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Integrating Technology into Pedagogy at the Basic level of Education in Ghana

By

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**Thesis is submitted to the University of Sussex, United
Kingdom, in partial fulfilment of the requirements for the
degree of International Professional Doctor of Education**

Declaration

This thesis has not been and will not be submitted in whole or in part to another University for the award of any other degree.

Dzigbodi Ama Banini

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UNIVERSITY OF SUSSEX

DZIGBODI AMA BANINI, DOCTOR OF EDUCATION

Integrating Technology into Pedagogy at the Basic Level of Education in Ghana

Abstract

Keywords: Teacher Professional Development, Action Research, Teaching-Learning Resources, Technological, Pedagogical And Content Knowledge, Mobile Phone Camera Use, Lesson/context-related Films

International debates on technology integration in teacher education stress the potential benefits to students' learning. Realising this, the government of Ghana initiated the Basic School Computerisation Programme in 2011, distributing sixty thousand laptops from the onset to some 2,500 basic schools to improve quality teaching and learning. In the midst of this distribution, teachers generally do not really claim to be literate in basic computer skills, let alone having the ability to use the technology to teach. For example, in a survey conducted in 2012, out of 17,953 teachers, only 7,920 (44.1%) had basic computing skills and 1,686 (9.4%) had integrative skills. The 2003 national ICT4AD policy talks about rapid deployment of ICT and teacher training from primary school upwards. Nonetheless, teacher training in basic computing skills and integrative skills has not followed technology integration into pedagogy in Ghana, at least at the basic level of education. This study, therefore, attempts to address a predominant question: "How can teachers explore the use of technology as tools to improve teaching and learning?" The study used a methodological approach involving a single case study, with an element of an open-ended single-cycle action research design, collaborative in nature and embodying planning, acting, observing and reflecting, to address this question. Thus, in collaboration with five purposefully selected Social Science teachers from a public Basic School, the study applied the Technological Pedagogical And Content

Knowledge (TPACK) framework to review existing lesson plans, which in the opinion of these teachers, could have been better taught if they had used films for illustrations. In the review process, the teachers discovered that their lesson plans integrated only content knowledge and pedagogical knowledge, excluding technological knowledge. The teachers then explored using their own mobile phone cameras to take lesson/context related pictures from the school's environment. Next, they imported the pictures onto Windows Live Moviemaker software, which they accessed from Windows XP, to produce lesson/context-related films. They then used the films to support the teaching and learning of their lesson plans revised into TPACK-compliant ones.

Data collected for this study was through documentary reviews, focus group discussions, SWOT analysis, reflective journal entries, observations, individual face-to-face interviews and field notes. Data, gathered in MP3 format was transcribed into text and analysed using deductive thematic approach, set against a predetermined framework. The results revealed that some Social Science teachers lacked basic computing skills and this influenced their ability to use technology effectively in their lessons. Participants successfully reviewed and revised their traditional lesson plans to develop TPACK-compliant ones. Through action research, teachers were able to produce lesson/context-related films to support their teaching and learning, though they needed much support to achieve this. Students found the use of film-supported lessons particularly useful in developing deep understanding of their subject. The main problems faced during the training workshop were the lack of teachers' own laptops to continue working on the films at home, poor functioning of laboratory computers, intermittent power supply to use the projector for smooth presentations and the time-consuming nature related to film preparation. Nevertheless, the study revealed that given the chance and the appropriate resources, teachers were able to utilise more of their creative skills and potential for the benefit of their students. In addition, the study revealed that the use

of films and other technology-enhancing instructional methods have the potential to make teaching less teacher-centred and more participatory to encourage students to be co-constructors of knowledge.



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LIST OF ABBREVIATIONS AND ACRONYMS

ADEA	Association for the Development of Education in Africa
AESOP	Annual Educational Sector Operational Plan
AV	Audio Visual
CAS	Critical Analytical Study
CK	Content Knowledge
CRDD	Curriculum, Research and Development Division
DETYA	Department of Education, Training and Youth Affairs
DFID	Department for International Development
GDHS	Ghana Demographic Health Survey
GES	Ghana Education Service
GNA	Ghana News Agency
GeSCI	Global e-Schools and Community Initiatives
GPRS	Ghana Poverty Reduction Strategy Framework
GSS	Ghana Statistical Service
ICT	Information and Communication Technology
ICT4AD	Information and Communications Technology for Accelerated Development
IRB	Institutional Review Board
JHS	Junior Secondary School

LDCs	Less Developed Countries
MOC	Ministry of Communications,
MOE	Ministry of Education
MTT	Mobile Task Force
NCA	National Communications Authority
NaCCA	National Council for Curriculum and Assessment
NMSA	National Middle School Association
OECD	Organisation for Economic Co-operation and Development
PCK	Pedagogical Content Knowledge
PK	Pedagogical Knowledge
rLG	Rogam Link Ghana
ROCARE	Réseau Ouest et Centre-Africain Recherche en Éducation
SAMR	Substitution, Augmentation, Modification and Redefinition
STI	Science Technology and Innovation
SITE	Society for Information Technology and Teacher Education
TCK	
TK	Technological Knowledge
TLR	Teaching Learning Resources
TPK	Technological Pedagogical Knowledge
TPCK	Technological, Pedagogical Content Knowledge
TPACK	Technological, Pedagogical And Content Knowledge
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development



Chapter 1: Introduction

1.1 Background to the Study

Technology integration in teacher education has been a topical issue in international debates among a number of researchers since the Twentieth Century (Mishra and Koehler, (2006), Valiente, (2010); Earle, (2002); Wildner, (1999) and Dockstader, (1999). The debates focus on technologies as powerful tools that can transform classroom teaching and learning experiences, such as assisting teachers in making teaching much easier and much more fun (Baytak, Tarman, & Ayas, 2011). Technologies also assist teachers in creating more active and interactive pedagogies, increased motivation and updated teaching materials (Toure, 2008; Anderson, 2000). The use of technologies to support pedagogies can also result in a range of potential benefits to both teachers' professional practice and students' learning (Akyeampong, 2016; Hernández-Ramos, 2005; Wood & Malley, 1996). Becker (2000: 29) also asserts that technology succeeds as “a valuable and well-functioning tool” in classrooms where teachers have personal conviction in its use within a constructivist pedagogy. Others such as Hollow, (2009); Tchombe, Maiga, Toure, Mbangwana, Diarra & Karsenti, (2008); and ROCARE¹, (2006) argue that technologies used as tools in the teaching-learning process can be a good support for building a more effective student-centred pedagogy. Besides, Sandholtz, Ringstaff, and Dwyer, (1997), reveal that technology has the tendency of producing the appropriate instructional environments that can facilitate active participation, meet specific and varying learning needs of the students, enhance collaborative problem solving, and provide students with a dependable learning environment.

The debate has not only been about what the technology can offer teaching and learning but also about how teachers and students can use these intervening artifacts to make the most of their potential benefits (Postholm, 2007). Muir, (2001) and Maddux, Johnson,

¹ ROCARE Stands for Réseau Ouest et Centre-Africain Recherche en Éducation

& Willis, (2001), affirm that technological changes make available new and better ways of teaching, as it helps empower students to do work they could not previously do easily.

Besides that, researchers like Oliver and Omari (1999), and Williams (1999) point out that technologies used appropriately can stimulate the development of higher cognitive skills in the learner and can give support for new instructional approaches. Apart from that, technologies and ICTs in general deepen learning and contribute to the acquisition of essential skills - mostly 21st-century skills (Tchombe, et al. 2008; Mayer and Gallini 1990). Students need these skills for life-long learning and for effective functioning in the world of work (Akyeampong, 2016; Boakye and Banini, 2008).

This notwithstanding, some critics, (Higgins, 2008), think that there is not a simple message in such evidence that ICT will make a difference simply by being used. Also, some researchers like Koehler and Mishra, (2005); Wagner, Day, James, Kozma, Miller & Unwin, (2005); and Ertmer, Conklin, Lewandowski, Osika, Selo, & Wignall, (2003), express the reservations, that when there is mere access to technology, it does not facilitate learning. Rather, it is necessary to complement a quality access with an innovative use of the technology. Thus, even though technology may be necessary, it is not a sufficient condition for a successful integration (Valiente, 2010). Nussbaum, (2012), argues further that without minimal training of the teachers, such programmes cannot be successful.

Furthermore, Gregoire, Bracewell & Lafarrière, (1996) explain that there could also be a significant potential for resources to be wasted if they are deployed to an environment, which is either not feasible or used ineffectively at a place where there is lack of sustained commitment on the part of stakeholders.

Indeed, in the context of its potential benefits to students' learning and lifelong learning skills development, technology integration into education has been receiving a lot of

attention in many policy-making contexts across the globe over recent years (Hew and Brush, 2006; UNESCO, 2004; DETYA, 2001; OECD, 1997).

From the early 1990s, stakeholders in education in Ghana have been concerned about how teachers and students use computers in schools and how their use assists learning (Boakye & Banini, 2008: 2). The government of Ghana decided to develop the National ICT for Accelerated Development Policy, dubbed the ICT4AD, in 2003 (Ministry of Communications, (MOC) 2003). This was because it realised that through the promotion of Science Technology and Innovation (STI) and integration of ICT across the various sectors of the economy, it can also engage in the general global technological competitiveness towards building economic growth and improving quality education (MOC, 2003).

The policy, which characterises an integrated ICT-led socio-economic Development Plan and Framework for Ghana (MOC, 2003: 6), was developed through a nation-wide consultative process that sourced input from the public and private sectors, as well as civil society. The policy statement takes into account the aspirations and provisions of key socio-economic development framework documents, including the Vision 2020 Socio-Economic Development Framework; the Ghana Poverty Reduction Strategy Framework (GPRS), 2002 - 2004, and the Coordinated Programme for Economic and Social Development of Ghana (2003–2012), in (MOC, 2003:6). Through the enactment of the ICT4AD policy, the government is “committed to a comprehensive programme of rapid deployment, utilisation and exploitation of ICTs within the educational system from primary school upwards” (MOC) 2003:37).

Based on the ICT4AD policy, the Ministry of Education also developed the ICT for Education (ICT4E) Policy in 2008, to guide the mainstreaming of ICT within the various spheres of education. The ICT4E policy thus adapted seven of the ICT4AD policy goals and the first two of such goals relevant to this study are:

a) Facilitating the deployment, utilisation and exploitation within the educational system to improve on educational access and delivery to support teaching and learning from the primary level upwards.

b) Modernising the educational system to improve the quality of education and training at all levels of the educational system and expanding access to education, training and research resources and facilities (MOE, 2008:13).

The seven policy goals of the ICT4E have been adapted and expanded to develop a number of concrete guidelines, objectives and strategies, grouped into seven thematic areas and my study is consistent with Thematic Area 2, which is Capacity Building (MOE, 2008: 14).

The study's focus on capacity building of teachers in technology integration into pedagogy to improve quality teaching and learning at the Basic level of education stems from firstly, that teachers occupy a central role in implementing educational transformations (Jamil, 2014). Yoon, Duncan, Lee, Scarloss, Shapley, (2007), affirm the influence of teacher competence and proficiency on student achievement. Secondly, quality education at the basic level of education forms the foundation on which other levels of education are mounted or built (Anamuah-Mensah, Effah, Sarkodie, (2002). We see the importance placed on primary or basic education by some governments like the East Asian "Tigers", whose investment spending on secondary and then higher education follow behind investment in primary education (Green, Little, Kamat, Oketch, & Vickers, (2007). Thirdly, Robertson, Novelli, Dale, Tikly, Dachi, & Alphonse, (2007) point out that between the 1980s and the 1990s, the World Bank continued to focus on five themes, Basic Education being one of such themes, which is the level of education of interest in this study. Other donor agencies such as UNICEF, USAID and DFID support Basic Education programmes technically and financially, through the MOE and the GES. Thus, such global considerations support the fourth reason for the selection of basic education for this study.

1.2 Technology Integration in Education in Ghana

Technology integration into pedagogy in many educational systems, especially in developing countries, like Ghana, is still at the infant stage (Fagerberg & Srholec, 2008; ERNWACA, 2006). Besides, a close examination of information on some listed ICT initiatives in Ghana by Mangesi (2007: 6), (Appendix A) suggests that most of the initiatives seem to focus more on technology deployment in one form or the other. Such deployment has been into the educational institutions or into education. However, there does not seem to be any clear policy or focus, in my view, on any form of ICT training offered to the teachers to enable them to use the technology as a tool to teach curriculum content across subjects. Likewise, the ICT initiatives (in Appendix B), that the MOE embarked on, in line with its own ICT4E policy, the National Education Sector Plan (ESP, 2010 - 2020), and the Education Sector Performance Report of May 2011, were majorly deployment of ICT equipment and other hardware to institutions and furnishing of laboratories. Thus, although researchers like Cuban (2001), Mills & Tincher (2003), Pierce, (1998) and Lawless and Pellegrino (2007) assert that in-service training in the use of new technologies for teaching and learning is an essential channel for teachers to develop effective instruction. These researchers have, however observed that technology has not been sufficiently incorporated into schoolwork and has yet to be properly articulated with other classroom teaching activities.

The integrative skills training courses that GeSCI embarked on in Ghana were for secondary school teachers, except for the two-weeks training given to some teachers at the basic school level in 2008 for the implementation of the 1:1 initiated computer projects (Banini, 2012). Where there was even a mention of training of teachers, the programme appears to be silent on the content of training the teachers received.

Apart from this, a number of other research studies conducted in Ghana on ICT integration into teaching and learning, also point out that teachers generally cannot really claim to be computer literate, let alone have the ability to use technology as a tool to

teach (Agyei, 2012; Banini, 2012; GeSCI, 2012; ERNWACA, 2008; Boakye & Banini, 2008). These studies revealed that the majority of teachers, who are to teach students, do not only lack the training, but also access and accessibility to the appropriate technology and other classroom resources. Agyei, (2012), points out that both in-service and pre-service teachers in Ghana have limited or no knowledge about ICT integrative skills, little or no use of ICT for instruction and therefore use the lecture approach mainly as the dominant classroom instruction technique.

Nevertheless, with this situation on the ground, the government of Ghana in recent times, initiated a number of interventions in fulfilment of its ICT policies for the Education Sector by directing efforts at 'using ICTs to facilitate education and ... to promote e-learning and education, as well as, life-long learning within the population at large' (MOES, 2003: 37). There was the development and restructuring of the relevant ICT curricula for all pre-tertiary levels of the educational system, among the policy strategies. Amenyedzi, Larrey & Dzomeku, (2011: 153), however have observed that "The commitment of government to the provision of infrastructure for ICT policy implementation has been minimal". Essentially lacking also was that the Curriculum Research and Development Division (CRDD) of the Ghana Education Service (GES) has not integrated technology into the ICT curricula content for schools. It has also not included teacher professional development in integrative skills into the programme, even though it was running the programme for basic schools. Timperley, Wilson, Barrar and Fung, (2007), explained professional development as processes and activities planned to enrich the professional knowledge, skills and attitudes of educators so that they might, in turn, improve the learning of the students. The ICT policy implementation programme failed in this respect because it did not include the essential component of professional development of teachers, particularly those at the Basic level to sustain the programme. It seems the most significant development in the implementation of Ghana's 2007 educational reform - that is the revision of the national curriculum to include ICT at the pre-tertiary levels of

education as a subject - appeared to be cosmetic because the process had not planned for teacher training. The CRDD of the GES merely recommended the use of ICT and the internet at various sections of all the subject syllabuses to draw teachers' attention to the need to apply those technology tools and skills to enhance their teaching and learning activities. At the same time, the CRDD was aware that majority of teachers did not have the knowhow to apply the tools and skills to teaching. This situation has been confirmed by Westbrook, Durrani, Brown, Orr, Pryor, Boddy, Salvi, (2013), who identifying with the views of Dembélé and Lefoka (2007) and the World Bank (2008) maintained that most often, when curriculum reforms are designed and implemented, they are not done side by side with reforms in initial teacher education and continuing professional development.

The move by the government through the Ministry of Education (MOE) to introduce the Basic School Computerisation Programme in 2011 was the distribution of an initial sixty thousand rogam Link Ghana (rLG) locally assembled laptops to some 2,500 Basic Schools for teachers to use to improve quality teaching and learning. The programme, however, did not seem to consider, a comprehensive nationwide training for teachers in basic computing and integrative skills (Banini, 2012). In a collaborative effort in 2012/13, the MOE and the GES teamed up with the Global e-Schools and Community Initiatives (GeSCI), a United Nations (UN) task force, USAID and Vodafone to train some Secondary School Mathematics, English Language and Science (MES) teachers as national trainers in integrative skills. These national trainers also, in turn, trained over 500 secondary school Mathematics, English Language and Science (MES) teachers nationwide. The programme however, did not include Basic schoolteachers, let alone consider the needs of Social science teachers. Thus, the focus on Social Science in this study has been occasioned by the extensive work already done in training a number of Secondary school Mathematics, Science and English teachers in integrative skills (Agyei and Voogt, 2012; GeSCI, 2012). Relatively very little or no similar skills training has been

organised for Social science teachers at the basic school level. Apart from that, these Social science subjects are equally important, as they do not only form part of the core subjects, but are also compulsory subjects for all students to study at various levels of education in Ghana.

Furthermore, Citizenship education, which dovetails into Social studies at the JHS level,

is a subject that aims at producing competent, reflective, concerned and participatory citizens who will contribute to the development of the communities and country It focuses on problems/challenges of human survival in Ghana. The subject exposes pupils to the persistent contemporary issues hindering the development of the nation and the desired attitudes, values, and skills needed to solve these problems (MOE, 2007: ii).

The importance placed on these social science subjects suggests that it is necessary to teach social science subjects practically, using technology integrative skills. This is likely to boost learners' understanding of difficult-to-teach concepts and topics. Heafner, (2004) confirms this that when teachers use technology to teach social studies, students become motivated, engaged in the learning process and improve their self-worth. It can be deduced from this that social science teachers need integrative skills training.

Apart from that, researchers and educators like Okobia, (2012), and Whitworth & Berson, (2003) have argued that in order to achieve the basic objectives of teaching social studies, teachers should adopt and integrate appropriate technology to enhance student-centred approaches to teaching and learning. Thus, "without teachers who can integrate technology, students' exposure to technology remains limited and inequitable" (Gorder, 2008: 65). Essentially, a number of researchers like Lewin and Stuart, (2003), Coultas and Lewin, (2002) and Fulton, (1997), have stressed the need to link curriculum to teacher education and pedagogy. Similar views, which I also support, have been shared by Valiente, (2010), Guzman & Nussbaum, (2009), Mishra and Koehler (2006), Harris, (2005), Toledo, (2005) and Wildner, (2005) that technology integration should incorporate professional development and curriculum content restructuring in order to satisfy the needs and preferences of students.

Therefore, excluding Basic School teachers who teach these subjects from the integrative skills training was thus denying them of the potential benefits they and eventually their students would derive from technology integration.

From the foregoing realisations, I take the stance that teacher training in integrative skills in particular needs to occupy the discussion space more at the Basic school level. This is to bring practice in line with the government policy of the Basic School Computerisation Programme - a move towards improving the quality of education in Ghana.

1.3 Deciding on the Nature of the Study

A number of personal factors influenced the decision to engage in this study. Experiences I have gained in the subject over the years since 2003, was one reason. In that year, I participated with other nominees from West and Central Africa in a 3-year transnational-multiple case study. The study was on Integration of ICT into Education in West and Central Africa. It was during this period that I developed the interest in this area of knowledge, as the findings in the field pointed to the merits of using technology as a tool for teaching and learning. Apart from that, I also had the opportunity to participate in a week's workshop at the University of Education, Winneba, which exposed me to various ways in which teachers could integrate ICT into pedagogy to enhance student learning at the pre-tertiary level of education. It was from this workshop that I developed further interest in learning more about technology integration into pedagogy. As a professional teacher, researcher, teacher trainer and a curriculum developer, this left an indelible mark on me to develop this way of teaching-learning in the Ghanaian classrooms, especially at the basic level of education – the basic level, because that level, as stated earlier in the introduction, forms the building block for our education system. In later years, between 2007 and 2009, I had a reinforcement of this knowledge and skills at the Master degree level in Computer Education and Technology at Ohio University, where I acquired the knowledge, skills and competencies in Computer-based

Instruction, Visual Literacy and Assessment, (among other courses) for pre-tertiary classrooms. This later strongly influenced my quest to draw on these experiences to undertake this study. I support this quest with two assertions – first, that ‘personal experiences may provide motive and opportunity for research’ (Hamersley and Atkinson, 1983, p.32) in Fean, (2012), and second, that ‘... the subject of analysis in social research is dictated by the interests of the investigator, and therefore, influenced by the values held’ (Weber, 1949).

