The use of Design Thinking in the integration of Geography teaching and learning using ICT.

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APPENDICES

Appendix 1: Turnitin report

Alan thesis 3

ORIGINALITY REPORT

3%	3%	0%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	creativecommons.org Internet Source	3%

Exclude quotes	On	Exclude matches	< 2%
Exclude bibliography	On		

Appendix 2: Research approval from Northern Cape Education Department

LK Nkoane Education House

156 Barkly Road
Homestead
Kimberley 8301

Private Bag X5029
Kimberley 8300
Republic of South Africa

Tel: 053 839 6500
Fax: 053 839 6580/1
Web: ncdoe.ncpg.gov.za

DEPARTMENT OF EDUCATION

Enquiries : G.D. SIBIYA
Contact No : 053 839 6703
Reference :
Date : 12 September 2018

TO: MR ALAN FELIX

GRANTING OF PERMISSION TO CONDUCT RESEARCH IN A PRIMARY SCHOOL IN THE NORTHERN CAPE: FRANCES BAARD DISTRICT

The Northern Cape Department of Education has noted your request to conduct a research that involves the Integration of Geography teaching and learning using Information and Communication Technology (ICT) in the teaching of Geography as part of Social Science in the Intermediate Phase.

We regard this research as central to providing the department with data on the innovative approaches and methodologies that can be used to integrate ICT to enhance the teaching and learning of Intermediate Phase Social Science.

We therefore trust that your research findings will be shared with the department in the near future.

We further trust that the selected school for this research will give you all the necessary support to complete this task.

Permission to your request is therefore granted and we take this opportunity to wish you all the best in your studies.

Thank you

MR. G.T. PHARASI
SUPERINTENDENT-GENERAL

NDP 2030

Page 1 of 1

Appendix 3: Title Registration

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS
UV

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Faculty of Education

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Bloemfontein 9300
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T: +27(0)51 401 3651
F: +27(0)51 401 2010

www.ufs.ac.za
Duvenhageoc@ufs.ac.za

15 December 2017

APPLICATION FOR TITLE REGISTRATION

Applicant: Felix, AA
Student Number: 2017147873
Discipline: Curriculum Studies
Study Code: EDCI9100

Dear Dr Moreeng

The CTR committee recommend the following changes to your students title: ***"Integrating geography teaching and learning using information and communication technology"***

The following recommendations can be taken into consideration in the application: (No need to give feedback to the committee again)

The section is well addressed and it clearly alludes to what is currently happening in the use of ICT in Geography teaching. It alludes to the complexity of using ICTs in teaching, a lack of training on how to effectively use technologies, the integration of ICT in geography teaching through inadequate ICT integration knowledge and skills of teachers, teacher's beliefs that ICT can improve teaching and learning, challenge relating to language and content and practices involving the integration of educational technology, equipment and software that do not notably improve education and instruction.

Research interest, focus OR problem
Clear focus has been provided. The study explores the ICT technologies that can be used in specific content-related activities in the geography IP curriculum.

Research paradigms and Theoretical Framework
Research paradigm: Missing and has to be discussed
Conceptual Framework: technological, pedagogical and content knowledge (TPACK) will be used as the conceptual framework

"The methodology of PAR has proven to be important." Care should be taken not to confuse PAR with research methods since it's a research design not a method and different methods can be used within PAR.

Data collection Methods: Observations, records of meetings, workshop discussions, and informal interviews

Selection of research participants
Population to be drawn from one school in the Northern Cape. The sample will comprise two or three IP social science: geography teachers at the school, one school management team member, a social science subject advisor, a school governing body member and three learners **Data analysis, Interpretation and reporting**
Critical Discourse Analysis (CDA) to be used to analyse data

Value of the proposed research
The contents thereof are clearly stipulated, however, the applicant should attempt to use the wording like the study is hope to.....The applicant seems to be sure of what the contribution of the study would be

Ethical considerations: Well-articulated

Layout of Chapters
This has been provided

The researcher has to be careful in the arguments as the study seems to be located in primary school, and to my knowledge there is no subject call geography in either primary or intermediate school environment, so for a PhD study focus and the field needs to be succinctly presented so as to have an unambiguous focus. The student seem not succeeding in providing a convincing argument' The content does not talk to the title: in short the content emphasis is integration of ICT in teaching

It is advisable for the student to be clear some arguments are actually defeating the purpose of the study, Why then do the student want to do research in the integration of ICT, if there is no evidence that the use of ICT an improve the teaching of geography? Does the student assume reconstruction of geography to be equivalent to ICT integration?