1.4 Challenges in the implementation of ICT in Education

The implementation of ICT in Education Programmes in Ghana, have a number of identified challenges associated with it (MOE, 2008); and even though there seems to be a concentration of such initiatives mostly at the secondary school level, the challenges likewise apply to the public Basic Schools, where there have been significant ICT deployments. The 1:1 initiative introduced into two public Basic Schools on a pilot basis in 2008 and the ongoing Basic Schools Computerisation Programme, which began in 2011, are two key examples that witnessed ICT deployments and the associated problems in the country.

The challenges identified by the Ministry of Education include:

- Poor selection of schools for ICT programmes without the involvement of GES / MOE, resulting in duplication of initiatives and in some schools having several parallel initiatives while others (especially those in the remote rural towns) having none.
- Lack of policy direction for the integration of ICT in education at school, district and national levels,
- Heavy dependency on external funds, with most initiatives stopping after depletion of initial funding.
- “Dumping” of obsolete and inappropriate equipment as "support" for the initiatives.

- Low levels of ownership, including poor leadership, at the level of the schools, due to external motivations, and low levels of understanding on the part of recipients about the potential of ICT in education.
- Lack of trained ICT personnel, including teachers; financial support and technical staff at the GES. Supporting the initiatives has become difficult because of having numbers far below what is required. To make matters worse, there has not been efforts put in place, after the initial training, to continue with future training. Thus, there are very little opportunities for professional development in basic computing and integrative skills.
- Lack of ICT integration courses in Teacher Education Programmes to train prospective teachers.
- Inadequate or absence of infrastructure (physical, power and network) to facilitate communication, and for the efficient running of initiatives.
- Teacher attitude – phobia and resistance to change for fear of the collapse of power – i.e. teacher anxiety over being replaced by technology or losing their authority in the classroom as the learning process becomes more learner-centred. This is an acknowledged barrier to ICT adoption, which can pose a hindrance to technology integration (Canuel, 2009).
- The ability of the teacher and student to access and evaluate the right content.
- Security for equipment in some cases is not tight enough, leading to burglary, as in the case of one of the 1:1 initiative ICT laboratories established in 2008 (Banini, 2012).

Other challenges making implementation inefficient include the intermittent supply of electricity or the lack of it, overcrowded classrooms, and the high cost of bandwidth and Internet services or the lack of connectivity.

1.5 Rationale of the Study and Research Questions

Several research evidences are there to suggest that the quality of teaching has a critical effect on student learning and achievement (Blömeke, Olsen, & Suhl, 2016; Leask & Younie, 2013; Hattie, 2009; Darling-Hammond, 2000; and Wright, Horn, & Sanders, 1997). The current global relevance and influential role that technology could play in education to improve pedagogical delivery in educational institutions informed my choice of this topic for study; more so, as computer-assisted teaching and learning have come

to occupy an influential role in schools across the world for more than two decades (Hardman, 2005: 1). Studies by McLoughlin and Oliver, (1999), Hollow, (2009) and several other research findings suggest that the computer has the ability to transform pedagogical practices in classrooms. However, Hardman (2005: 2) points out that:

there is a relative dearth of research regarding how the computer comes to transform pedagogy, especially in developing countries, (Ghana not excluded), where access to this technology has only recently become available to students who are, in many cases, educationally and economically disadvantaged.

The study attempts to address this gap. The study thus, explores how public Basic School Social Science teachers can use the mobile phone camera (a hardware device) in conjunction with the computer's Windows Live Movie maker (a software device) as technologies, to produce lesson/context-related films, to use as Teaching-Learning Resources (TLRs) to support their teaching and learning activities.

Furthermore, my choice of this area of study is consistent with my background experiences and interest that I have stated earlier in section 1.2 of this chapter.

In addition to these, I had done a Critical Analytical Study (CAS), in the earlier part of the EdD course on this subject, which revealed a trend. That is most of the studies conducted on emerging technology integration practices in the developing world, in Africa are rather in the form of desk reviews (Farrell & Isaacs, 2007; Mangesi, 2007; Tusubira, Butcher, Adam, and Sibthorpe, 2011). In some cases, even mixed methods are employed using desk reviews supported by questionnaires and interviews of selected experts and stakeholders in telephone conversations in country case studies and online engagements. Farrell & Isaacs, (2007), explain that since the data collected in such surveys are not primary data, there is the likelihood of glossing over important information. They assert that one would hardly find any research studies conducted on behalf of multinational donors, investigating classroom pedagogical practices. This is why this study aimed to explore pedagogical practices in technology integration in the milieu of a school's classroom context.

Apart from these reasons, the findings from a study conducted by the Ministry of Education (2009) in Ghana and cited in Agyei, (2012) revealed the importance of the need for teachers' professional development in integrative skills, in particular. The study revealed that even though 44.1 percent of 17,953 classroom teachers interviewed said they had basic computing skills, only 9.4 percent of that number said they had ICT integration skills. It makes sense to build the capacity of teachers to enable them to come up with a strategy or pedagogy to make technology, like any other tool, work in their teaching-learning activities. Some basic and secondary school teachers interviewed in another survey (ERNWACA, 2006) have reported this position.

Besides, the Basic School Computerisation Programme has deployed several thousands of laptop computers to Basic Schools. Teachers are supposed to use these computers to enhance their teaching-learning activities. Apart from the 60,000 laptop computers distributed in 2011, the programme had further distributed another set of 50,000 laptop computers in 2014 to other Basic schools (MOE, 2014), but with minimal training for teachers in integrative skills. Even though the MOE requested the rLG staff to train teachers nationwide, the training was only in basic computing skills. Besides, the rLG trainers themselves were not teachers and so had no pedagogic skills to impart even the basic ICT knowledge they were so conversant with to classroom professional teachers they were training.

It was evident that teachers who had these laptop computers and even teachers in schools with computer laboratories need the ICT integrative skills professional development opportunities beyond just receiving training in basic computing skills. This is to enable the teachers to learn to repurpose their computers from mere typewriting tools to exploring and creating new knowledge and products. Teachers can then support the creation of these products with the use of their own mobile phone cameras in conjunction with Windows Live Moviemaker and sharing them with their students. It has been advocated that applying technology effectively in classrooms can result in teachers

developing a more learner-centred approach to pedagogy (ROCARE, 2006), leading to preparing students to be more effective citizens (John & Sutherland, 2004). The students would develop 21st Century skills such as critical thinking and problem-solving skills necessary for deeper understanding of their subject (Akyeampong, 2016; Moskovich and Sharf, 2012).

Apart from that, I capitalised on the use of the mobile phone camera instead of a digital camera as the technology for picture taking for the study, firstly because it is very handy and secondly because it is commonly used by both adults (teachers in this case) and learners (pupils and students). The portability of the device suggests that it is not only mobile, but also individuals use them. This makes learning to be situated within a real-world setting and affords context sensitivity (Cheon, Lee, Crooks, & Song, (2012).

Teachers use mobile phones mostly for making and receiving calls, playing games, messaging text and making conversations (ERNWACA, 2008). However, if teachers can use their phone cameras to take lesson/context-related pictures/videos, they will not need to spend any extra money buying digital cameras to take the same pictures. The former is cheaper and more affordable and all teachers likely own at least one.

Besides, casual conversations I have had with a number of Social science teachers during my monitoring and supervisory exercises to schools, suggest that these teachers have never explored the possibility of using their mobile phone cameras to develop lesson-related films to use as TLRs to support their pedagogic activities. They would rather complain that they do not have textbooks or other TLRs to support their such activities. Therefore, I asked myself, "Why should Social science teachers have mobile phones (with built-in cameras) very handy and commonly used for calls, texting and games (ERNWACA, 2008) and would not use them to prepare lesson/context-related films to support their teaching-learning activities?" I find this question relevant as researchers like Whitworth and Berson (2003), Holmes, Russell, and Movitz, (2007) and Russell, (2004) argue that to achieve the basic objectives of social studies teaching,

teachers should adopt and integrate appropriate technology to facilitate student-centred pedagogy.

Apart from that, despite a ban on the use of mobile phones in schools, I still had the confidence to use it (as a digital hardware) for this study. I did not see myself defying the ban or putting my researched school in trouble. This was because when I applied to the gatekeepers at the GES Headquarters, they readily granted permission to me to undertake the study (See permission letter in Appendix K).

In essence, I am of the view that any likely potential benefits emerging from the study should be able to influence the MOE and GES to reconsider lifting the ban on mobile phone use among teachers in particular, and students. Apart from that, it is my expectation that the outcome of the study would cause the MOE and GES to initiate measures that would redirect mobile phone use as a learning tool to promote constructivist pedagogies among teachers and increase engagement and participation in students' learning.

These considerations influenced me to explore the possibility of sharing with Social science teachers and learning with and from them, how we can use the cameras on their mobile phones to contribute to students' learning. My idea was to use this opportunity, in collaboration with public Basic school Social studies teachers, to develop new and supportive pedagogies that will subsequently encourage independent creativity among them and their students (Jackson, 2009).

That is not all. Such an exercise will enable both teachers and students to move from total reliance on textbooks, which are in most cases inadequate in quantity, picture quality and relevance (Essuman, & Osei-Poku, 2015), to the practice of creating their own original TLRs, which will be lesson/context related (Jackson, 2009). The use of such TLRs is more likely to make lessons more participatory (Willmot, Bramhall, & Radley, 2012; Toure, 2008; Linn, 1998).

Furthermore, if teachers in Ghana can collaborate with their students to use mobile phone cameras to prepare their lesson/context-related films to use as TLRs, it is likely to have some positive impact on teaching and learning. Firstly, both teacher and student will regard and use their phones as learning tools. Secondly, even before the teacher starts delivering the lesson, the students would have had a high degree of ownership of the lesson, since they had contributed to preparing their own TLRs (the films). Such lessons are more likely to be student-centred, leading to active participation and activity/problem/project-based. The learner's interest, motivation and confidence level become higher (Gromik, 2012; Hussain, Rahim and Ali, 2007; Leach, 2004). Alongside these, both teacher and student will more likely develop 21st Century skills such as critical thinking, problem solving, collaboration and communication skills. Teachers will no longer need to engage in preparing teacher-made notes for students to copy, leading to low cognitive attainments, such as rote learning. Teachers and their students will more likely reach high levels of cognitive attainment, such as comprehension, application, analysis, evaluation and creation (Kurt, 2010).

In addition, student learning will become more practical and fun (Chang, 2016; Baytak, Tarman, & Ayas, 2011) and cease to be 'pen and paper'-based and/or examination oriented. It is my view that when teachers are able to integrate technology into their teaching-learning practices, they will also involve their learners to move along with them. It is important to point out that one cannot talk about improving teachers without mentioning their pedagogical effects on the learners who interact with them. Thus, that collaboration is necessary here and that is why I echo the voice of Mitra (2010), who advocates that children need encouragement to use new technologies of their time and at their disposal as this could help them organise their learning activities.

Lastly, from my own professional point of view, I think, there is the need to generate new knowledge that can be useful to education delivery at the foundation level of education in Ghana. Besides, using technology as a tool for teaching the curriculum content in

Social Science subjects to enhance pedagogic delivery and improve students' active participation in their lessons, requires sharing with teachers how to use these technologies in creative ways to support their traditional teaching-learning methods.

The foregoing are tangible reasons, in my view, for carrying out this study. These reasons inspired my ultimate desire to acquire new knowledge and gain a better understanding of the real phenomenon. This phenomenon is using the mobile phone camera, in conjunction with Windows Live Moviemaker (as the technology), to produce films to integrate into teaching and learning activities in the natural milieu of a typical public basic level school classroom in Ghana.

The following research questions that guided the study form an analytical framework for understanding the critical issues that emerged from the study. A single case study approach was adopted in the research design of the study, incorporating an element of an action research. It involved teacher professional development, exploring and creating knowledge and product, (in the form of films), and sharing in practice, at the basic school level.

I, therefore, confined the scope of the research to the following questions.

1. To what extent are basic schoolteachers using technology as a tool in classroom teaching and learning?
2. How can teachers explore the use of technology as tools to improve the quality of teaching and learning?
3. What are the teachers' reflections and experiences in the use of the mobile phone cameras and other new technologies, using the TPACK as a process?
4. Which challenges do the teachers face in the implementation process?
5. What are the teachers' views on the impact of technology use on students' learning?

The findings are intended to inform and direct national policies on how the integration of technology into teaching and learning could lead to maximum benefits to basic school pupils/students in Ghana (MOES, 2008) with similar characteristics.

1.6 Organisation of the Thesis

Chapter 1 introduces and sets the scene of the study. It commences with the relevance of technology integration to teaching and learning, its implementation in Ghana and some challenges faced in the implementation. It continues with reasons for the choice of this area of study, the purpose and rationale of the study and the research questions, which guided the study. Chapter 2 reviews literature on technology integration and examines the definitions of some related concepts to the study and the role of contexts in shaping technology integration in pedagogy. The chapter also examines some technological and pedagogical models and concentrates on the Technological, Pedagogical and Content Knowledge (TPACK), which forms the main theoretical framework for this study. The chapter further discusses the potential of films/movies to teaching social science, creativity in technology use and the potential contribution of mobile camera use as a technology tool in teacher practice. It concludes by examining the most commonly used phone activity in five African countries, including Ghana to justify why the mobile phone should be promoted as a learning tool in schools. Chapter 3 examines the research methodology and methods adopted in the study. It discusses the study's epistemological and ontological positions, the research approach, the research design (consisting of a single case study with an element of a single cycle action research), the research strategies used. The chapter also examines the data collection methods, ethical considerations, data analysis procedures, as well as trustworthiness of data and reflexivity. Chapter 4 examines some research activities as part of the action research. It demonstrates how the core part of the action research was conducted and the findings formed the discussions that addressed the research questions. The chapter also examined the use of technology (the lesson/context related films the teachers produced) as tools in teachers' classroom professional practices. Part of this chapter also discussed teachers' reflections on the use of mobile phone camera and other new technologies such as Windows Moviemaker, using the TPACK as a process. It also examined the

challenges teachers faced in the implementation process and their views on their students' reactions to lesson/context film-based lessons. The chapter ends with the researcher's reflections and field notes from the lesson observations. Chapter 5 summarises the findings of the study, and examines the policy implications for practice, limitations of the study, contributions to knowledge, major conclusions and recommendations.



Chapter 2: Literature Review

2.1 Introduction

This chapter reviews literature related to technology use as tools for teaching and learning. It begins by reviewing the operational definitions of some terms used in the study, such as 'Technology', 'Technology Integration' and 'Pedagogy'. It proceeds to examine some technological and pedagogical conceptual models and explains why the study specifically applied the Technological Pedagogical And Content Knowledge (TPACK) framework / model constructed by Mishra and Koehler (2006), as the theoretical underpinning for the study. Other relevant issues reviewed in this chapter include the potential of technology use as a tool for teaching Social Science, (Citizenship Education and Social Studies), and the potential contribution of the mobile phone camera as a technology tool in teacher practice.

2.2 Definition of Concepts

2.2.1 Technology

Regarding the definition of the term 'technology', researchers like Bijker et al (1987) have argued that there is no point wasting time and energy to search for a specific definition for the term, technology. They maintain that since the term has no particular definition, it will be fruitless to search for a particular one. Nonetheless, there has been a number of attempts at defining the term. Earle (2002: 5), for instance, observes that the word 'technology' as defined in the *Webster's New Collegiate Dictionary* seems to take a sociological perspective as "... the totality of the means employed to provide objects necessary for human sustenance and comfort and a technical method of achieving a practical purpose". He explains that the prevailing public definition based on current usage is "technology equals machinery" (Earle, 2002: 2). He further maintains that viewing technology the same way as machinery implies that the focus on machinery, at the expense of process, is a limited one. This is because such a focus ignores the true sense of technology as "the systematic application of scientific and other organized

knowledge to practical tasks” (Galbraith, 1967: 12). In this sense, Earle further explains that technology becomes a problem-solving process, which uses human and other resources to seek solutions to human problems. I find this definition more like technology integration rather than a definition of technology because it brings in the issues of process. Examples of technology from literature would rather, in my view, comprise computers (e.g. laptops with Internet connectivity), software applications, web materials in the form of Text, Photos / Pictures), mobile phones, cameras, projectors, printers, interactive CD ROMs, AV equipment, pencils and blackboards. George Lucas Educational Foundation, (2007), also gives a similar definition as comprising computers, mobile devices like the smartphones and tablets, digital cameras, social media platforms and networks, software applications, the Internet, and so on.

Mishra and Koehler (2006: 1023) explain that technology refers to “digital computers and computer software, artifacts and mechanisms that are new and not yet a part of the mainstream”. In their work in 2009, they did a classification that ‘technology’ applies to both analog and digital, as well as new and old, technologies. They explain further that technology in current literature refers to newer and digital technologies, which have some intrinsic properties that make applying them in straightforward ways difficult. To make these two distinctions on what technology entails clearer, I summarised the two classifications and their intrinsic properties as identified by Koehler and Mishra, (2009), in Table 2.1. The information does not only categorise the technologies into types and their intrinsic qualities, but also reveals that the newer digital technologies, by virtue of their intrinsic properties, “can present challenges to teachers who are struggling to use more technology in their teaching” (Koehler and Mishra, 2009: 61).

Table 2.1: Classification of Technologies by Type and Intrinsic Qualities

Traditional Pedagogical Technology	Newer Digital Technologies
Examples: Pencils, Chalkboards, Microscope, Pendulums	Examples: Computers, Handheld devices, (mobile phones, digital cameras, iPads and tablets) and software applications.
Characteristics	Characteristics and Challenges
Specificity – usable in specific ways. E.g., Pencil is for writing as microscope is for viewing small objects.	Protean – usable in many different ways. (Papert, 1980). E.g. Computers have several uses – for typing, drawing, designing, movie-making etc.
Stability – Pencils, pendulums, and chalkboards have not changed much over time.	Instability – Digital technologies are rapidly changing and therefore less stable.
Transparency of function – the inner workings of the pencil or the pendulum are simple and directly related to their function. (Simon, 1969).	Opaque – It is not easy for users to understand directly the inner workings (Turkle, 1995). E.g., functions of software simulations are more opaque to teachers and offer less stability than more traditional technologies.
Transparency of Perception – they become commonplace tools, and in most cases, they no longer act as technologies (Bruce & Hogan, 1998).	Opaque perception – digital technologies are, most of the time, not straightforward tools to use as the inner workings are not clear to users (Turkle, 1995). As a result, it becomes more complex to use by teachers who are struggling to use more technology to teach.
Source: Information from Mishra and Koehler (2009). http://www.citejournal.org/volume-9/issue and summarised in table by author.	

It is worth noting that the technologies this study focuses on for the intervention are digital in nature. They include hardware devices comprising the mobile phone camera (a handheld device) and the computer, and Windows Live Moviemaker (on XP computers) which is a software application.

2.2.2 Technology Integration:

The fundamental challenge with the issues around the definition of technology integration is that there is no standard definition (Bebell, Russell and O'Dwyer, 2004). It is a relative concept, which various scholars attempt to define. For some, technology integration is

understood and examined in terms of types of teachers' computer use in the classrooms: low level (e.g. students doing internet searches) or high level (e.g. students doing multimedia presentations, collecting and interpreting data for projects) (Cuban, Kirkpatrick & Peck, (2001). George Lucas Educational Foundation (2007), defines technology integration as when students are not only using technology daily, but have contact with a variety of tools that fit into the task at hand and afford them the chance to build a deeper understanding of what they are learning (i.e. content.

For researchers like Hernández-Ramos (2005), technology integration should be defined not simply as a question of access, but rather as a tool for improving educators' professional efficiency and also promoting student learning. Others such as Dockstader, (1999) argue that technology integration is not putting computers in the classroom without teacher training. She explains further that it is not about providing software applications like electronic encyclopaedia, spreadsheet, and databases without a purpose; or using pre-packaged programmes that are often unrelated activities, clustered around a particular topic, which address fewer higher concepts or goals. It is also not teacher-centred programmes, which do not fit into a content-area curriculum. Dockstader, (1999), stresses that technology integration is rather using computers as a tool effectively and efficiently in the general content areas to allow students to learn how to apply computer skills in a meaningful manner that enhances their learning. She asserts that technology integration enhances student learning through the flexible, purposeful, and creative use of computers, with the curriculum driving technology use and not technology driving the curriculum. Students learn through computers and not about them. Thus, when it is integrated, it is defined not by the amount or type of technology used, (Mishra, Dirkin and Cavanaugh, 2007), but by when, how, and why it is used to transform teaching practices (Valiente, 2010).

Despite a number of varied views on technology integration, there is the need to understand the term 'technology integration' better, if we review other definitions culled

from the writings of scholars in the field (Earle, 2002). Shelly, Cashman, Gunther & Gunther, (2006), assert that technology integration is curriculum integration; and it involves the use of technology such as the hardware and software to enhance learning of subject-related curriculum. Brooks-Young (2002) also explains that technology integration is an instructional program, which weaves technology use throughout the curriculum and at the same time focuses on the learning objectives of the student. It is thus seen not merely as getting the tools into the classroom but making its use in teaching the curriculum content seamless in such a way that learners become more involved and take control of their own learning (George Lucas Educational Foundation (2007).