Background towards the problem statement can still be improved.

Although theoretical framing is a matter of preference, I see the conceptual framing lacking depth

The question and the aim of the study lacks alignment

The use of data generation techniques is in conflict with PAR approach.

Yours sincerely,

Prof M Mokhele Makgalwa
Chair: CTR committee

Mrs CS Duvenhage
Secretary: CTR committee

Appendix 4: Participant consent

RESEARCH STUDY INFORMATION LEAFLET AND CONSENT FORM

Dear Participant

I am currently a student at the University of the Free State and busy with my Phd studies. Hereby I would like to request permission from you to take part as one of my participants to conduct research. You will be of great assistance to me in participating in this project to improve the teaching and learning in schools. See more information below regarding the research project.

DATE FOR DATA COLLECTION

First and Third Term 2019

TITLE OF THE RESEARCH PROJECT

Integrating geography teaching and learning using information communication technology

PRINCIPLE INVESTIGATOR / RESEARCHER(S) NAME(S) AND CONTACT NUMBER(S):

Name and Surname: Alan Felix
Student number: 2017147873
Cell number: 0837909096

FACULTY AND DEPARTMENT:

Faculty: Education
Department: Curriculum Studies

STUDYLEADER(S) NAME AND CONTACT NUMBER:

Dr Boitumelo Moreeng
0732691760

WHAT IS THE AIM / PURPOSE OF THE STUDY?

To suggest ways to integrate ICT to enhance the teaching and learning of Social Science (geography) in the IP.

WHO IS DOING THE RESEARCH?

I am Alan Felix, a lecturer at Sol Plaatje University. I am doing this project to fulfill the requirements for my Phd studies and to make an impact on the teaching and learning in a Northern Cape Province school.

HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This study has received approval from the Research Ethics Committee of UFS. A copy of the approval letter can be obtained from the researcher.

Approval number: UFS-HSD2018/0306

WHY ARE YOU INVITED TO TAKE PART IN THIS RESEARCH PROJECT?

The following participants will be selected:
One SMT member, teachers, one SGB member and one subject advisor.
The reason for involving the school management member is this participants' direct link with the teachers that he/she can help to organise and monitor the progression of activities at the school. The subject advisor will assist with alignment of CAPS and give feedback on teaching and learning. The school governing body member will be helpful to determine the impact and the way different resources impact on teaching and learning and to make informed decisions in school governing body meetings. All the participants' details will be collected from the principal of the school, except the subject advisor, which will be obtained from the Northern Cape Education Department.

WHAT IS THE NATURE OF PARTICIPATION IN THIS STUDY?

The role of the participant's is to give feedback in the form of free attitude interviews, which will be recorded. The questions will relate to the following:
What is the need for integrating ICT to enhance Social Science (geography) teaching and learning in the IP?
How can TPACK be use as a model to integrate ICT to enhance Social Science (geography) teaching and learning in the IP?
Which conducive condition are needed for integration of ICT in Social Science (geography) teaching and learning in the IP?
The time allocated for the interview will be: 2 to 3 sessions of 30 minutes to the participants mentioned above.
No anticipated risk are foreseen for the learners in the study. The researcher will explain to the learners that they must tell his/her parents if they are sick or in pain during the course of study.

CAN THE PARTICIPANT WITHDRAW FROM THE STUDY?

The participation in the study is voluntary, there is no penalty or loss of benefit for non-participation, and participants are under no obligation to consent to participation. If you do decide to take part, you will be given a written consent form and be asked to sign. You are free to withdraw at any time and without giving a reason.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

The potential benefit for the participants will be the following: learning new skills on how to use different technologies in their teaching and learning in Social Science (geography); overall improvement in teaching in learning of Social Science (geography) subject; learn new technologies which can possible been use in other subjects and improve their learners learning. The names and classes of participant will be kept confidential in the research report.