Wicomico County Board of Education (WCBOE, 2010), shares similar views on technology integration, but adds that it is the incorporation of technology tools to teach content, using effective instructional practices.

The International Society for Technology in Education (ISTE) regards technology integration as the use of tools in general content areas in education to enable students to apply computer and technology skills to learning and solving problems. Harris, Grandgenett & Hofer (2010), assert that technology needs to be made an integral part of how the classroom functions and as accessible as all other classroom tools. In sum, the ISTE views technology integration as the infusion of technology as a tool in curriculum to enhance the learning in a content area or multidisciplinary setting.

Additionally, Christen, (2009), points out the need to integrate networking with technology and pedagogy in order to bring about transformation. On the contrary, Pulkkinen, (2009) believes that technology integration employs web-based learning to reach people who cannot have access to school or an educational institution. E-book browse, (2011), views technology integration as having the technical and cognitive proficiency to access appropriately, to use, develop, create and communicate information using technological tools. In technology integration, learners demonstrate

this capability by purposefully applying technology to solve problems, analyse and exchange information, develop ideas, create models and control devices. Mishra & Koehler (2006), explain that integrating technology to develop good content for teaching and learning requires a thoughtful interweaving of all three key sources of knowledge: technology, pedagogy, and content.

All these definitions seem to suggest that technology integration has to do with technology woven into curriculum content for teachers to use more creative and innovative pedagogies, in order to facilitate students' engagement in their learning. In other words, for technology integration to take place there must be a seamless blend of a suitable and relevant technology with the curriculum content to be taught, matched planned learning activities and the skills for teaching that content with the technology (Harris and Hofer, 2011). By inference, teachers become central to the integral part of the integration process.

I share these views expressed on technology integration and believe that technology integration is the seamless use of technology tools to deliver curriculum content in a coordinated whole to meet the goals of learners (Mishra and Koehler, 2006; Harris and Hofer, 2009). Thus, technology integration becomes an integral part of how the classroom functions – as accessible as all other classroom tools (Harris, et al., 2010). When it is integrated, it is defined not by the amount or type of technology used, (Mishra, Dirkin and Cavanaugh, 2007), but by when, how and why (Valiente, 2010) it is used to transform teaching practices. The expectation is therefore on teachers to repurpose the technology they use to explore its innovative uses to create and share with others (Mishra and Koehler (2011). Besides this, as spelt out in the 778 Act of Parliament of the Republic of Ghana, our educational system is supposed to “produce well-balanced individuals, with the requisite knowledge, skills, values, aptitudes and attitudes to become functional and productive citizens for the total development ...” (Republic of Ghana, 2008: 3). To be able to achieve this goal, I hold the strong view that classroom teachers in this digital

age, especially those in public basic schools, must be able to innovate new and creative pedagogic techniques (Becker, Ravitz & Wong, 1999). This would most likely enable their students also to acquire new knowledge and develop skills such as critical thinking and problem-solving skills that would make them become functional and productive citizens. The students are also more likely to develop, interpret and analyse new information effectively in order for them to fit into the fast changing technological and globalised world (Lewin and Dunne, 2000; OECD, 2010). It is for this reason that I am of the opinion that the rapid pace of development in society due to the impact of globalisation, and the new 'information age' require that teachers be equipped with diverse skills that they can apply in the classrooms to remain competitive globally. This implies that there should be a transformation of classes into creative workshops, which will ultimately support learning.

2.2.3 Pedagogy

The root of the word 'Pedagogy', is traced from French and Latin adaptations of the Greek word [παις or παιδ (boy) + αγωγος (leader)], which literally means a man having oversight of a child, or an attendant leading a boy to school (Watkins & Mortimore, 1999). This definition, according to Watkins & Mortimore, (1999), is archaic and inappropriate in these modern times because girls also now participate in formal education. In a review of literature on pedagogy, I came to agree with a number of researchers and academics like Watkins & Mortimore, (1999), Alexander, (2008), and Westbrook, et al., (2013) that models, conceptions and definitions of the term 'Pedagogy' have become more complex and contested over time. Watkins & Mortimore explain the reason being that the most common and brief definitions of pedagogy such as, it is 'the science of teaching', may be viewed and interpreted differently by readers, based on their own assumptions about 'science' and their conceptions about 'teaching'.

Some other writers like McDonald, (1992) and Marland, (1993) see pedagogy as a craft. However, Watkins and Mortimore (1999: 3) in their view of pedagogy, define the term as “any conscious activity by one person designed to enhance the learning of another”. They further stress that the term should not be limited only to the role and activity of teachers, but also the learner. Alexander, (2008), on the other hand, expands the definition to ‘encompass both an act of teaching together with its attendant discourse about learning, curriculum, theories, beliefs, values, policies and controversies by which that act is informed, sustained and justified’. He further points out that pedagogy connects the act of teaching with culture. It is important to note that the UNESCO’s 2005 Global Monitoring Report on quality explains pedagogy to include creative, emotional and social development as indicators of quality learning. It is also worth noting that Westbrook, et al., (2013: 14), conceptualise ‘effective’ pedagogy, which they describe as “those teaching and learning activities, which make some observable change in students, leading to greater engagement and understanding and/or a measureable impact on student learning”.

Other writers like Barrett, Sajid, Clegg, Hinostroza, Lowe Nickel, Novelli, Oduro, Pillay, Tikly, Yu, (2007) and Moreno, (2005), acknowledge other factors including creative, emotional and social developments, quality human interaction in the classroom, and lack of corporal punishment, to be taken into consideration.

Leach and Moon (1999: 267), in their *Learners and Pedagogy*, expand further on the definition of pedagogy by describing it as a ‘Pedagogic Setting’ – “the practice that a teacher (teachers) together with a particular group of learners, creates, enacts and experiences”. To Leach and Moon, pedagogic setting encompasses a setting that includes the interactions between all its participants, as well as individual actions within it, all as one process. That is, there is an interdependence of all its parts, making a single whole or entity within a time. They further explained that what the participants within that entity create, enact and experience together or separately, comprise “purposes, values

and expectations". Other elements include "knowledge and ways of knowing; rules of discourse; roles and relationships; resources, artefacts; and the physical arrangement and boundaries of the setting. All of these together and none of these alone" (Leach and Moon, 1999: 268). In effect, what people essentially view conventionally as forming part of learning, according to Leach and Moon (1999), are the physical surroundings, the materials the learners used, the social, institutional and personal commitments at play, as well as the language the participants use. In addition, in creating and sustaining pedagogic settings, they pointed out that it is the teachers, who critically determine both the nature and quality of learning.

Other definitions of pedagogy worth noting are those by Bruner, (1986), and Lave and Wenger, (1999). Bruner expresses his views on some significant aspects of pedagogy in Chapter One of Leach & Moon's, (1999) '*Learners and Pedagogy*'. These views were summarised by Leach and Moon (1999: 2) as "how educational goals, curriculum and assessment, learning activities and the roles of the teachers and learners are transformed into different views of the mind and the learning process". Bruner also emphasises the importance of the cultural context in which teaching and learning occur. Besides, he advocates learning to involve a participatory, proactive and collaborative process. Lave and Wenger (1991), share similar ideas on pedagogy with Bruner. They however have extended the meaning of the term pedagogy, to include what they refer to as 'Community of Practice'². Lave and Wenger (1991: 2), have advocated a curriculum which is viewed from the standpoint of learners as against that of a "teaching curriculum which is limiting and fragmented, mediated by external view of knowing" in Moon and Leach (1999). It is important to note that Gardner (1983), whose work is entrenched in the theory of Knowledge and Intelligence, has expounded another extension of the idea

² 'Community of Practice' has been elaborated on in Chapter 4, Section 4.3.3

of focusing on the learner. Gardner holds a perception of pedagogy that shifts the focus from the teacher and places it more on the learner's understanding.

Leach and Moon's (1999) focus on the learner, on the other hand, draws on the socio-cultural psychology of Bruner, (1986:1996).

Most of the definitions, features and descriptions that researchers assign to the term 'pedagogy' focus on learning. It is, therefore, not out of place, in my view, to realise from literature that researchers have linked pedagogical practices to features of key learning theories. These learning theories - *Behaviourism*, from the works of Thorndike (1911), Pavlov (1927) and Skinner (1957), *Constructivism* - built especially on the works of Piaget (1896-1980), and *Social Constructivism* postulated by Vygotsky (1986). Thorndike (1911), Pavlov (1927) and Skinner (1957) identify, for example, that behaviourism has pedagogic practices that support teacher-centred approaches, where the teacher acts as the sole reservoir of knowledge, packaged from various parts of the curriculum and delivered to the learner. Teachers act as 'sages on the stage', while the voice of the student is silenced. Akyeampong (2002), cites reports of classroom teaching and learning in primary schools in Botswana (Tabulawa, 1997) and Nigeria (Sunal, 1998), which reveal that learning is mainly based on behaviourism practised through acquiring and assimilation of knowledge to pass examinations, and chorus learning and memorisation respectively. Akyeampong (2002), further points out that there are similar behaviourist pedagogic practices prevalent in the Ghanaian context.

A research report on classroom teaching and learning (Akyeampong, Pryor and Ampiah, 1999) revealed that even though teachers could picture real situations in which their students essentially learned through social interaction and interrogation of ideas (i.e. adopting the constructivist teaching-learning strategies), they still instinctively regarded learning to be through transmission. This goes to point out that even if learners do not agree with any knowledge the teacher shares with them, the learners will still not have

any right to question it. The use of sanctions such as corporal punishment, as a form of deterrent is acceptable under behaviourism, as pointed out by Pitsoe & Letseka, (2014) and Grayson, (2006). For instance, when I was in primary class one, I could not write the number '8' any time we were asked to write numbers 1 to 10. I solved that problem my own way by mounting a smaller circle on top of a bigger one and it always looked like the figure '8' to me. However, my teacher noticed the difference always, and would cane me very hard on the middle part of my head, instead of helping me to write it correctly. She put so much fear in me that I could not report or complain to anyone. I had to go through that ordeal to the extent that I saw the first term, which was only three months as one year. Behaviourism also links with high stake accountability exams. Assessment methods are also characterised by exams.

Other features of practice are lecturing, demonstration, rote learning, memorisation, choral repetition, and imitation or copying. It features the 'one-size-fits-all' approach, which excludes students with individual differences, (Westbrook, et al., 2013: 9). Alhassan and Adzahlie-Mensah, (2010), also identified verbal and physical abuse as frequently used and harmful practices. This means that the practice does not also support or encourage inclusive education. On the other hand, the works of Piaget, (1896-1980), explain that constructivist learning theory involves pedagogic practices, which are learner-centred. Learners take the opportunity presented to them to explore their environment actively in order to build on their existing knowledge. The essence is for them to link the environment with any new knowledge introduced to them. To make this happen, learners could engage in experiential learning, which could take place in outdoor contexts, for example.

The Social constructivist learning theory, postulated by Vygotsky (1978), on the other hand, argues that learning is not an absorption and imbibing of new knowledge by learners but it has to do with social interactions, (Vygotsky, 1978: 57) in Graduate Student Instructor (GSI) Teaching & Resource Centre, (2017). Vygotsky (1978), further

explains that the level of potential development of a learner is the level at which the learner is capable of reaching under the guidance of teachers or collaboration with peers. The Social constructivist theory supports pedagogic practices that relate to learner-centredness, involving collaboration and interaction with peers and teacher, and students learn from each other. In the process, the teacher is supposed to facilitate and direct activities to aid the learners. The learners also develop teamwork skills as a result. Other features of social constructivism include the formation of small-groups for discussions and presentation, pairings for 'think-pair-and-share', whole-class discussions and other interactive work, among others.

Some key issues have emerged from the foregoing definitions of pedagogy, the associated pedagogic practices and the links to key learning theories. These issues are relevant to my study as far as technology-integrated classrooms are concerned. Firstly, the term, 'Pedagogy' relates to the socio-cultural context within which the participants are situated. In addition, my study's focus is on teachers using pictures taken from the learners' own environment to make lesson-related films to use as TLRs. Secondly, participants in a School community relate to each other through active interactions. Thirdly, pedagogy involves active learner-participation, collaboration, sharing, discussions and group work, among others, with the teacher as the guide. Fourthly, there is the need to view the design of the curriculum, taking into account the perspective of the learner. The term, *pedagogy* as in the title of my thesis, shares and relies on these key ideas expressed mainly under social constructivism. These ideas are consistent with the kind of classroom and its interrelationships I envisaged for the Social Science teachers in my project school. It is that, which I sought to create in the school and leave behind, after embarking on the teacher professional development.

2.3 The Role of Contexts in Shaping Technology Integration in Pedagogy

From the foregoing discussions in section 2.2.3 on pedagogy, the picture of what context is has also emerged to include the physical structures, (school and classrooms), the socio-cultural milieu, beliefs and values held among people, the interactions and relationships among individuals and groups (participants) in the entity, all of which affect pedagogy. Luckin, (2010: 6), in her submission on context, explains that “Context is associated with action and time, emphasising that it is a dynamic entity and is associated with connections among people, things, locations and events in a geographic and temporally situated narrative”. Luckin, further agrees with Nardi (1996), that context is studied in order to understand “... relations among individuals, artefacts and social groups”, (Nardi, 1996: 69). Luckin, again acknowledges what Schwanen, Djist, & Kwan, (2008: 520) point out that though contexts differ from one discipline to the other, “there is general agreement that the effects of the ways in which ICT mediates everyday life cannot be separated from the contexts in which they are situated”.

In addition, Cox, Webb, Abbott, Blakeley, Beauchamp & Rhodes, (2003) have identified some factors, which affect technology integration in pedagogy. These include favourable government policy environment, the school curriculum, ready access and accessibility to technology, increased training for teachers, school leadership, and the wider community involvement. Additionally, Ertmer, (2005) asserts that teachers’ pedagogies and pedagogical reasoning influence their uses of technology and in effect, enhances learners’ engagement in their learning.

Another important factor essential to technology integration is leadership, (Hudson, 2012); (Drayton, et al, 2010, cited in Valiente, (2010). The lack of support from institutions’ leadership has undermined many teacher or student-initiated ICT projects. For ICT integration programmes to be effective and sustainable, Canuel, (2009), suggests that administrators themselves must be competent in the use of the technology,

and they must have a broad understanding of the technical, curricular, administrative, financial, and social dimensions of ICT use in education. To buttress this point, Hudson, (2012), recommends an urgent need for a more wide-ranging development of educational leadership, which concentrates on the educational use of technology to support and sustain teaching and learning.

Other factors which can promote technology integration include alignment of technology initiatives to curriculum content to be taught, (Kanaya et al., 2005 cited in Valiente, 2010) and teacher's own attitude to technology use (Ertmer, 2005). Teacher anxiety over being replaced by technology or losing their authority in the classroom as the learning process becomes more learner-centred - an acknowledged barrier to ICT adoption can pose a hindrance to technology integration (Canuel, 2009).

In addition, another important factor is the teachers' own knowledge about their subject matter and how that subject matter relates to the technology they select as a tool for their practice. In this regard, teachers will need extensive knowledge of the technology to be able to select the appropriate resources (Mishra and Koehler, 2006).

Ertmer, (2005) explains that teachers' own pedagogical beliefs and values shaped by their position in the school, previous teaching experience, the kind of teacher training they had, how they see their colleague teachers teach, etc., all play important roles in determining technology-enhanced learning opportunities. However, some teachers also fear using the computer, resulting in limited or no use at all. Cox, et al., (2003), argue that this could limit the use of new approaches to teaching and learning, and lesson planning.

Apart from these, is poor access and accessibility to the technologies and the required infrastructure (Agyei, 2012), minimal level or the lack of technical and financial support, to sustain its use (Canuel, 2009). This can lead to limited impact, as students and teachers will use the technology for a very limited time.

Another context-related factor is capacity building. Researchers have identified this as a main catalyst to enable the adoption of IT innovations (John and Sutherland, 2004; Ofsted, 2002). Other barriers, which are closely related to the school and classroom contexts include overcrowded classes, typical of most public Basic Schools in Ghana, (UNESCO, 2012; Anyinah, 2017). Also, is the lack of integrative skills among teachers (Agyei, 2012). In addition is the lack of policy direction for the integration of ICT in education at School, District and National levels, (MOE, 2008), and lack of leadership drive (Banini, 2012; Valiente, 2010).

The context earmarked for the implementation of an ICT initiative, is a very critical issue determining its success. However, literature on ICT4D reveals an imitator-oriented approach toward innovation and not one based on how IT can be adapted for innovations within one's own context (Lawrence & Rohde, 2010). ICT4D seems rather to promote the transfer of innovations from the developed world to developing countries. As pointed out earlier on in Chapter 1, most governments see technology integration in educational institutions as merely providing and teaching a prescribed set of technology tools such as laptops in schools to students to learn computing. However, I share the stance of researchers who believe that technology integration should incorporate professional development, curriculum content restructuring, (Valiente, 2011; Harris, 2005; Toledo, 2005; Wildner, 2005), a favourable policy environment and teacher pedagogical beliefs (Ertmer, 2005), in order to satisfy the needs and preferences of students. The phenomenon of not considering context and other factors has led to a string of failures in technology integration in many developing countries, including Ghana (Banini, 2012). Research highlights issues of cultural uniqueness and context appropriateness of innovations (McCoy, et al, 2007; Mursu, Olufokunbi, Soriyan, & Korpela, 2000). As far as context is concerned, we may need to consider locally driven innovation that can make the technology used in the schools and in the classrooms, in particular, more appropriate, relevant, accessible and more effective.

In contrast to the traditional perspectives that promote a unidirectional flow of innovations and knowledge, Al' Abri, (2011) echoing Dale, (2000) suggests a partnership, where the provider of the innovation and the adopter could collaborate and learn from each other, in order to achieve a sustainable, context-appropriate innovation. In this study however, I view such a partnership to also bring on board the main policy maker in education that is the Ministry of Education, (MOE), in the case of Ghana, as well as donor agencies, which may buy into the idea of programmes dealing with Technology Integration into classroom instruction across subjects.

2.4 Conceptual Models

Research evidence shows the merits of technology integration in enhancing teaching and the ultimate attainment of learning objectives of students (Toure, 2008; Tchombe, et al. 2008). Subsequently, a number of researchers and educationists have come out with designs of some theoretical pedagogical or technological models / frameworks, which can assist teacher educators, pre-service and in-service teachers, to acquire the requisite knowledge necessary for effective teaching. Thus, apart from the foregoing examination of definitions of some key concepts of the study, this chapter also examines, from a theoretical perspective, some of the pedagogical and technological frameworks constructed by some researchers. The reason is to essentially justify why I finally settled on TPACK framework, among others, as a process, to: i) expose my research participants to the knowledge components they needed to acquire for technology integration, and also ii) to guide them to use the knowledge components to review and revise some of their already taught traditional lesson plans. I have elaborated, in detail, on these processes in Chapter 3. The following section starts with reviewing the Conceptual Pedagogical Models first before moving on with the Technological Models.

2.4.1 Conceptual Pedagogical Model

2.4.1.1 Pedagogical Content Knowledge (PCK)

Section 2.4 introduces Pedagogical Content Knowledge framework comprising conceptualised knowledge components that expect teachers' grounding for effective teaching. Literature suggests that before the introduction of PCK models / frameworks in the eighties (Shulman, 1986, 1987), there was the belief in the education systems of several countries that the amount of information a teacher is able to 'pour out' to students on a topic (content), is all that the teacher needs to know to be a good and effective teacher. For example, back in school, even up to the secondary level, some of us used to make remarks like "The teacher is very good", based on how much information the teacher is able to 'pour out' to us. This was irrespective of whether we understood what the teacher taught us or not. In any case, the expectation was that we memorised, (i.e. engage in rote learning) and reproduced whatever was 'dished' out to us for marks, if we did not want to be caned, drilled or punished in any other form. Apart from adopting this behaviourist tradition of teaching and learning, later years revealed that teachers were also not blending content with pedagogy – they handled them separately. That is teacher education shifted its focus largely towards general pedagogical classroom practices separately from subject matter and often at the expense of content knowledge (Ball and McDiarmid, 1990).

Thus, teachers regarded content knowledge and pedagogical knowledge as mutually exclusive domains. As time went on, however, this became a concern to a number of researchers, like Elbaz, (1983), Shulman, (1986, 1987); Wilson, Shulman and Richert (1987); Putnam and Borko, (1997); Calderhead (1996); Grossman (1990), who were prompted to engage in designing PCK frameworks to represent the knowledge teachers need for effective teaching to enhance learners' understanding. Table 2.2 presents five key teacher practical knowledge components that some authors have conceptualised for

teachers to have for effective teaching. A close perusal of each construct and their components from the table, suggests that Content Knowledge and General Pedagogic Knowledge (or instructional strategies, or teaching methods) run through all the models. Next in popularity are three of the models, including that of Shulman, which used the Pedagogical Content Knowledge, Curriculum and Environment (Context). Two other models include 'Students and their Characteristics'. The least knowledge components include 'Knowledge of self' used by Calderhead (1996) and 'Knowledge of aims, purposes & educational philosophies' used by Shulman, (1986, 1987) and Wilson, Shulman and Richert (1987).

Table 2.2: Teacher Knowledge Components some Authors Propounded		
S/N	Name of Researchers / Writers	Teacher Practical Knowledge Components
1	Elbaz, (1983).	Five components for teacher knowledge: i) Knowledge of yourself, ☺ ii) Environment, ‡ iii) Content Knowledge, ♠ iv) Development of curriculum ● v) Instructional strategies ♣
2	Shulman, (1986, 1987); and Wilson, Shulman and Richert (1987).	Seven categories for teacher knowledge: i) Content knowledge, ♠ ii) General pedagogical knowledge, ♣ iii) Curriculum, ● iv) <i>Pedagogical Content Knowledge</i> § v) Students and their Characteristics, ☺ vi) Educational contexts, and ‡ vii) Knowledge of Purposes, Aims, Objectives and Educational philosophies *
3	Putnam and Borko, (1997).	Three categories for teacher knowledge: i) General Pedagogical knowledge ♣ ii) Content ♠ iii) <i>Pedagogical Content Knowledge</i> §
4	Calderhead (1996).	Five components for teacher knowledge: i) Knowledge of yourself, ☺ ii) Subject matter Knowledge, ♠ iii) Students' knowledge, ☺ iv) Curriculum ● v) Teaching methods. ♣
5	Grossman (1990).	Four components for teacher knowledge: Uses Shulman's proposal on: i) Content Knowledge, ♠ ii) General Pedagogical Knowledge, ♣ iii) Pedagogical Content Knowledge § iv) Context Knowledge. ‡

KEY		
Symbols	Teacher Practical Knowledge Components	Frequency
♠	Content Knowledge,	5
♣	General Pedagogical Knowledge,	5
§	Pedagogical Content Knowledge	3
●	Curriculum	3
‡	Environment (Context)	3
☺	Students and their Characteristics	2
☺	Knowledge of self	1
*	Knowledge of aims, purposes & educational philosophies	1

A scrutiny of Shulman's model, however, seems to reveal a more comprehensive set of components. It also seems to summarise the components of all the other models put

together. Drawing on this perspective, I consider Shulman's model relevant to my study, more so because my conceptual framework (TPACK), for this study, was a built-up on Shulman's PCK construct. Shulman's (1986) original work on the complex relationship between Content Knowledge and Pedagogical Knowledge (PCK) model is well known and has been widely used. In literature, the model describes how teachers need to have a deep and flexible understanding of their subject content and the knowledge of how to develop student understanding of it, if they are to teach their students effectively (Mishra and Koehler, (2006); Shulma, (1986). If the teacher co-ordinates content knowledge and pedagogical knowledge deeply and well, it is likely to make students understand the issues the teacher discusses with them.

In Shulman's view, PCK is "... that special amalgam of content and pedagogy that belongs only to the universe of teachers, their special form of professional understanding" (Shulman, 1986: 9). That is, the knowledge base of teaching, lies in the intersection or blending of Content and Pedagogy – in the capability of the teacher to transform the content knowledge he / she has into forms that are pedagogically powerful and yet adaptive to the variations in ability and background presented to the learners (Leach & Moon, 1999). Shulman defines Pedagogical Content Knowledge as the knowledge of how to teach within a particular subject area in such a way as to make it easily understandable to learners. Shulman posits that teachers use explanations, "the most powerful analogies, illustrations, examples, demonstrations and presenting learning in interesting, motivating and even entertaining ways (cited in Mishra and Koehler, 2006). Since its introduction in 1987, PCK has become a widely useful and used notion.

The PCK framework represents the blending of content and pedagogy into an understanding of the way we organise, represent, adapt particular topics, problems or issues, to the diverse interests and abilities of learners, and present it for instruction (Shulman, 1987: 4). Fig. 2.1 shows an integration (fusion) of content knowledge and

pedagogical knowledge, necessary for effective teaching. It points out that teachers have to blend knowledge on Content (subject matter) and Pedagogy together and not separately or used in isolation.

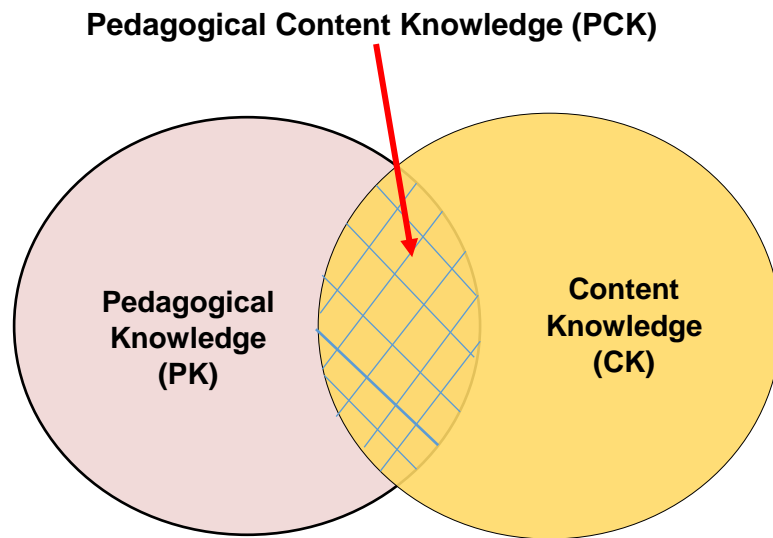


Fig. 2.1: Pedagogical Content Knowledge Framework (Shulman, 1986)
Source: Drawn from www.Google.com.gh with a portion shaded by researcher for elaboration.

Shulman has expressed this in his 1986 Educational Researcher article that:

Teachers must not only be capable of defining for students the accepted truths in a domain. They must also be able to explain why a particular proposition is deemed warranted, why it is worth knowing, and how it relates to other propositions, both within the discipline and without the discipline and without both in theory and practice (Shulman, 1986: 9).

In his prologue to *Knowledge and Teaching: Foundations of the New Reform*, Shulman (1987: 1), vividly buttressed his appeal that:

We find few descriptions or analyses of teachers that give careful attention, not only to the management of students in classrooms, but also to the management of ideas within classroom discourse. Both kinds of emphasis will be needed if our portrayals of good practice are to serve as sufficient guides to the design of better education.

In an earlier work, Shulman (1986) expands on content knowledge to include knowledge of concepts, theories, ideas, knowledge of proofs and evidences, as well as practices and approaches to develop this knowledge.

For pedagogical knowledge, he includes the educational purposes, the methods of teaching and learning, that is, knowledge about techniques or methods used in the classroom, the nature of the target audience. Moon and Leach (1999: 91), however, are of the opinion that Shulman's (1986) work leans more on the Theory of Cognition that views knowledge as a fixed and external body of knowledge of information. Besides, it leans on a teacher-centred pedagogy, which focuses primarily on the skills and knowledge the teacher possesses, rather than on the process of learning. I share a different view that the model's focus on teachers is because it has been designed for teacher preparation, professional development and teaching. If teachers succeed in integrating pedagogy into content, they will positively affect the learning of their students. Besides, as pointed out earlier, Shulman's model is relevant to this study because the TPACK conceptual framework of Mishra and Koehler (2006) on which I hung this study, built on Shulman's model by introducing a technology component.

2.4.2 Technological Models

Research into the integration of technology in teacher education and professional development has enabled scholars to develop theoretical models aimed at integrating technologies into teaching (Garrison, Anderson & Archer, 2000; Mishra & Koehler, 2006; Wang, 2008). Apart from the TPACK model (2006), there are other technology models, such as the SAMR model, (2006) and the Zhu and Kaplan's model (2001) designed for technology integration.

This section examines these three models designed for application to teaching with technology.

2.4.2.1 Substitution, Augmentation, Modification and Redefinition (SAMR) Model

Puentedura (2006) designed the SAMR model in 2006, in collaboration the Maine Learning Technologies Initiatives (Oostveen & Muirhead, 2011). The model is for evaluating the level at which a given technology has had an impact on a learning activity

(Shaw, 2015). Researchers such as Pride, (2016), Chien, Choo, Schnabel, Nakapan, Kim, Roudavski, (2016) and Oxnevad (2013), often describe the SAMR framework, (Fig. 2.2), as a 'ladder', which lends itself to the image of scaffolding.

Scaffolding is what the education system is based on; that is building upon previous knowledge (Reid, 2016; Pride, 2016; Swanson, 2014). The model has four levels, comprising Substitution, Augmentation, Modification and Redefinition and each word in the acronym represents a higher level of impact. The first two lower levels lead to enhancement of learning with technology use and the last two higher levels, lead to the transformation of learning, from the creation of new tasks.

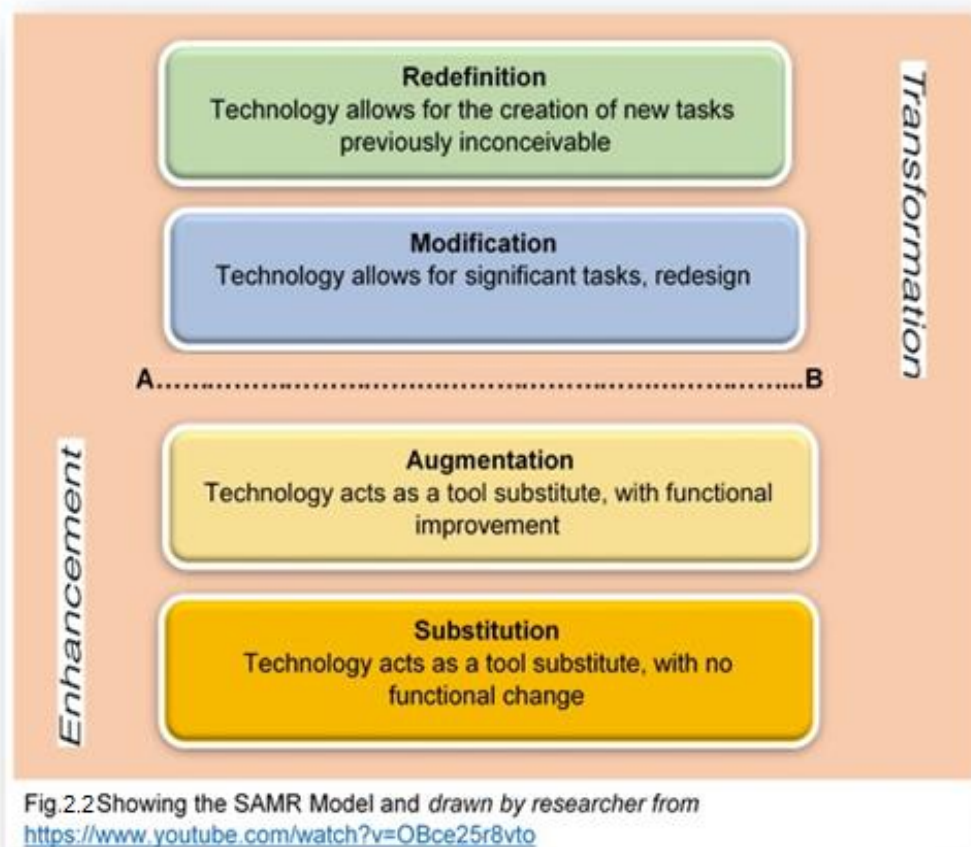
Puentedura (2006) argues that at the level of substitution, technology acts as a direct substitute with no functional change. That is a technology swaps a more traditional tool with no functional improvement. For instance, instead of using a pen or pencil to write an essay, the student will use a basic word processing program, say Microsoft Word to write the essay. Here, the task is the same, but the substitute used is technology.

At the Augmentation level, even though the task is the same, the change brings about some amount of functional improvement. For instance, using Microsoft Word to write a piece of work and the teacher passes comments on the student's work sent in Word directly without passing exercise books back and forth (Shaw, 2015). At this stage also, there could be peer interactions, peer reviews, sharing of information and possible additions. Thus, at the Substitution and Augmentation levels, there is enhancement as shown in the Fig. 2.2, as the technologies used will make performance of the task more efficient, though there will be little difference in future learning outcomes (Rich Colossi Media, 2014). Most learning, according to Puentedura, takes place above the line, A–B.

At the Modification stage, Puentedura explains that, technology allows for the redesign of a significant task, such that instead of writing on paper with a pen, the student can use a video or pictures and publish a work. The audience will no longer be

a teacher but the whole world and people from all over the world with Internet connectivity will view and review the work, allowing for deeper analysis.

At the Redefinition stage, Puentedura argues that technology allows for the creation of new tasks, previously unimaginable. That is, instead of writing an essay with a pen, students can now produce and publish a digital story-telling project with multimedia. This allows other people to analyse and comment on the work or message. So, the task is the same but technology allows students to engage in a new and more involving task which otherwise would have been impossible. At these last two levels, the use of technology and a significant involvement in learning is likely to take place and transform learning.



The framework promotes reflective teaching in the classroom – what I do, why I do it and how it promotes learning are the issues to focus on. It is important to note that the type of technology tool does not determine the level. It is how the individual teacher uses the

tool in a lesson with the ultimate aim of maximising the student's learning outcomes (Rich Colossi Media, 2014).

This model, in my view, provides some very useful examples of how to integrate technology into teaching and learning. One other merit is that the model systematically presents the stages from level to level, from introduction through innovation.

Even though the model provides great examples on implementation and scaffolding, in my view, it seems to be silent on context and assumes that the teacher already has the integrative skills or competence. Besides, the scope of my study limits the application of the model in the sense that my selected conceptual framework (the TPACK) does not intend to evaluate its impact on student's learning alone. The TPACK framework does not also assume that teachers already have integrative skills but rather recommends to teachers the 'knowledges' they require to be able to teach effectively with technology (Mishra and Koehler, 2006).

2.4.2.2 Model for Teaching with Technology

A second technological model (Fig. 2.3) developed by Zhu & Kaplan, (2001), is to serve as a guide to teachers who want to engage in technology integration. Zhu & Kaplan assert that we view the model from a systems' approach, where teaching with technology involves four major components: i) the student ii) the instructor iii) the course content and iv) technology tools. From figure 2.3, the relational arrows show that none of these four components works individually or in isolation, so that content is related to technology which is also related to the instructor and then to the student and back to content.

Zhu & Kaplan, (2001) explain that because each component raises a set of issues, one needs to examine the components well in order to make technology integration as successful as possible. For example, Zhu and Kaplan (2001) further explain that content can be examined in terms of learning outcomes and the discipline that the teacher

teaches. However, this study is limited more to students' engagements in technology-integrated lessons rather than students' learning outcomes that Zhu and Kaplan suggest.

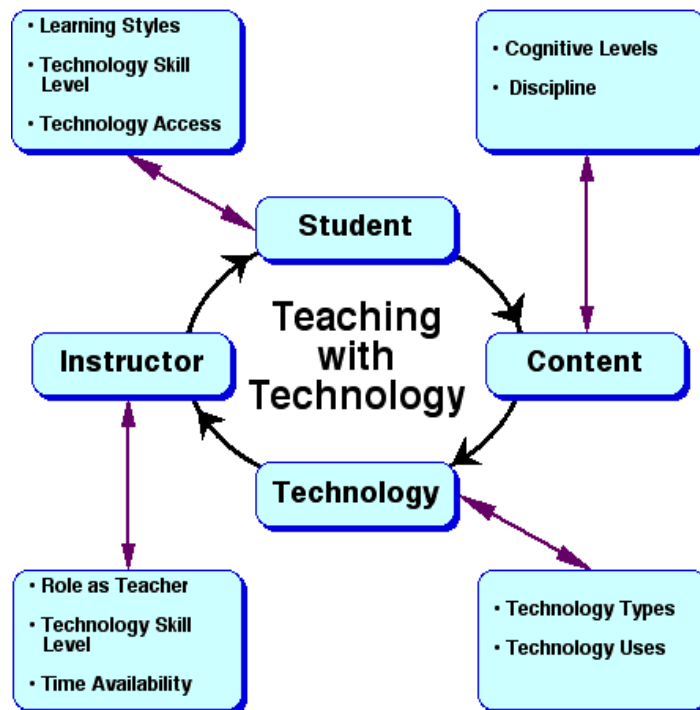


Fig. 2.3: Showing a Model for Teaching with Technology

Source: McKeachie's Teaching Tips, (2006) (<http://www.crlt.umich.edu/inst/mode>)

Zhu & Kaplan (2001) explain further that the instructors could think of their own experience with technology, the amount of time they have for planning and teaching, and their own views of the roles they will play in the teaching and learning process. Zhu and Kaplan (2001) suggest that issues to be considered about the learners include first their access (exposure) to the technology. I will add student's accessibility to the technology - i.e. their quality use of the technology (Valiente, 2010). The second factor Zhu and Kaplan suggest is the learners' preferred learning styles.

The concept of learning styles has, however generated debates and discussions among some researchers, including Cassidy, (2004), De Bello, (1990) and Curry (1991). De Bello (1990) notes that there are as many definitions of learning styles, as there are

theorists in the area. De Bello further points out that there is the level of ambiguity and debate surrounding the definition, such that even the task of selecting a suitable instrument for investigation becomes a difficult one. Cassidy (2004: 420) confirms this point that 'there are a variety of definitions, theoretical positions, models, interpretations and measures of the construct'. Curry (1991) also expresses a major concern that highlights the inability of the definition to identify and agree upon style characteristics, which are most relevant to learners and instructional setting. Nonetheless, Cassidy admits a 'general acceptance that the manner in which individuals choose to or are inclined to approach a learning situation has an impact on performance and achievement of learning outcomes' (Cassidy, 2004: 420). It is, however worth noting here that discussions on the concept of learning styles are not within the scope of this study but suffice it to note that critics of the concept believe the definitions are varied, controversial (Cassidy, 2004; De Bello (1990) and weak in reliability and validity (Curry, (1991).

As far as the technology-teaching model is concerned, Zhu and Kaplan (2001) also suggest that teachers consider the technology itself and analyse it according to its functions. Valiente, 2010; Koehler and Mishra, 2005; Hernández-Ramos 2005; Trotter, 1997), however argue that access to technology is not a sufficient condition for integration but that accessibility (i.e. quality use of the technology) is also a very crucial factor. From my point of view, I believe teachers can go a step further to collaborate with their students to explore, create and share ideas and products that they create among themselves and with others. This approach to teaching and learning with technology appears to assume that the four component parts are integrated and that changes in one part will require adjustments to the other three in order to achieve the same goals. The model raises quite a number of issues worth considering as far as Ghana is concerned. Firstly, if the model suggests the instructors can think of their own experience with technology, this presupposes that the instructor has the technological knowledge and skills. This is a problem in Ghana as empirical evidence suggests that most teachers

lack the technological knowledge, let alone having the integrative skills to use the technology as a tool to teach. This raises the issue of a focus on teacher professional development and as Zakaria and Daud, (2009) point out, professional development is the main defining factor towards improved student performance.

Secondly, the framework assumes that both teachers and learners have access and accessibility to technology. In chapter one, we stated a gloomy picture of access to technology in Ghana. Thirdly, the framework assumes that teachers have full knowledge of the learning styles of their students. On the contrary, with our overcrowded classrooms of about 1 teacher to 240 children (Anyinah, 2017), in some cases especially at the public basic school level in Ghana, getting to know the learning styles of each individual learner, to make technology integration viable appears an onerous task. Besides, the model has not stated the context in which the implementation of technology integration is possible.

2.4.2.3 Technological Pedagogical And Content Knowledge (TPACK) Framework

Literature suggests that the TPACK framework that Mishra and Koehler (2006) designed is indebted to contributions of other earlier scholars like Keating and Evans (2001) and Pierson (2001), who used the acronym TPCK. Others were Angeli and Valanides (2005), Niess (2005) and Zhao (2003). The principal reference of TPACK is the work of Shulman (1986; 1987), and in particular his pedagogical content knowledge construct. Mishra and Koehler (2006) used the term technology pedagogy content knowledge (TPCK) later to describe a knowledge base for teachers teaching with technology. Chai, Koh, Tsai, Tan, (2011), observed that within the field of educational technology, Technological Pedagogical Content Knowledge (TPACK) has been theorised as a seven-factor construct to describe teacher's integration of information and communication technology (ICT) in their teaching. The framework, illustrated in Fig. 2.4, shows the Technological Pedagogical And Content Knowledge (TPACK) theoretical framework designed by Mishra and Koehler (2006). According to Mishra and Koehler, (2006: 1020) the basis of

the framework is the understanding that teaching is a highly complex activity that relies on many kinds of knowledge. They agree with other researchers like Leinhardt & Greeno, (1986) and Spiro, Coulson, Feltovich, & Anderson, (1988) that teaching is a complex cognitive skill occurring in an ill-structured, dynamic environment. The framework describes the knowledge teachers require to have, in order to integrate technology effectively as a tool, into their teaching and learning practices (Ibid). The TPACK framework was constructed from Shulman's (1986) framework (Fig. 2.1), comprising Pedagogical Content Knowledge (PCK), which intersects knowledge between pedagogy and content. Mishra and Koehler (2006: 1022) admit that their emphasis on PCK is based on Shulman's acknowledgement that:

pedagogical content knowledge is of special interest because it identifies the distinctive bodies of knowledge for teaching. It represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented and adapted to the diverse interests and abilities of learners, and presented for instruction (p. 8).