WHAT IS THE ANTICIPATED INCONVENIENCE OF TAKING PART IN THIS STUDY?

No potential inconvenience or discomfort are foreseen for the participants.

WILL WHAT I SAY BE KEPT CONFIDENTIAL?

What you will say will be kept confidential. Your name will not be recorded anywhere in the study report (fictitious names or codes will be link to it). You will be referred to in this way in the data, any publications, or other research reporting methods such as conference proceedings.

Although a transcriber will have acces to the data, these individuals has to sign an confidentiality agreement. Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report. While every effort will be made by the researcher to ensure that you will not be connected to the information that you share during meetings, I cannot guarantee that other participants in the meetings will treat information confidentially. I shall, however, encourage all participants to do so. For this reason, I advise you not to disclose personally sensitive information in the meetings. Please keep in mind that you can stop being in the study at any time.

HOW WILL THE INFORMATION BE STORED AND ULTIMATELY DESTROYED?

Hard copies of your answers will be stored by the researcher for a period of five years in a locked cupboard/filing cabinet (where?) for future research or academic purposes; electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. Information will be deleted from computer and any hard copies will be burned after a period of time.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICPATING IN THIS STUDY?

Unforunately, there will be no payment or financial reward for taking part in the study.

HOW WILL THE PARTICIPANT BE INFORMED OF THE FINDINGS / RESULTS OF THE STUDY?

If you would like to be informed of the final research findings, please contact Alan Felix on 0534910152 / 0837909096 / alan.felix@spu.ac.za . The findings are accessible for a year. Should you require any further information please use contact details abbve. Should you have concerns about the way in which the research has been conducted, you may contact Dr B Moreeng at 0732691760 or email at boitumelo.moreeng@spu.ac.za.

Thank you for taking time to read this information sheet and for participating in this study.

CONSENT TO PARTICIPATE IN THIS STUDY

I, ______________________________________ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable). I am aware that the findings of this study will be anonymously processed into a research report, journal publications and/or conference proceedings.

I agree to the recording of the *insert specific data collection method*.

I have received a signed copy of the informed consent agreement.

Full Name of Participant: ____

Signature of Participant: _____________________________________ Date: ____________________

Full Name(s) of Researcher(s): ____

Signature of Researcher: _____________________________________ Date: ____________________

Appendix 5: Sample of one of free attitude interview questions for the co-researchers

1. Do you think the use of ICT (technology) is important in Geography teaching and learning? Why?
2. How comfortable are you using ICT?
3. Why are some teachers not using ICT in their teaching and learning?
4. Which computer programmes are you familiar with?
5. Which topics of Geography do you think would be excellent for integration of using ICT? [How did you use ICT in these topics]
6. Which other ICT or technology could be use in Geography teaching and learning?
7. Which ICT resources do you have access to and how do you use it in Geography teaching and learning?
8. Did you have any training in the use of ICT in the Geography classroom? [If any, was the training adequate? / What are your expectations for training?]
9. Do you think the SGB and SMT can play a role to support ICT integration in the Geography classroom?
10. Do you think there is a need to integrate ICT in Geography?
11. What can the school do to support ICT or what is needed to support ICT in the Geography classroom?

Appendix 6: Observation checklist

Teacher 1	
Teacher 2	

Date and time of class visit:……………………………..

O = Observed   NO = Not Observed

	O	NO	Comments
Teacher			
• Teachers talks and explain all information			
• Breaks up complex information			
• Invites pupils to participate in conversation			
• Teacher are giving all the answers			
• Give learners chance to participate in an activity			
• Inform pupils of different concepts			
• Ideas are shared between teacher and pupil			
• Give special attention to individuals			
• Foster higher-order thinking			
• Promotes learning from and with peers (group work)			
• Pupils needs to come to own conclusions (discover)			
• Facilitates learning			
• Scaffolding take place			

• Make goals clear of the lesson			
Learners			
• Work on own most of time			
• Engage in authentic activities			
• Engage in active learning			
• Do not understand questions			
• Do not exchange ideas during group work			
• Formulates own questions			
• Are passive in class			
• Engage with different concepts			
Use of ICT			
• Use ICT in the introduction			
• Relevance of pictures (linked to content, skills)			
• Use of ICT resources is relevant during the process of teaching			
• ICT Programme is relevant to content			
• Teaching approach is complements the technology or vice versa.			
• Used ICT for assessment in lesson			
OTHER INFORMATION			

Appendix 7: Analysis Questionnaire

Please answer all of the questions and if you are uncertain of or neutral about your response, you may always select "Neither Agree or Disagree".

Teacher: ………………………………………………….

	Strongly disagree	Disagree	Neither Agree or disagree	Agree	Agree strongly
TECHNOLOGICAL KNOWLEDGE					
I can use the internet					
I can use Ms Word					
I can use Ms Excel					
I can use Ms PowerPoint					
I keep up with important new technologies					
I regularly learn about new technologies					
I have the technical skills I need to use technology					
I frequently play around with technology					
CONTENT KNOWLEDGE					
I have sufficient knowledge about Social Science (Geography) / your subject					
I have various ways and strategies of developing my understanding of Social Science (Geography) / your subject					
PEDAGOGICAL KNOWLEDGE					
I can adapt my teaching style to different learners					

I can assess learners learning in multiple ways					
I can use a wide range of teaching approaches in my subject					
PEDAGOGICAL CONTENT KNOWLEDGE					
I know how to select effective teaching approaches to guide learners thinking and learning in Social Science (Geography) / my subject					
TECHNOLOGICAL PEDAGOGICAL KNOWLEDGE					
I can choose technologies that enhance the teaching approaches for a lesson					
I can choose technologies that enhance learner's learning for a lesson					
I can adapt the use of the technologies that I am learning about to different teaching activities					
I am thinking critically about how to use technology in my classroom					
TECHNOLOGY, PEDAGOGY AND CONTENT KNOWLEDGE					
I can teach lessons that appropriately combine Social Science (Geography)/my subject, technologies and teaching approaches					
I can select technologies to use in my classroom that enhance what I teach, how I teach and what					

learners learn					
I can choose technologies that enhance the content for a lesson					

Appendix 8: Ethics Statement

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS·UV
EDUCATION
OPVOEDKUNDE

Faculty of Education

16-Jul-2018

Dear **Alan Felix**

Ethics Clearance: **Integrating geography teaching and learning using information and communication technology.**

Principal Investigator: **Alan Felix**

Department: **School of Education Studies (Bloemfontein Campus)**

APPLICATION APPROVED

With reference to you application for ethical clearance with the Faculty of Education, I am pleased to inform you on behalf of the Ethics Board of the faculty that you have been granted ethical clearance for your research.

Your ethical clearance number, to be used in all correspondence is: **UFS-HSD2018/0306**

This ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension.

We request that any changes that may take place during the course of your research project be submitted to the ethics office to ensure we are kept up to date with your progress and any ethical implications that may arise.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours faithfully

Prof. MM Mokhele Makgalwa
Chairperson: Ethics Committee

Education Ethics Committee
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www.ufs.ac.za

Appendix 9: Language Editing

Mi-PA
The Professional Office Asst

Editing Services Certificate

This certifies that the article titled:

Integrating Geography Teaching and Learning Using Information and Communication Technology

Commissioned to us by:

Mr Alan A Felix

University of the Free State

Has been successfully edited for the following:

- English Language: grammar, punctuation, vocabulary enhancement, sentence structure, phrasing and spelling, paraphrasing and summarising
- Complete Alignment and Coherence
- Proofreading

Mrs Deshnee Chetty-Sherief
Editor and Transcriptionist
Mi-PA (Pty) Ltd

Date: 19 February 2021

Disclaimer: The author is free to accept or reject our changes in the document after our editing. However, it is to be noted, and **we do not bear responsibility for revisions made to the document after our edit on <19/02/2021>**

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