Mishra & Koehler added technology to the PCK model, resulting in TPCK, which they described as the interweaving of technology, pedagogy, and content. Literature explains that the TPCK was later renamed as TPACK (Technological Pedagogical And Content Knowledge) in 2008 to represent content, pedagogical and technological knowledge. This was when some educators in the research arena suggested using the more easily coined term, TPACK. The new name was generally accepted and was referred to as “forming an integrated whole, a ‘Total PACKage’” (Thompson & Mishra, 2007: 38).

The TPACK framework places emphasis on the many-sided intersections or relationships between a teacher's knowledge of subject content (CK), pedagogy (PK), technology (TK) and context. The model thus constitutes an integrative knowledge base of technological knowledge and skills, as well as knowledge of learners, subject matter content and pedagogy that are necessary for teachers to become competent to teach with technology in the classroom. TPACK attempts to capture some of the essential qualities of knowledge

required by teachers for technology integration in their teaching, while addressing the complex, multifaceted and situated nature of teacher knowledge (Koehler & Mishra, 2006). 'At the heart of the TPACK framework, is the complex interplay of three primary forms of knowledge: Content (CK), Pedagogy (PK), and Technology (TK)' (Koehler, 2012). Koehler explains that for effective technology integration, there must be a 'transactional relationship' between these knowledge components, which in turn, must be sited in specific contexts. Mishra and Koehler (2006: 1022 & 1023), acknowledge that technologies evidently have a critical role to play in aspects of what Shulman says the 'amalgamated portion of the PCK' in his framework represents - that is "the most powerful analogies, illustrations, examples, explanations and demonstrations" and presenting learning in interesting, motivating and even entertaining ways (Mishra and Koehler 2006: 1023). They, however, caution that there is no single combination of content, technology, and pedagogy, which will apply for every teacher, or every course, or every level of teaching. This is because of distinct school-specific factors, grade-level, demographics, culture and other factors, which ensure uniqueness (Koehler, 2012; Reid, 2016). Reid further explains that the interplay of the TPACK elements occurs in a complex classroom landscape, which requires teachers to reflect in action and to solve problems creatively. In other words, it will require teachers to use technology as a means of developing and enhancing pedagogical and content elements. Koehler (2012) further explains that "effective technology integration for pedagogy around specific subject matter requires developing sensitivity to the dynamic, transactional relationship between these components of knowledge situated in unique contexts".

Mishra and Koehler (2006), however caution teachers that even though the TPACK construct is broken into TK, CK, PK, PCK, TCK, TPK, integrating technology with content and pedagogy in classroom practice should not be viewed as distinct from each other or mutually exclusive. Thus, the Venn diagram (Fig. 2.4) formed from the TPACK results from the interplay of these elements and hitherto, provides a clearer understanding of

their dynamic relationship at the point of intersection. According to Mishra and Koehler, the intersection stresses the “connections, interactions, affordances, and constraints between and among content, pedagogy, and technology” (Mishra & Koehler, 2006: 1025).

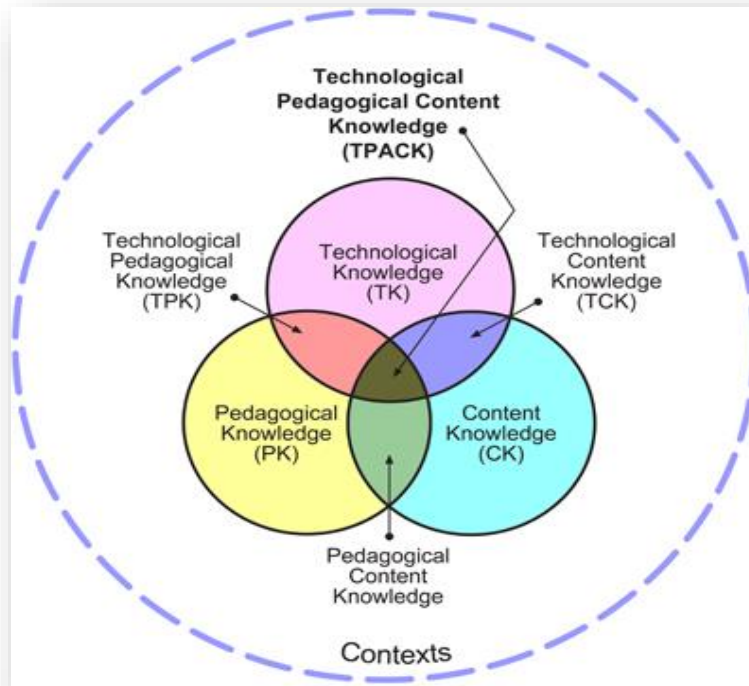


Fig. 2.4: Showing Technological Pedagogical And Content Knowledge (TPACK) Framework (Graphic adapted from <http://tpack.org>).

Besides, the framework since its contribution to teacher knowledge, has been extensively accepted for the preparation of teacher ICT education (Cox & Graham, 2009; Thompson & Mishra, 2007). In order to establish a theoretical basis for this inquiry, I gave a brief overview to explain these components here.

1. *Technology Knowledge (TK)*: Technology knowledge refers to the knowledge about various technologies, ranging from low-tech (analog) technologies to digital technologies tools and resources (Mishra & Koehler 2006). TK also involves having the necessary skills to apply and operate a particular technology productively, as well as the ability to learn and adapt to new technologies. This knowledge goes beyond

the basic computer literacy to knowing a broad enough base of technological application to make it part of everyday life, to fit into work and use it productively. It also involves the ability to recognise when a particular technology can improve or hinder a learning goal. Mishra & Koehler explain that knowledge of technology becomes an important aspect of overall teacher knowledge. They echo the opinions of other scholars like Hughes, (2005), Neiss, (2005), and Zhao, (2003), who have argued that technology knowledge (TK) cannot be treated in isolation of context and that good teaching requires an understanding of how technology relates to the pedagogy and content.

2. *Content Knowledge (CK)*: Content knowledge is the knowledge about actual subject matter that the student learns or the teacher teaches (Mishra & Koehler, 2006). Thus, teachers are supposed to receive good grounding in the content they teach. This includes the central facts, theories, principles and procedures related to that content within the given field.

3. *Pedagogical Knowledge (PK)*: Mishra and Koehler (2006: 1026) explain that PK is deep knowledge about the processes and practices or methods of teaching and learning. This, according to them encompasses the overall educational purposes, values and aims, among other things.

Pedagogical knowledge is the methods and processes of teaching and includes knowledge in classroom management, students' prior knowledge, use of resources, student assessment, lesson plan development and implementation, as well as students' learning. This generic form of knowledge applies to understanding how students learn, general classroom management skills, lesson planning, and student assessment (Koehler & Mishra, 2009), in Koehler, (2012). It involves knowing the processes, which are required to impart the content knowledge in teaching and learning. Thus, teachers with deep pedagogical knowledge will be able to apply the

appropriate methods that are capable of engaging and stimulating their students to learn in particular ways to achieve their learning objectives.

4. *Pedagogical Content Knowledge (PCK)*: Mishra and Koehler (2006) admit that the notion of pedagogical content knowledge is consistent with, and similar to, Shulman's idea of knowledge of pedagogy that is applicable to the teaching of specific content. Pedagogical content knowledge blends both content and pedagogy with the goal of developing better teaching practices in the content areas. Koehler & Mishra, explain that "... PCK covers the core business of teaching, learning, curriculum, assessment and reporting, such as the conditions that promote learning and the links among curriculum, assessment, and pedagogy" (Koehler & Mishra, 2009).

5. *Technological Content Knowledge (TCK)*: Technological content knowledge suggests that teachers understand, that by using a specific technology to support content knowledge, they can change the way learners practise and understand concepts in a specific content area. That is to say, it behoves teachers to select technologies that best embody and support particular content-based precepts (Harris and Hofer, 2011).

6. *Technological Pedagogical Knowledge (TPK)*: Technological pedagogical knowledge is the knowledge about how to use various technologies to support teaching, and enhance understanding of the learner, in such a way that may change the way teachers teach.

7. *Technological Pedagogical Content Knowledge (TPACK)*: Technological pedagogical content knowledge is the knowledge required by teachers for integrating technology into their teaching in any content area. Teachers are supposed to have an intuitive understanding of the complex interplay between the three basic components of knowledge (CK, PK, TK) by teaching content using appropriate pedagogical methods and technologies.

The TPACK with its components is summarised in the structural module in Fig. 2.5a, adapted from Chai et al. (2011). It shows the main ‘knowledges’ lined up vertically on the left-hand side as TK, PK and CK, the integrated ‘knowledges’, TPK, TCK and PCK, also vertically lined up at the centre and their interrelationships, the TPCK or TPACK, which Mishra and Koehler refer to as the triad in 2006 (Mishra and Koehler, 2006: 1026).

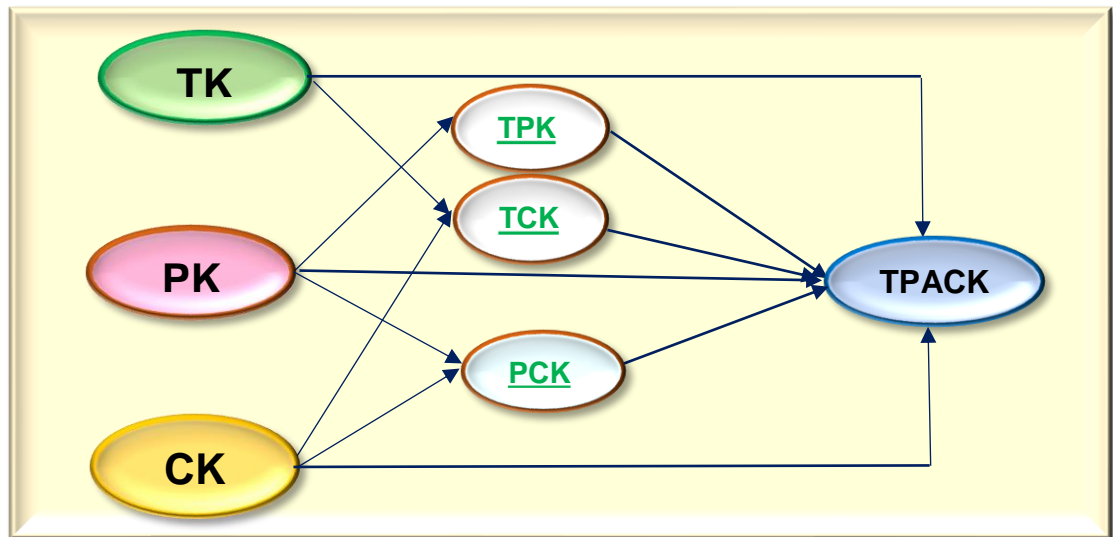


Fig. 2.5a: Model showing the interrelationships among the TPACK components, adapted and drawn by author from Chai et al. (2011: 1187).

Within the field of educational technology, researchers and educators have conceived the TPACK framework as a “seven-factor” construct to describe the knowledge teacher’s need to integrate technology in their teaching. Consequently, it has since been broadly accepted for the planning of teacher ICT education (Cox & Graham, 2009; Thompson & Mishra, 2007). However, it has received a number of criticisms from some researchers like Chai, et al. (2011). They assert that several TPACK surveys designed and conducted among a large sample of respondents and hitherto validated, have generally reported a difficulty with isolating all seven constructs that Mishra and Koehler (2006) proposed. Likewise, Reid (2016) argues that even though one can easily recognise the three main areas of technological, pedagogical, and content knowledge very clearly, distinctly and recognisably, it is difficult to determine exactly what the different knowledge boundaries of the model are, thus making it difficult to work with the intersections. She further asks

a number of questions including this: “What does Technological Pedagogical Knowledge look like?” She also remarks that there are very few or no examples given to help explain what she refers to as ‘crossover’ of these ‘knowledges’. Cox and Graham, (2011) make a similar observation that there is still a lack of understanding about how the seven TPACK construct are being applied by teachers as they formulate technology integrated lesson to promote C21st learning. They suggest the need to expand and refine the TPACK constructs, as well as associate it with other theoretical frameworks that influence ICT integration. Furthermore, even though Mishra and Koehler describe the teachers’ knowledge growth within the context of social and multi-disciplinary situations, Angeli and Valanides (2005) disputed the teachers’ knowledge growth at the intersection and view TPACK as separate knowledge domains, which can be developed and assessed independently of each other.

Despite all these criticisms, TPACK is regarded as a potentially fruitful framework that may provide new directions for teacher educators in addressing the problems associated with integrating ICT into classroom teaching and learning (Hewitt, 2008).

One significant thing about this model, in my view, is its applicability to any and every course or subject taught (Reid, 2016). Besides, the model allows all teachers to use technology in the way that best suits their classroom environment, their pedagogical practices, and their content including the objectives set for a particular lesson (Ibid). As pointed out by Koehler and Mishra (2009), there is no ‘one best way’ to integrate technology into curriculum. Rather, there is the need to creatively design or structure integration efforts for particular subject matter ideas in specific classroom contexts. It also allows them to use technology to whatever degree necessary for each lesson. The approach the framework adopts, however, is that integration demands that teachers do not just know how to use technology, but how to teach with it. This is the challenge the framework poses to teachers who are not only expected to be conversant with their subject content areas and how this content can be presented to the understanding of the

learner (Pedagogical Content Knowledge - PCK), but also to be able to integrate technology into these two knowledge components, within a prevailing context. Koehler and Mishra (2009: 62), explain that “There is ‘no one best way’ to integrate technology into curriculum”. They further suggest that “Rather, integration efforts require a creative design or structure for particular subject matter ideas in specific classroom contexts” (pg. 62). Quoting them verbatim from the same page, they further state that:

Honouring the idea that teaching with technology is a complex, ill-structured task, we propose that understanding approaches to successful technology integration requires educators to develop new ways of comprehending and accommodating this complexity.

Importantly, this implies that the framework demands that, for purposes of integration, the teacher knows how technology affects her subject content area, Technological Content Knowledge – (TCK), how the technology adds to his pedagogical delivery (TPK) and how he / she is able to combine the three seamlessly (TPCK) for effective integration and delivery. In this study, therefore, I introduced TPACK as a way of representing the knowledge base that teachers in the researched school would need to have, to teach effectively with technology. I further argue for the role of training, based on recommendations from Harris, Mishra, & Koehler, (2009), that successful technology integration is rooted primarily in curriculum content and content-related learning processes, and secondarily in savvy use of educational technologies. Literature suggests that adopting TPACK integrative skills can also lead to empowering both teachers and students to develop 21st Century skills such as creativity, critical thinking and problem-solving skills, communication skills and ICT skills to make them fit into the world of work. Again, from the point of view of empowering young African students for the world of work, Akyeampong (2016: 7) further suggests that:

... teachers have to experience this (‘this’, meaning teachers have to experience acquiring innovative pedagogic skills in their own training) in a way that will transform how they learn subjects, especially how they experience various applications in real world context, solve relevant problems and use technology to improve understanding of concepts and its applications.

This is the central point on which I also hang my action research (the professional development) element of this study.

2.5 Theoretical underpinning for the study

2.5.1 The specific application of TPACK in the study

In this study, the ‘knowledges’ required of Basic school Social science teachers to be able to teach Citizenship education or Social studies with technology, is designated by TPACK. The technology (T) in this instance consists of the mobile phone camera, used in conjunction with Windows Live Moviemaker to produce self-prepared lesson/context-related films. These films (product of technology) form TLRs with the support of knowledge of learner-centred pedagogies, PK and ABL³ approaches designed to facilitate learning among pupils and students. The content (C) is the knowledge of Citizenship Education / Social studies subject matter content needed for effective pedagogic delivery. Figure 2.5b, shows the TPACK (the shaded portion) as emerging from these three fields of Content, Pedagogical and Technological ‘knowledges’ that the teachers have to be able to teach these social science subjects with technology.

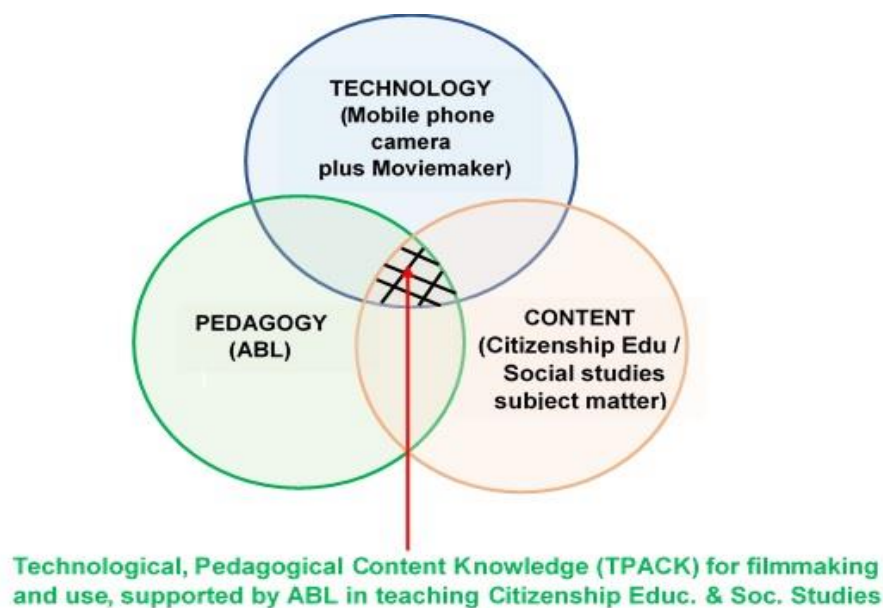


Fig. 2.5b: TPACK = Conceptual framework used in the study.

³ ABL stands for Activity-Based Learning

The TPACK components as related to this study consist of the following specific 'knowledges' and skills:

- i. Content knowledge – (CK_{Ct / Ss}) – coined to stand for the teachers' grounding in content knowledge in Citizenship Education (Ct) and Social Studies (Ss).
- ii. Pedagogical Knowledge – (PK_{ABL}) – coined to stand for the teachers' pedagogical knowledge and skills including application of Activity-Based Learning approaches they used for teaching Citizenship Education and Social studies.
- iii. Technological Knowledge – (TK_{mpc+TKwmm}) – coined to stand for Technological knowledge and skills the teachers are able to apply in order to use their mobile phone cameras (mpc) and Windows moviemaker (wmm) to produce films to fit particular Ct and Ss content.
- iv. Pedagogical Content Knowledge – (PCK_{ABL}) – coined to stand for teachers' knowledge and skills applied to teaching and learning, including the application of activity-based learning (ABL) strategies used to teach particular Ct and Ss content.
- v. Technological Content Knowledge – (TCK_{(mpc+wmm) + Ct / Ss}) – coined to stand for teachers' knowledge and skills capable of selecting the appropriate technology (in the case of this study, self-made lesson/context-related films from mobile phones in conjunction with moviemaker) that fit Ct and Ss content.
- vi. Technological Pedagogical Knowledge – (TPK_{ABL}) – coined to stand for teachers' knowledge and skills to use their lesson/context-related films to teach particular Ct and Ss concepts.

- vii. Technological pedagogical content knowledge – (TPCK_{Ct/Ss}) – coined to stand for participants' knowledge and skills capable of integrating their self-made lesson/context-related films into content, with the support of ABL strategies to communicate Ct and Ss concepts in ways that are appropriately matched to students' needs and preferences.

Another application of TPACK in this study is evident in participants' lesson planning. In Chapter 4, participants were guided to review and revise their traditional lesson plans to make them TPACK-compliant. Harris and Hofer, (2011: 213) explain that "Teachers' technological pedagogical content knowledge is enacted in part, during instructional planning". They further concur with John, (2006) and Yinger, (1979), that teachers' lesson planning is structured and communicated mainly by content goals and learning activities.

In chapter four of this study, participants included lesson/context-related films that their learners watched as a main learning activity in their lesson planning. Other learning activities included brainstorming, whole-class and group discussions and 'Think pair and share'. The activity-based learning emanating from such teaching methods are referred to as Activity-based Learning (ABL), which form part of PK and subsequently, PCK mentioned in the preceding paragraph. It is worth noting that when teachers incorporate Activity Based Teaching Methods into their lesson plans and implement them effectively among their learners, the lessons become activity-based, participatory and learner-centred. Harris and Hofer, (2011: 214) further explain that technology integration must be approached in a way that links students' content-related learning needs with blends of deliberately selected content-based learning activities. According to them this link needs to be supported by the selected technology, (in this study, a lesson/context-related film), which places emphasis on content-based learning activities because these activities are the primary elements in teachers' instructional plans.

2.6 Potential of Films for Teaching Social Science

Teaching with a film is a powerful and meaningful instructional strategy (Russell, 2012). Holmes, Russell, and Movitz, (2007) and Russell, (2004), further explain that teaching with a film is an effective strategy for teaching social studies related content. Literature from Manfra and Bolick (2017), and Marcus, Metzger, Paxton and Stoddard, (2010), reveal a number of merits for the use of films in teaching Social Studies and for that matter, social science subjects in general. One merit Marcus, et al., (2010) explained was that when teachers use films to support teaching, it allows students to visualise what they read in textbooks and such visual representations most often cannot equal the quality of pictures in books. In other words, using films to support teaching and learning enable students, to see things happen more differently than in a textbook and this encourages them to dig deeper and want to find out more information about the topic. Marcus et al., (2010: 5) also explain that “Young people may get more excited about lessons using popular media than about instruction only using official school materials such as textbooks, primary documents, or worksheets”. Films enhance the development of critical thinking, analytical and interpretive skills in learners, if teachers make the materials relevant to the learners, while incorporating popular culture to enhance their creative skills (Allam, 2006). At the same time, films help teachers to learn more about the materials, which also form a resource for them and the students (Marcus et al., 2010). Using films to support students’ learning inspires and helps them to retain knowledge about what they learn (Shepard and Cooper, 1982). Mirvan, (2013) also explains that films have the potential of making a class more interesting, more engaging and breaking up the monotony of a normal lesson.

That is not all. A research that Donnelly (2014), conducted on film use in teaching History (an aspect of social studies) revealed that teachers were motivated to use films to teach to encourage empathy and to bring past events back to life. In a similar vein, case studies that Metzger and Suh (2008) conducted about film use in teacher practice revealed that

films have the power of historical storytelling. The claim is that films have the ability to help students visualise the past and experience reality. Likewise, Johnson and Vargas, (1994) point out that a film can communicate about the past in a way that cannot be done easily from written sources.

A similar research conducted by Blake and Cain, (2011) reported that when teachers use a film to support their teaching, it arouses the interests of the learners. Another merit of film use to support pedagogy include its ability to support student inquiry. This inquiry involves students deepening and delving more into questions and problems, as they seek for their own understanding and solutions (Vygotsky, 1978).

From these foregoing benefits, it makes sense that social science teachers should also use lesson/context-related films to support their traditional teaching and learning activities in order to assist their students' learning (Willmot, et al., 2012). These benefits form part of the expectations of this study.

2.6.1 Creativity in Technology Use

Creativity is viewed alongside educational technology “as fundamental constructs of 21st century education” (Henriksen, Mishra, and Fisser, 2016: 27). Thus, discussing creativity in technology use in this study is consistent with Lewis’s (2008) view that creativity is a sought-after quality of thinking, which is an important feature of innovation and change. The focus of this study includes the creativity the participating teachers require to prepare the appropriate and relevant TLRs for a particular level of students (McGrath, 2016; Block, 1991), to support their teaching-learning activities. Zhao (2017) in an interview he granted Richardson, Henriksen, Mishra, and The Deep-Play Research Group (2017: 516), points out that “creativity ... can be considered the genesis of all learning in every area and across every discipline.” Likewise, Keirl, (2004: 145) regards creativity as an essential part of design and technology. These hints presuppose that when a teacher engages the use of technology to develop instructional content and materials using the

TPACK as the process, for instance, the issue of creativity afforded by the technology and the teacher's innate creative potential become part of the process. Consistent with this, Zsolt, (2016), suggests that the education system has to give special attention to nurturing the imagination and creativity of teachers and their students. Allam, (2006), also points out that while the teacher is developing films for instance, the other set of transferable skills, such as research skills, collaborative working, problem solving, technology and organisational skills develop. I observed these skills in practice among the participating teachers during the workshop and practice periods when they were developing TPACK. The development of these skills is consistent with what this study aims at achieving among teachers. One important point to note, however is that to produce innovative materials (such as films in the case of this study), teachers would have to deal with the challenge of capitalising on the creative features built in the digital tools or software they select (Galbraith, 2004). Thus, researchers argue that the use of technology act as a catalyst to creativity and transformation of the classroom space (Henriksen, Mishra and Fisser, 2016; Zhao, 2012; and Matzen and Edmunds, 2007).

As far as the technology features that handle the creativity aspects are concerned, the Moviemaker, for instance has built-in features such as Visual effects, Transitions / Animations, 'add music' and 'record narration', and 'Timeline', which are used to enhance the quality of the film. This software also has the interactive features of modern web-based media players, which the participating teachers used a lot to promote 'active viewing' approaches (Galbraith, 2004), with their pupils/students. Ultimately, teachers should be able to develop new, innovative and supportive pedagogies woven into content with the relevant technology that can encourage independent creativity in them and subsequently in their students.

2.7 Mobile Phone Camera Use as a Technology Tool in Teacher Practice

The potential of films to teaching social studies as discussed in section 2.6, pre-supposes in my view, that the mobile phone camera used in taking lesson-related pictures to make films to use as TLRs is equally important and useful. Thus, in order for teachers to appreciate the importance of mobile phone cameras in their professional practice, we need to consider the level of mobile phone penetration in the Ghanaian environment as against the activities for which subscribers commonly use them. This would give us a picture of how much more advocacy is needed for its use by teachers and in turn their students, as a learning tool.

Ling, (2004), further stresses its usefulness that mobile phones have become an almost essential part of daily life, since their rapid growth in popularity in the late 1990s. Larry (2016) also explains that “Mobile technology is seen as a game changer and lifeline for the West African nation”, (i.e. referring to Ghana), “with both urban and rural youth embracing the new technology for their banking and other telephony services.”

This information is consistent with statistics revealing that mobile phone active lines of subscribers in Ghana, as at April 2018, stood at 34.57 million with a penetration rate of 119% (April 2018 Jumia report). This according to Jumia, (2018), is higher than the estimated 28,656,723 population of Ghana with many Ghanaians now owning more than one device. Jumia assigns a number of reasons to explain why the growth in mobile phone subscriptions outstrip the total population. The reasons include i) falling prices of smart phones over the years from 219 US dollars to 65 US dollars in 2017, making it more affordable to increased number of people. ii) Increased number of people now like to own mobile phones to have access to Internet for online payment transactions. The Chief Executive Officer (CEO) of Jumia, (2018) adds that there has also been a push for telecommunication companies to expand their network coverage, availability of cheap smartphones from China and the presence of a robust legal regime.

Table 2.3, presents most common phone activities in Ghana. These include Facebook, (54%), sending SMS/text (40%), listening to radio, (40%), taking photos (37%), instant messaging, (34%), playing games (33%), downloading apps, (31%), and Twittering (13%). With the comparatively low percentage recorded in photo taking, one can conclude that mobile phones are not as much used for picture taking as they are for the first four activities.

Table 2.3: Most commonly used mobile phone activity in Ghana

Phone Activity	Ghana
Going on Facebook	54%
Send SMS	40%
Using FM Radio	40%
Browsing the Internet	51%
Taking Photos	37%
Instant Messaging	34%
Playing Games	33%
Downloading Apps	31%
Twittering	13%

Source of Information: Data for Ghana selected by researcher from information given for five countries. <http://www.itnewsafrika.cohttp://citifmonline.com/2015/04/08/study-reveals-ghana-mobile-phone-usage-stats/>

In my view, school administrators and other concerned stakeholders can capitalise on its low use in picture taking to advocate its increased use in schools as a learning tool, especially as the technology integrated into pedagogy in this study is mainly the mobile phone camera.

Furthermore, the Ghana Business News Agency (2015) reported on a research, conducted by a group of researchers from the Department of Geography and Regional Planning of the University of Cape Coast (UCC) in Ghana.

The research was conducted in the Central and Brong Ahafo Regions among the youth between the ages of 7 and 25 years on the impact of the use of mobile phones in the

areas of education, health, job creation/search, livelihoods/incomes, religion, surveillance, exploitation/safety, harassment and bullying. The study revealed that even though 29,531,488 people have subscribed to mobile phone use from the six service mobile phone providers⁴, there is no national policy guiding its use. The research also revealed that people use the mobile phones in educational institutions for storage purposes, media players, navigation, encyclopaedia, appointment bookings and new portals. It is important to note, however that no mention has been made of picture taking with mobile phones among this age bracket. The research recommended formulation of policy guidelines for monitoring and supervision to regulate its use, as well as pragmatic measures to integrate the use of mobile phones into the educational system to enhance national development.

The figures in Table 2.3 and the survey findings suggest that a reasonably large number of people between 7 and 25 years (who in my view could be school going, including Basic school) own mobile phones but hardly use them for taking pictures. Teachers, in collaboration with their students can use the mobile phone camera as a learning tool. However, even with the ICT4AD, the ICT4E policies and programmes and the Annual Educational Sector Operational Plan, (AESOP), (2010 – 2020) in place, there is still a ban on mobile phone use by teachers and students in schools. This sounds a contradiction, as if in one breadth, there is the promotion of ICT use but in another breadth, authorities curtail or disallow its use (Agbe, 2013). I take the stance of Agbe, who suggests that the introduction of mobile technology should go hand-in-hand with teacher training to support the teachers. He explains that mobile technology requires a different approach to instruction. In his view, “the approach requires a collaborative, interactive exploratory approach, where questions are asked, answers sought and the teacher provides the guidance for a successful learning experience” (Agbe, 2013).

⁴ These six mobile phone service providers include i) MTN Ghana, ii) Vodafone, iii) Tigo, iv) Airtel, v) Glo.

One can, therefore reason that i) if mobile phone subscriptions are high to even outstrip total population, then teachers and students should be allowed to capitalise on its popularity and affordances and use it as a learning tool to support teaching and learning activities. ii) The government of Ghana could engage in a national dialogue and subsequently, chart a policy direction on how basic schoolteachers and students can use the mobile phone as a potential learning tool. This move will not only lead to lifting the current ban on both teachers and students using the mobile phone in schools, but will also lead to regulation, monitoring and supervision of its use to explore its benefits to teaching and learning.

2.8 Summary

This chapter reviews literature related to technology use as a tool for teaching and learning. It examines some key operational definitions of terms used in the study such as 'Technology', 'Technology Integration', 'Pedagogy' and Context. The chapter reveals that technology consists of two categories of i) traditional pedagogical technologies, such as the pendulum, chalk, chalk board and pencils, and ii) the digital technologies such as software applications, computers, iPads, mobile phones and cameras.

On the issue of technology integration, the review points out that it has no standard definition. However, the general trend emanating from the definitions, tend to focus on technology integration being a seamless use of technology as a tool to teach curriculum content in such a way as to enhance the student's, participation, understanding leading to the attainment of learning objectives. The meaning suggests the need for teachers to teach content with technology tools and not teach the tools per se. The chapter also stresses the importance and benefits of technology integration in classrooms in particular. It points out that being in the digital age, especially affords the opportunity for innovation of new teaching methods / techniques, to enable learners in public basic schools, in particular, to acquire new knowledge, interpret and analyse new information

effectively in order for them to be able to fit into the fast changing technological and globalised world.

A review of the term *pedagogy* revealed that it is a complex and debatable term as experts in that area of research, define the term variously based on their own inclinations. A close examination of the term suggests that its focus is mainly on the learner. Bruner (1986) emphasises learner-centredness, as well as the teacher's attitude, experience, teaching skills, relationships, grounding in the subject matter, teaching methods adopted, and context (school, classroom and community), within which the teaching is taking place. I also discussed issues on the role of context in relation to technology integration.

The chapter proceeds to examine some technological and pedagogical conceptual models and explains why the study specifically applied the Technological Pedagogical And Content Knowledge (TPACK) framework / model constructed by Mishra and Koehler (2006), as the theoretical underpinning for the study. Other relevant issues reviewed in this chapter include the potential of films in teaching Social Science subjects (i.e. in this study, Citizenship Education and Social Studies), the mobile phone environment in Ghana and its main uses by young people, and the potential contribution of mobile phone cameras as a technology tool in teacher practice. The chapter concludes by making a strong case to suggest that educational institutions need to have policy guidelines to regulate and monitor mobile phone use. In addition, the guidelines should indicate to teachers, young learners, all and sundry, to view the mobile phone as a learning tool, to project creativity in both the learner and the teacher.

Chapter 3: Research Methodology and Methods

3.1 Introduction

This chapter details and justifies the research methodology and methods used to investigate the research questions stated in Chapter 1 of this thesis. As pointed out by Blaikie, (2000), a methodological approach in research is a broad concept that covers the whole research process. Dunne, Pryor and Yates, (2005: 11), further explain that “the research process usually starts with a concept and ends with a text, in such a way that the space in-between is usually shaped by the decisions (which comprises the methodology), that the researcher makes about how to proceed.” According to them, within the research process exists a link running through the identity of the researcher, the context of the research, as well as the researcher’s own beliefs, values, conceptions and knowledge of issues within that social context. The social context in itself, they assert, is a factor that lends certain power to the text. This implies that the researcher, playing the role of one of the actors, is in the process of constant social construction – meaning that the researcher is jointly constructing knowledge with the researched (Dunne, et al., 2005: 11). Consistent with this argument, are the views of Angen (2000: 385), who points out “... because we cannot separate ourselves from what we know, our subjectivity is an integral part of our understanding of ourselves, of others, and of the world around us”. Further building on these fundamentals within the research process, I adopt a constructivist position, which is also relativist, transactional, subjectivist (Guba and Lincoln, 1998), methodological position in this study that enabled me to combine the process of inquiry and exploration with substantive and theoretical issues to address my research questions.

In the ensuing sections of this chapter, I reviewed the common philosophical assumptions that determine research processes, and identified and validated the selection of the interpretive paradigm for the study. Other issues I discuss in the chapter include an explanation of how the study sits within a macro and micro political space. I

also discussed the research design and strategies underpinning the study, the research setting, sampling procedures, profile of the research participants and the data collection methods. In the sections ending the chapter, I discussed the ethical considerations of the study, the methods of data analysis, dependability of data (i.e. data validity) and concluded with a summary of the chapter.

3.2 Situating the Research

3.2.1 Epistemological and Ontological positions

Situating the research within a suitable ontology and epistemology, as well as an appropriate research methodology was necessary in order to enhance a deep exploratory enquiry into the research participants' perception and practice of technology integration into teaching and learning in their classroom contexts. Researchers hold different specific assumptions or worldviews, based on their beliefs, values and interpretations about how they will learn and what they will learn during their research (Creswell, 2003). This, in turn, underlies the entire research process adopted to conduct the research. Lincoln & Guba, (2000) and Mertens, (1998), refer to these claims as paradigms. Kuhn (1962), who reportedly was the first to have used the term, referred to a paradigm as a research culture, which the members of a scientific community, and they alone, share (Kuhn, 1977: 294). This culture would include a set of beliefs, values, and assumptions that this community of researchers have in common, regarding the nature and conduct of research. A number of researchers like Guba and Lincoln, (1998), point out that the research process has three major elements of ontology, epistemology and methodology. They identify them under two opposing paradigms – that is positivist/objectivist and subjectivist/interpretivist. Guba and Lincoln, (1998) argue that whichever perspective one leans on, whether it is towards the natural sciences or towards the social sciences, determines the way one conducts the research and the research methods to adopt.

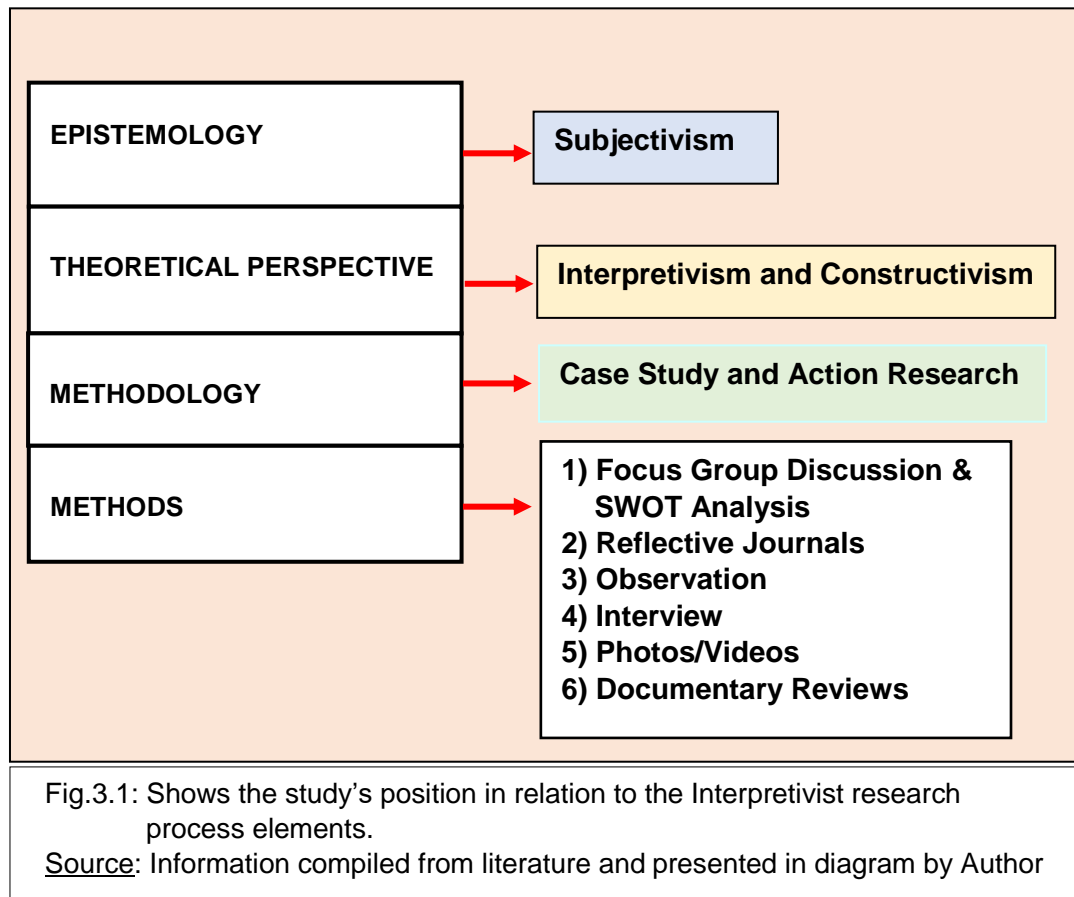
Epistemology, on the other hand, is “the nature of the relationship between the knower or the would-be knower and what can be known” (Guba and Lincoln, 1998: 201), or “how we know what we know” (Crotty 1998: 8). In other words, epistemology is about knowledge, and the way we acquire that knowledge.

Ontology, according to Dunne, et al., (2005: 14), refers to “the nature of being, to how things are in themselves”. Meaning, to the researcher, he/she will be asking the question, “What is the nature of the social’, or what is the nature of my claims to know about myself and the world and how do I justify those claims? They further explain that these questions link to epistemology and determine how we perceive and carry out our research. Crotty (1998) earlier on cautions that this link should not disentangle ontology from epistemology because both are mutually dependent and difficult to separate.

To Crotty, (1998: 10), “to talk about the construction of meaning (epistemology), is to talk of the construction of a meaningful reality” (i.e. ontology). Dunne, et al., (2005: 164) support the same view that “within research it is difficult to speak of epistemology without invoking ontology”. Thus, Crotty’s identification of the four elements of i) epistemology, (with ontology embedded), ii) the theoretical perspective, iii) methodology and iv) methods, constitute the research process. From Crotty’s argument, it is noticeable that, even though four elements within the research process do not visibly include the term, ‘ontology’, it is not mutually exclusive from the epistemology element. Within the positivist tradition associated with Auguste Comte (1798 –1857), there is the belief that one can use observation and reason to understand human behaviour (Cohen, Manion, & Morrison, (2011). That is, one can arrive at genuine knowledge based on the senses and enhance it through observation and experiments. The positivists believe that to investigate social phenomena, scientific methods, like those applied to the natural sciences, are used (Oldroyd, 1986). They do not believe in the influence of the human factor in the equation. Rather they believe that scientific knowledge consists of facts whose ontological reality is independent of social construction. Charmaz, (2006) points

out that the positivists believe that data is lying 'out there' to discover and derive theories out of them.

Within the interpretive framework, on the other hand, the researcher tries to make sense of what s/he is researching, relying heavily on naturalistic methods such as interviewing and observation and analysis of existing texts. Both the subject (the researcher) and the object, the (researched) have a stake in the interpretation of the situation on the ground from their own perspectives – “they are both interactively linked, so that the ‘findings’ are literally created as the investigation proceeds” (Guba and Lincoln, 1985: 207). By so doing, both the researcher and the researched collaboratively construct a meaningful reality (Habermas, 1984: 109-10) and Giddens, (1976), refer to this process as 'double hermeneutic'. Interpretivists assume that individuals construct reality, based on how each person interprets and understands things and researchers seek to understand situations through the eyes of the participants (Ringer, 1997). Thus, two people do not necessarily have to have the same interpretation or understanding of the same issue. Again, researchers acclaim that the Interpretivists situate interpretations of participants in the particular setting or state of affairs and time. This is why in the Interpretivist paradigm, dialoguing within the research community is permitted. Following these submissions, I situate my study in the Interpretivist tradition and positioning myself in the constructivist methodological stance. Therefore, I engaged my respondents in discussions through focus group discussions, face-to-face interviews, observations and reflective diaries, which assisted me to interpret information, gathered in a 'double hermeneutic process' - a process of understanding and interpreting the social situations within which my participants practised their profession (Cohen et al, 2011: 31, 349). Figure 3.1 shows the summary of the position I have adopted for this study. This position relates to the research paradigm and interpretivist research processes, which include the research methods.



3.3 Macro-Political and micro-Political Issues

3.3.1 Macro-Political Issues

Dunne, Pryor and Yates, (2005) argue that macro and micro-political issues are forces playing a crucial role in conducting research. A number of macro and micro political issues affect this study also. In the case of Ghana's education sector, for example, there are several policy documents, that the MOE (the policy formulating body) has handed down to the GES (one of its policy implementing agencies) to implement. One such policy is the Education Act 778 of 2008. The act behoves the GES to ensure that the education sector produces "well balanced individuals, with the requisite knowledge, skills, values, aptitudes and attitudes to become functional and productive citizens ...". (Republic of Ghana, 2008: 3). Yet even if certain heads of schools and their teachers at the school level are very creative, they may not be able to do much, because the curriculum for schools is centrally developed and is time bound. Besides, such heads are answerable

to their District Directors, who are also answerable to their bosses at the regional level. The Regional Directors are also answerable to Director-General at the Headquarters, who is also answerable to the Minister of Education. The evidently strong and airtight structured power relations seem to limit how far school heads, teachers and their students at the lowest level can go, especially as Ghana uses a centrally developed curriculum.

3.3.2 Micro-Political Issues

From experience, I noticed that any time a GES officer from headquarters visits a school, be it basic or secondary school, the moment the teachers become aware that the visitor is from Headquarters, sees a kind of uneasiness among the teachers. They always feel the person has come on a monitoring or supervisory mission. I was very much aware of this situation when I visited the researched school for the first time. My position as a professional teacher, curriculum developer and a teacher trainer, as well as a monitoring officer from the CRDD of the GES headquarters presented a kind of power relations between the teachers and myself. My position as an inside and outsider practitioner also contributed to easing out any tensions, just as other previous occasions, when I was able to familiarise myself with them. Most of the time, I would pass the comment “I’m one of you.” I did that at another workshop shortly before this research, where the Headteacher and his assistant of the researched school were and so I established the rapport again at the researched school. The moment I passed this comment, they felt more comfortable, relaxed and more open than before. In this instance, I had done some preparatory activities ahead of the research, like going to the school to distribute the Information sheets. Even though I faced the challenge of how to disclose to them about what I was coming to do, (because it had to do with mobile phones, which have been banned in schools), the detailed description as spelt out on the Information Sheet did the greater part of the work and they were eager and ready to participate. Another groundwork I did was to have enough discussion with the head of school even before I

brought him a letter from the gatekeepers at the Headquarters. At least, I believed the interpretation of my identity enabled all of them to read my presence properly in the situation I was focusing on (Mandell, 1988).

3.4 Research Approach

3.4.1 Selection of Appropriate Research Approach

The nature of the research questions I posed bears an influence on the methodological approach needed to shape the appropriate research approach that I assumed for this study. For example, questions starting with 'To what extent are basic school teachers ...?' and 'How can teachers explore...?' and some questions in the face-to-face interview sections, such as Q17 'How did you feel introducing this new technology (Films) to your pupils?' Q28. 'What did you enjoy doing most with the technology and why?' Q29. 'In what way did the technology help you to improve your teaching-learning activities?' were questions, which needed a lot of enquiry and investigation to be undertaken. Consequently, the questions demanded a particular research approach and design, which further influenced the various methods that would meet the target set. In addition, the nature of the questions showed that a case study approach requires a small sample size (Creswell, 2003) to be able to conduct an in-depth study. Furthermore, knowing very well that the study demanded a form of training as an intervention, the study included an action research element with its accompanying research methods, which included dairies, focus group discussions, observations and interviews. This enabled the collection of first-hand data and allowed the participants to build their confidence level. It also provided them the opportunity to voice out their opinions freely.

3.4.2 Research Design

The research design adopted in this study, followed Lincoln and Guba's (1985) idea of what they described as "naturalistic" enquiry, which they also admitted later in 1998 as a form of constructivism, which I touched on in section 2.2.3 of the study. The study

involves a single case study (Stake, 1995), with an element of a single cycle action research. This two-in-one design ties to interpretative enquiries, which in turn influenced the kinds of data collection methods, such as Focus Group Discussion, reflective journal entries, observation and face-to-face interviews. The action research which embodies an open-ended process of coming to 'learn and share', follows Lewin's (1946, 1948) 4-staged codified action research process of i) Planning, ii) Acting Implementing, iii) Observing and iv) Reflecting. As mentioned earlier, the study engaged in a collaboration with five Social Science teachers in a peri-urban public basic school. The ensuing paragraphs elaborate on case studies, especially, the single case study design, which this study uses, its strengths and justification for its adoption, as well as a full description of the processes followed. I discussed the action research element of the design in detail in section 3.4.4 of this chapter.

Concerning case studies, literature concedes that there are multiple definitions. Researcher Robert Yin, for instance, defines the case study research method "as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (Yin, 1984, p. 23). Merriam, (2002: 8), defines it as "an intensive description and analysis of a phenomenon or social unit such as an individual, group, institution, or community". Bromley (1990: 302) also defines it as a "systematic inquiry into an event or set of related events which aims to describe and explain the phenomenon of interest". According to Denscombe (1998), case studies involve the study of a particular group or organisation selected and events are studied in-depth as they occur naturally, unlike would have been the case of a survey.

Zucker, (2009), asserts that researchers use the terms "case study", "case review" and "case report" loosely in scientific and professional literature, but its key features are its scientific nature and evidence-base for professionals. Other features of case studies are that it researches an 'instance in action' (Adelman, Kemmis and Jenkins, 1980), studies

a case in a context, (Yin, 2009: 18), and studies a single instance in a bounded system (Creswell, 1994: 12). Critics of the case study method believe that the study of a small number of cases can offer no grounds for establishing reliability or generality of findings or conclusions (Zainal, 2007). Others feel that the intense exposure to study of the case biases the findings. Some dismiss case study research as useful only as an exploratory tool.

These notwithstanding, case study research through reports of past studies, allows the exploration and understanding of complex issues. Researchers considered it as a robust research method, particularly when it requires a holistic and in-depth investigation (Zainal, 2007). Case study is a unique way of observing any natural phenomenon, which exists in a set of data (Yin, 1984). The purpose of case studies is to collect comprehensive, systematic and in-depth information about particular cases of interest. A case can be a person, an event, a programme, an organisation, a time or a community. The case study attempts to describe the unit in depth and detail, in context, and holistically.

Case studies are particularly useful when the researcher needs to understand particular people, problems or situations in great depth, and when information-rich cases can be found which provide great insight into the phenomenon in question (ERNWACA, 2006). The strength of case studies is that they recognise effects in real contexts (Cohen et al., 2011). Yin further explains that case studies provide an exceptional example of real people in real situations and this makes readers understand ideas expressed more clearly than just presenting the ideas in the abstract. Case studies also stand the advantage of including direct observation and interviews with participants (Yin, 2009), making it possible for the researcher and the researched to have close interaction. They involve looking at a case or phenomenon in its real-life context, usually employing many types of data (Robson, 2002: 178).

Regarding types of case studies, Stake, (1994) identifies and classifies them into 3 main types, i) intrinsic case studies (undertaken to understand a particular case) ii) instrumental case studies (examination of a particular case in order to case an insight into an issue), and iii) collective case studies (groups of individual cases, studied to gain a fuller picture). However, Yin identifies 4 main designs as i) the single-case design, ii) embedded single-case, iii) the multiple-case design and iv) the embedded multiple case study. The case study approach used in this study is a single-case design and as the name implies, it focused on a critical case – exploring how teachers can integrate technology into pedagogy at the basic level of education. Thus, the aim of this research fits into the features of a single case study, as it depended heavily on gathering participants' opinions, experiences and reflections of the situation researched. Similar justification for a case study approach is found in Yin, (2009). Based on the justification, the study therefore allows for an in-depth study, which taps multiple data sources and information to enable the readers to understand better, the exemplary use of technology in teaching in the selected school. A further reason for using the case study approach is to enable the findings to inform and direct national dialogue and policy formulation, at least for basic schools, which have similar characteristics in the researched school.

Overall, the research design embraces an exploratory enquiry comprising five major threads of enquiry. Having once been a classroom professional practitioner and moving on to becoming a curriculum developer and teacher trainer, the justification for adopting an enquiry approach is the desire I have to enhance my own knowledge about the experiences classroom teachers gain in technology-integrative teaching. This, in my view, will enable me make a contribution to this field of research. The approach also aims at offering teachers the opportunity to engage in collaborative work, thereby building their confidence to voice out their experiences and opinions on integrative teaching in their own context. In addition, to co-construct knowledge that they, the teachers can share with other colleague teachers, students and the research community.

Giving the voice to the participants supports McNiff's assertion, (2013) that knowledge is socially developed. In the third edition of her book, *Action Research, Principles and practice*, McNiff (2013: 17) agrees with Lave and Wenger, (1991) that 'knowledge situates itself within the groups of people who create it', and that it is a collective endeavour among individuals who share the practice even though its usages for broader impact, is endless.

The first major thread of enquiry for this study was into the teachers' knowledge of technology, pedagogy and content and the relations among these three domains (TPACK). It involved a collaboration with five social science public basic school professional teachers – three (teaching citizenship education) at the primary school level and two (one teaching social studies and one teaching ICT) at the Junior High School (JHS) level. It also required teachers' review of their own already-prepared and taught lesson plans that they think could have been taught and understood better if they had used films to support their teaching-learning. By this activity, I gave the teachers the opportunity to not only self-assess their knowledge of TPACK but also appreciate the TPACK as the integrated 'amalgam' of knowledge required to do technology-integrative teaching. Roblyer & Doering (2010) in Harris, et al., (2010), suggest TPACK self-assessment as the initial step in each stage of instructional decision-making.

Consistent with this view is the study of Harris, et al., (2010), which identifies three types of data for assessing teachers' TPACK. They suggested i) self-report, gathered through interviews and surveys, or other generated documents, such as reflexive journal entries), ii) observed behavior, and iii) teaching artifacts, such as lesson plans. They argue that teachers' knowledge is naturally mirrored through their actions, statements, and artifacts, rather than being directly observable. Thus, instruments and techniques that assist the teachers' self-assessment of TPACK, according to them, should provide ways for assessors to recognise the dimensions and extent of teachers' TPACK in systematic, reliable and valid ways.

Asking my research participants to i) review their lesson plans (teaching artifacts), ii) generate individual reflective journal entries coupled with iii) class lesson observations and iv) conducting individual face-to-face interviews with them are data collecting methods consistent with the stance held by Harris, et al., (2010). Harris and Hofer (2009), suggest that in teachers' planning practices, one could adopt a learning activity-based approach to selecting and combining curriculum-related teaching/learning strategies and corresponding educational technologies. I have elaborated on this in chapter 4, following the Learning Activity Types (LAT) model that Harris and Hofer designed.

A second major thread of enquiry in the study was into lesson/context-related film production. This required that participants use their mobile phone cameras to take school and community context related pictures, which are linked to the lesson topics and lesson plans they had developed.

The third thread of enquiry required the participants to use the pictures they have taken and in conjunction with Windows Movie maker software, explore the production of lesson-related films. The pictures required that the participants use these films as Teaching-Learning Resources to support their traditional teaching-learning practices. In addition to this, there was an enquiry into the participants' experiences and reflections during the five days training. They documented these in their individual reflective journals regarding the intervention.

The fourth major thread involved inquiring, through observation, into the participants' practices and experiences of incorporating their lesson/context-related films into their teaching and learning processes. The fifth thread of enquiry comprise individual face-to-face interviews with participants on the whole research process. I elaborated upon the research methods in section 3.7 of this chapter.

3.4.3 Research Strategies

Earlier sections of this chapter stated that this study is a qualitative and descriptive one and adopts the interpretive research paradigm. It uses a single case-study design with an element of a single cycle an action research. The action research forms the substantive basis of this thesis, constituting varied processes of coming to know by collaborating with participating teachers. Within the three qualitative, naturalistic approaches – that is i) phenomenology, ii) ethnomethodology and iii) symbolic interactionism in (Cohen, et al., 2011), my study fits more into the first tradition because the study relied on the direct voices (from experiences and opinions) of the research participants in their specific contexts. In that circumstance, I attempted to understand and interpret information based on the participants' own definition of social reality (Beck, 1979). The study, therefore, adopts both enquiry and exploratory approaches to collect data. It also engages in activities, which the constructivist methodology supports, where I studied subjectivist interpretations of a social phenomenon in the milieu of classroom settings (Denzin, 1998: 318). In effect, the study adopted Focus Group Discussion (FGD), supplementing it with SWOT Analysis.

I also introduced reflective journal entries, participant and non-participant observation, individual face-to-face interviews and documentary reviews as methods for data collection. I included videos and still picture taking to add to transparency of my data. All these aimed at ensuring triangulation (Rose, Spinks & Canhoto 2015; Yeasmin & Rahman, 2012). Triangulation entails using various data sources in an enquiry to yield better understanding (Merriam, 1995). Rose, et al., (2015), also share a similar view that triangulation is the process of using multiple sources of data or multiple methods to crosscheck the validity of your findings. I transcribed data, which I gathered digitally in MP3 format into text and wrote it in a synthesised format into relevant points. I examined other data from the interview and reflective journal entries. I put data that emerged and stated more frequently into categories. Then I grouped them into themes under the

research questions to do the analysis, using deductive thematic approach, which I set against a predetermined analytical framework.

Overall, data gathered aimed at revealing how teachers are actively using technology to teach and how they can explore the use of technology tools to improve teaching and learning and the experiences gained in the process. As a case study, it becomes suitable to write the report “as a descriptive narrative, often chronologically, with issues raised throughout” (Cohen et al., 2011: 539). Even though I analysed the data within a predetermined frame of key issues that cross the individual participants, I did not lose sight of the importance of individual verbatim data and reflections, which in any case, formed the bulk of the research data, in my view. Reports suggest that some researchers like Ball (1990), and Bowe, Ball and Gold (1992), have quoted many verbatim data in reporting.

3.4.4 Action Research Design – Single Cycle

Literature reveals that Kurt Lewin (1946) is the first to develop an Action research model in the 1940s to respond to some World War II problems he identified in social action (Kemmis and McTaggart, 1990). Lewin perceived action research as calling for group decision and commitment to improving situations in a particular setting (Dickens & Watkins (1999). The action research model Lewin constructed ‘consisted in analysis, fact-finding, conceptualisation, planning, execution, more fact-finding or evaluation; and then a repetition of this whole circle of activities; indeed, a spiral of such circles’ (Sanford, 1970: 4; Lewin, 1946). Literature further reveals that Lewin, however, left very scanty work of only 22 pages on the topic (Peters and Robinson, 1984) and “never wrote a systematic statement of his views on action research” (Argyris, Putnam, and Smith (1987: 8). Dickens and Watkins, (1999: 128), also suggest that perhaps because Lewin was unable to fully conceive his theory of action research before his death in 1947, that could explain why he left the field open for other similarly-minded researchers to

expatiate on and reinterpret his definition. Nevertheless, he left an action research model, (Fig. 3.2a) which depicts the action research processes as “a cycling back and forth between ever deepening surveillance of the problem situation (within the persons, the organization, the system) and a series of research-informed action experiments” (Dickens & Watkins, 1999: 128). In this model, Lewin constructs key activities forming the processes of a single complete cycle, to include *planning*, *acting*, *observing* and *reflecting*, which this study also follows.

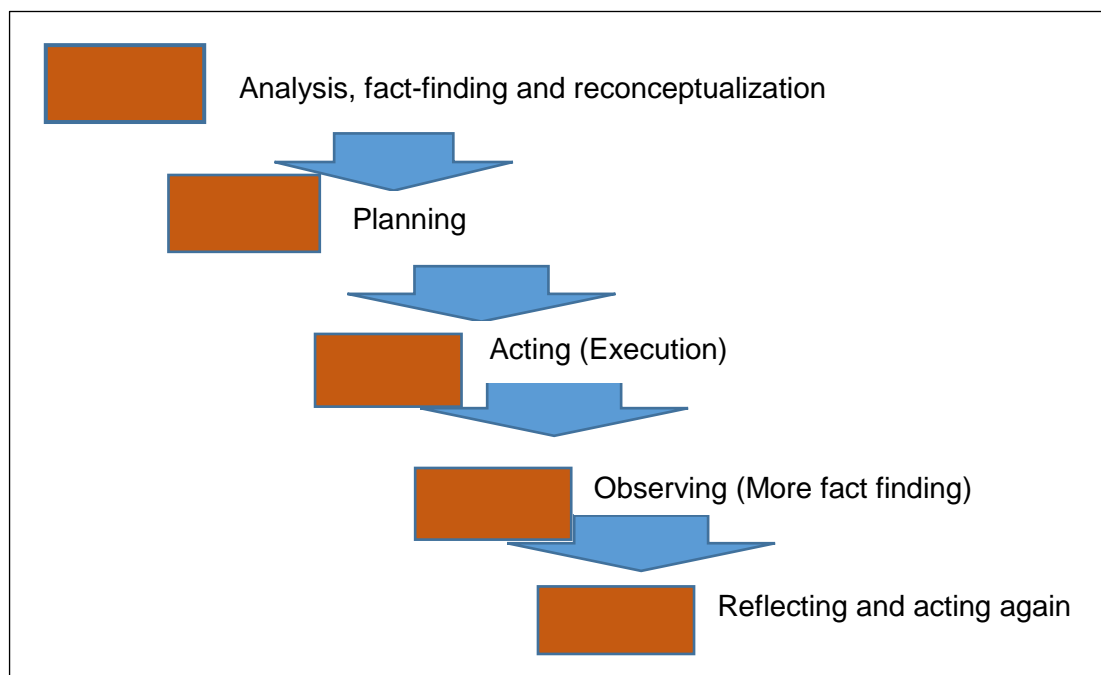


Fig. 3.2a: Lewin's Action research model — phases that he originally depicted as a spiral. Author adopted model from Dickens & Watkins (1999: 133).

Several other researchers who followed Lewin attempted various definitions of action research. McNiff and Whitehead, (2006: 7), say action research is a form of enquiry that enables practitioners in every job and occupation to investigate and evaluate their work. They ask ‘What am I doing? Do I need to improve anything? If so, what? How do I improve it? Why do I improve it?’ Other researchers like Postholm, (2009), Rönnerman, Furu, & Salo, (2008) and Zeichner, (2009) regard action research, as a means of encouraging teachers’ professional development. A broadly acknowledged definition of the term is that it is a self-reflective enquiry undertaken by participants in social situations

(Carr and Kemmis, 1986). The definitions from literature generally have a central theme running through - that it is a systematic study that combines diagnosis, action and reflection with the intention of improving practice (Ebbutt, 1985: 156). Cohen and Manion (1994: 186) sum it up “as a small-scale intervention in the functioning of the real world and a close examination of the effects of such an intervention”. The essence of action research is to improve (a) people’s own social or educational practices, (b) their understanding of these practices, and (c) the situations of the practices (Carr and Kemmis, 1986). It also has a learning component for researchers because they are able to improve their own professional practice (Dick, 2002). McNiff, (2002: 6) explains that action research acts as “a powerful tool for change and improvement at the local level” and that it aims at solving specific problems within a programme, organisation, or community. She identifies these problems as ranging from teaching methods, learning strategies, continuing professional development of teachers or nurses or other professionals to evaluative procedures (McNiff, 2002).

One important feature worth noting about action research is that it can be participatory and collaborative, making people work towards the improvement of their own practices. In that vein, there is no longer any separation between the researcher and the participants and the research becomes a collective and shared enterprise, including data generation (McNiff, 2013: 8). McNiff elaborates further that the focus of action research is not on the ‘I’ as the centre of the enquiry from the ego-centred researcher-centred perspective – i.e. seeing the ‘I’ in isolation or as the centre, but rather the ‘I’ works in collaboration with others. She explains it as the ‘I’ being in a “dialogical relationship with others”. Elaborating on this point, I can say that in this study, I am in a dialogical relationship with others, and others with me and others. In her book *Action research: Principles, Theory and Practice*, McNiff further echoes Kristeva, (2002: 162) in an interview with John Lechte that:

Each person has the right to become as singular as possible and to develop the maximum creativity for him or herself and herself. And at the same time, without stopping the creativity, we should try to build bridges and interfaces - that is sharing.

Supporting this view, I left a large enough space for my research participants to manoeuvre to explore their own ideas, understanding, creativity, artistic and pedagogic skills to come out with their own information and lesson-related films which they think will support their traditional teaching and learning. Besides that, the participants played a double role – as research participants, as well as researchers, who gathered data by way of documenting their own reflections and experiences in personal journals. This was possible through making notes from observing their students' behaviours, attitudes and their reactions towards the introduction of films to support teaching and learning activities. This enabled me to collect first-hand information from the researched in their own context. I remained more a facilitator and a guide rather than a 'sage on the stage throughout the study.' By so doing, the participants were able to boost their confidence levels, increase their awareness of classroom issues and change their values and beliefs, (Noffke and Zeichner, (1987), that they can also prepare TLRs, using technology. Ferrance, (2000: 1), also acclaims that a dominant justification for action research is that teachers work best on problems that they have identified themselves.

Besides, they become effective when they are encouraged to examine and assess their own work. Patton (1990) also points out that design and data collection in action research tend to be more informal, and the people in the situation are directly involved in gathering information and studying themselves. One other merit of action research is that participation of teachers in the research supports education development as they learn new things to improve the system.

Action research also has a number of demerits. One of them is that it does not allow for the inference of causal relationships (McNiff and Whitehead, 2006). Another demerit is that since its aim is mainly problem solving in a particular setting, the relevance of any

findings cannot be applied to any other research setting beyond the one researched (Rose, et al., 2015). Those who hold the positivist tradition also see it as unscientific. Despite these and other demerits identified with action research, the preceding merits encouraged me to adopt the action research as one of my research designs.

Finally, it is worth noting that Zuber-Skerritt and Perry (2002) identify two action research cycles actually functioning side-by-side, if the research conducted is part of an academic assessment. The first or inner cycle is the 'core' action research cycle. It focuses on the practical aspect of the problem, which the researcher intends to solve. The second or the outer cycle is the 'thesis' action research cycle, in which the researcher involves in planning, acting, observing and reflecting, as far as the academic part of the research project and their learning derived from it is concerned. The core action research, which is the fieldwork component of the whole research, (shown in the core of Fig. 3.2b), consists of planning, acting, observing and reflecting and involves the candidate within a workgroup of practitioners in an organisation. The written report of this cycle is in the first-person plural and in narrative form. Zuber-Skerritt and Perry (2002) point out that the core action research cycle represents the 'act' and 'observe' stages of the researcher's own thesis cycle (Figure 3.2b). Rose et al. (2015), explain that during the core research cycle, one can apply theoretical frameworks to assist in diagnosis. They further echo Coghlan and Brannick's (2010: 93) assertion that such frameworks can also provide a basis for "conversation and mechanisms for collaborative sense making and joint action planning and action". The thesis action component (the outer part of Fig. 3.2b), also focuses on the planning, acting, observing and reflecting and it involves workgroups similar to action learning, which seminars and supervisors, for instance, support to fulfil the thesis requirements. Thus, two main goals emerge from this kind of action research project – how it can enhance learning within an organisation and how it can contribute to the body of knowledge and understanding that benefit the university (Perry and Zuber-Skerritt, 2002). Coghlan (2007: 293), explains that the output

is “actionable knowledge” that is beneficial to both the practitioner (also the researcher) and the academic communities.

Figure 3.2b shows the core and the thesis cycles of the action research.

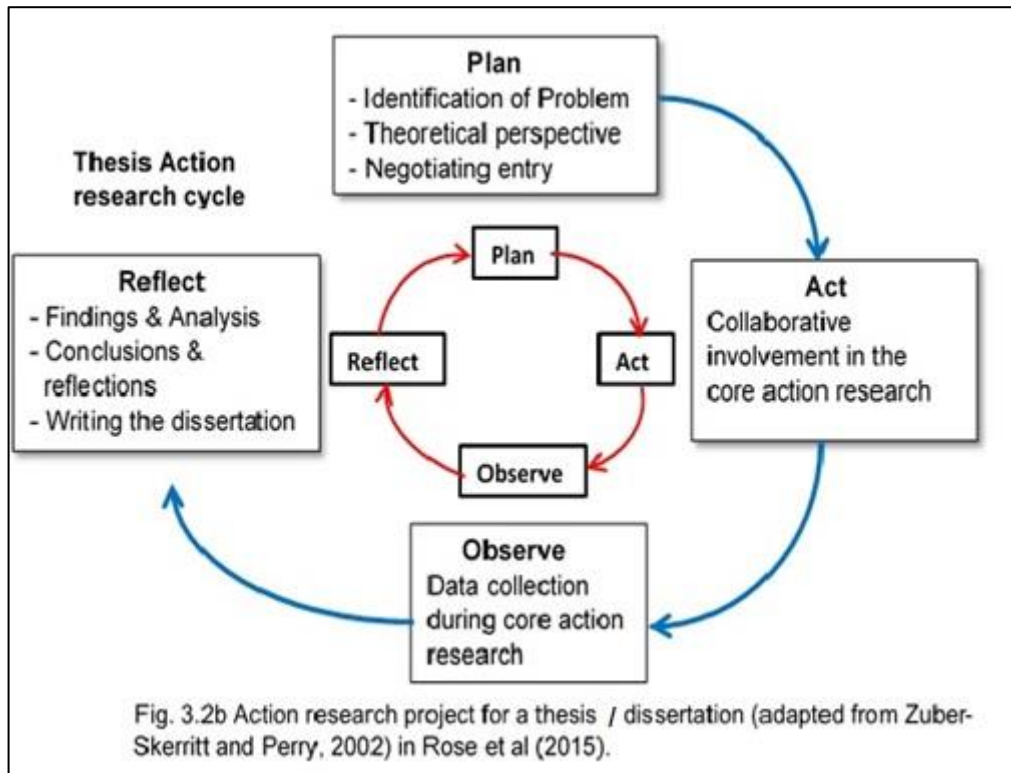


Table 3.1 shows the list the activities done at various stages of the Action research. The activities are grouped under the four stages (i. Planning, ii. Acting, iii. Observing, iv. Reflecting) of the single action research cycle.

3.5 Process of School Selection

3.5.1 Sources of Information on schools

Searching for a public Basic school with a possible environment for the study formed part of the planning. I first sought for information from i) the ICT coordinator of the Ministry of Education, ii) the Ghana Education Service ICT officers and also from the iii) Circuit supervisors and training officers attached to the District Directorates of the GES on possible schools from which I could visit and select one that satisfies the conditions for my study. Information gathered from these offices revealed that very few schools fell within the defined criteria for choice. For instance, one of the schools had 24/7 solar-

panelled electricity for the computer laboratory and the required infrastructure conducive for the training and study, but none of the teachers live in the school community which has no electricity. They all reside in a bigger town 12 kilometres away and if I were still to carry out the training, it would have disrupted normal classes.

Table 3.1: List of activities done at various stages of the Action research	
Step 1: Planning	<ol style="list-style-type: none"> 1) Literature review and problem identification 2) Proposal writing and approval. 3) Discussions with ICT-GES-MOE officers, School heads, Circuit supervisors and Training officers about possible schools legible for the type of study to engaged. 4) Searched for a school. 5) Letters to and from Gatekeepers. 6) Reconnaissance stage (Focus Group Discussions). 7) School visits. 8) Reflections
Step 2: Acting Core action research (Zuber-Skerritt & Perry, 2002)	<ol style="list-style-type: none"> 1) Planning for the workshop 2) Training Workshop (5 days) <ul style="list-style-type: none"> * SWOT Analysis * TPACK presentation and showing films on TPACK * Review of already taught lessons plans, which could have been taught better if there were supporting films * Film production – group and individual levels * Revision of lesson plans to TPACK-compliant ones * Peer presentation of new TPACK-compliant lesson plans with accompanying films. 3) Data collection in the form a reflective journal entries 4) Lesson observation 5) Face-to-face interviews 6) Reflection
Step 3: Observing	<ol style="list-style-type: none"> 1) Lesson observation 2) Field notes writing 3) Reflection
Step 4: Reflecting	Evaluation of Action research from findings and analysis. Conclusions and reflections; writing the thesis.

3.5.2 Selection process

Ely (1999) suggests some eight very useful guiding conditions (Appendix C) that assist the adoption and implementation of educational technology innovations within an educational setting. However, since ICT integration is at a minimal stage in our public basic schools, as mentioned in Chapter 1, I did not adhere strictly to all of Ely's

conditions, but adapted them to suit our own context to allow for easier selection. In addition, based on the kind of study I planned to carry out, I finally settled on the following criteria that the schools should have to qualify for selection.

- a) A computer laboratory with functioning computers
- b) At least one functioning projector
- c) Social science teachers – who teach Citizenship Education or Social studies and have basic computer skills
- d) Good reception from Head teacher, (leadership) who also expresses enthusiasm for the training of the teachers.
- e) Willingness and commitment of selected teachers.
- f) Constant electricity supply to run the equipment in the laboratory.
- g) Time devoted for the training that will not disturb normal classes.

* I provided participants with free and 'easy-to-access' software (Moviemaker).

The characteristics for choice still made it difficult for the consideration of a sizeable number of schools and thus the selection became purposeful and involved only a handful of schools.

3.5.3 Screening

Among the schools MOE, GES and the circuit supervisors suggested, I visited three of them, which seem to meet most of the criteria I discussed with the education officers. The essence of the school visits was to do my own on-the-spot assessment to confirm my choice of school. To do that, I constructed 10 structured interview questions (Appendix D) from the items listed in section 3.5.2 to administer on a 4-point rating scale of 0 to 3. That is 'None' = (0); 'Low' = (1); 'Medium' = (2); 'High' = (3) respectively. For the 10 questions, the total highest mark was $(30 \div 30) \times 100 = 100\%$. If the school got at least 60% of scores or above, I considered it in the first instance. Only one out of the three schools emerged with a total score of $(23 \div 30) \times 100 = 76.7\%$. This was just to

give me a fair idea of which school to select. Besides this screening method, one factor essential to technology integration is leadership, (Hudson, 2012); (Drayton, et al, 2010), cited in Valiente, (2010). Literature has revealed that lack of support from institutions' leadership has undermined many teacher or student-initiated ICT projects. For ICT integration programmes to be effective and sustainable, Canuel, (2009) suggests that institutions' administrators themselves must be competent in the use of the technology. They must have a broad understanding of the technical, curricular, administrative, financial, and social dimensions of ICT use in education. What I also looked out for was the zeal of the leadership to welcome the training and the study as a whole.

3.5.4 Sampling Process

Following Creswell's (2013) recommendation that case studies should have a sample size of no more than four to five cases, I settled on a sample size of five teachers, three Citizenship Education teachers from primary 4 to 6 and one Social studies teacher who teaches JHS 1 to 3. The school head with the help of the Assistant Headteacher handpicked these teachers for me, based on the characteristic features the study demanded. The fifth participant, who teaches ICT in all the classes in the school, is also one of the Assistant Headteachers. This made my sample a purposive sample. One of Ely's (1999) conditions for implementation of educational technology innovations in educational setups is the issue of leadership, which he says should be two-pronged and necessary. One from the overall head and the other from someone who will manage the project. Ely suggests that the latter would be a guide to other participants in the absence of the facilitator. I therefore chose the ICT teacher because he is the most fully equipped with basic computing skills and was likely to grasp what I planned to share with the group faster, especially when it comes to developing their films. In addition, he would be in a position to relay all that transpires to the Head teacher. Ely (1999: 302) points out that "Even though individuals act alone, especially in classroom endeavors, they need the

inspiration and continuing support of individuals whom they respect. These individuals, often called leaders, provide initial encouragement to consider new ideas ...". The ICT teacher was, thus a participant observer, who was an immense assistance to his colleagues in multiple ways.

The participating teachers, returning their consent forms reinforced their selection. Even though researchers recognise purposive sampling as not representative of the larger population and thus, its findings cannot be generalised, Teddlie & Yu, (2007) explain that the procedure provides greater depth to the study.

3.6 Research setting

3.6.1 Brief profile of the researched School (Socio-economic context)

The researched school with the pseudonym Mondragon Basic School is located at Pokuase, (also spelled Pokoasi), a suburb of Accra, (the capital city of Ghana), in the Ga West Municipal Assembly. The erstwhile Ga municipal, created in 1988, carved out this assembly in pursuance of the government decentralisation and local government reform policy. In 2004, the government divided the Ga Municipality into two with Amasaman, the capital remaining the capital for the newly created Ga West Municipal. Pokuase is not only a town in the municipal but also an electoral area. It is located at the southernmost part of Ghana, as shown in Fig. 3.3.

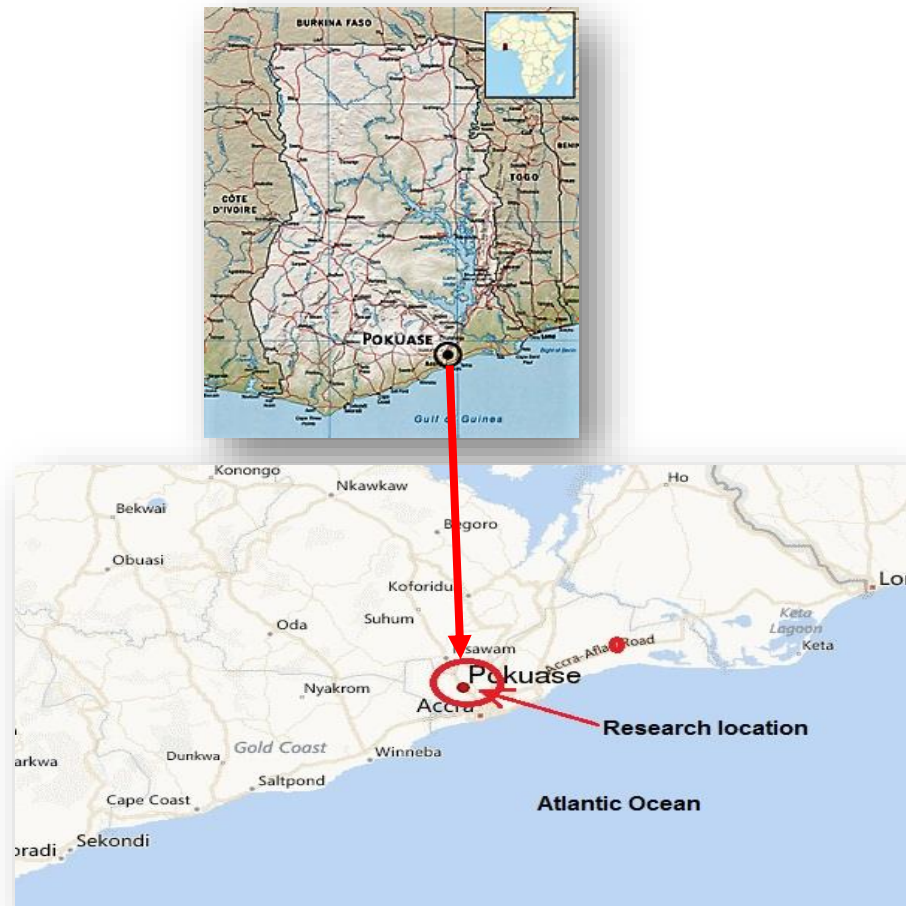


Fig. 3.3: Two maps merged by author to show the map of Ghana and the location of Pokuase – the research site.

Sources of Maps:

- i) Map of Ghana: Google Maps, Google Inc. [Accessed 18-07-16].
- ii) Map of Pokuase: www.google.com [Accessed 18-07-17].
(Researcher added a red circle and 2 relational arrows to complete)

The Municipality lies within latitude 5°35' North, 5°29' North and longitude 0°10' West and 0°24' West of the Greenwich Meridian and occupies a land area of approximately 284.08 sq. km with about 412 communities⁵. The 2010 Population and Housing Census reveal that the municipal assembly electorate has a population of 219,788 with relatively

⁵ Source of Information: Ghana Statistical Service (GSS), (2014).
[http://www.statsghana.gov.gh/docfiles/2010 District Report/Greater%20Accra/GA%20WEST.pdf](http://www.statsghana.gov.gh/docfiles/2010%20District%20Report/Greater%20Accra/GA%20WEST.pdf)

more females, forming 51.0% than males (49.0%). It has a youthful population, with 33.4% of the population below aged 15 years and 4.0% above age 60 years.

Ninety-three percent of the population from 11 years and above are literate (GSS, 2014). About 91.5% of the population who are 15 years and above are economically active. The occupation of the people is mainly in service and sales but 22.6% engage in craft and related trades. One important information of interest to this study is that in the area of ICT, 76.1% of the population 12 years and above own mobile phones. Males who own mobile phones constitute 80.1% and females constitute 72.3%.⁶ The age 12 years quoted in the census report as far back as 2010, suggests that by the time children reach the JHS level, they own mobile phones.

The school is a mission school, housed on the church's compound but run by the Ghana Education Service. Its total student population at the time of data collection was 893 students, comprising 452 boys and 441 girls. A break down reveals the following. At the Kindergarten (KG) level, there are 125 children, (65 boys, 60 girls); at the primary level, there are a total of 518 pupils, (271 boys and 247 girls) and 250 students (116 boys and 134 girls) at the JHS level. Most of the students come from within Pokuase, Amasaman, and its environs.

The classes begin officially at 7:30 a.m., end at 2:00 p.m. Single periods are 35 minutes, and double periods last for 70 minutes. The school's ethos appears academic and well organised in terms of administration and daily routine. In addition, the teachers appear well organised and busy about their duties. The school seems very lively, with children playing during break time. There is also the school bell, which a student rings to indicate the time for each activity. The sound of the bell regulates the activities, such that all the teachers and students know, for example, the time for morning assembly, start of

⁶ Data Source: Ghana Statistical Service (GSS), (2014).
http://www.statsghana.gov.gh/docfiles/2010_District_Report/Greater%20Accra/GA%20WEST.pdf

lessons, change of lessons, break time and closure. The school devotes Wednesday mornings for morning worship held in the main chapel, which belongs to the church mission. There the ICT teacher, who is also the music teacher and one of the Assistant Headteachers of the school, also teaches the students new songs.

The school has two streams, A and B with 30 teaching staff, including one Head of school and two Assistant heads, one in charge of the primary school and the other, the Junior High School (JHS) level of education. The school also has 5 support staff, consisting of one secretary, one cleaner, two security men (one day and one night, both of whom have been employed by the church), and one school attendant, who helps the younger children to cross the main highway to and from school. There is a well-established Parent Teacher Association (PTA) for the school. The school has washrooms and toilets for both students and staff. These are allocated on male and female basis. There is also a newly built health centre for the school, though not in use at the time of the study. One striking thing about the school is that even though it is very spacious, it has inadequate number of classrooms, making the school to house some of their classrooms to under tents. This certainly has a negative implication for integrating technology into teaching and learning because there are no electricity connecting points under the tents. Table 3.2 gives a summary of the profile of the school setting, including infrastructural facilities available in the school.

The computer laboratory houses 40 Windows 7 desktop computers. An alumnus donated 30 of them to the school and the school bought the remaining 10. Out of these 40 computers, 30 were functioning and 10 were not at the time of my research. Findings also reveal that the computers have not been upgraded or updated ever since they were brought to the school. The laboratory has no connectivity, though the ICT teacher said he relies mostly on content from Educational CD ROMs, which the GES provides the school, together with the ICT syllabuses for teaching his ICT lessons.

Table 3.2: Summary of the Profile of the School Setting & Infrastructural Facilities		
S/N	Items	Information
1	School Name	Mondragon Basic School (Pseudonym)
2	Urban / Rural setting	Peri-urban setting
3	Gender type	Mixed
4	Student population	893 (452 boys and 441 girls).
5	No. of Headteachers	1
6	No. of Assistant Headteachers	2 (One for Primary and one for the JHS)
7	Support staff	5
8	Digital technology in the classrooms	None; but there is a mobile projector stored in the computer laboratory.
9	Computer lab and number of computers	1 computer lab. 40 desktop computers, 30 functioning, 10 not functioning; none have been upgraded or updated at the time of research. No connectivity in the computer lab.
10	Technology in school	* Printers (2) * Photocopier (1) * Projector (2). One fixed in the computer lab. and the mobile one not functioning at the time of visit.
11	Health centre (Newly built)	1 (Not in use at the time of visit).
12	Number of Nurses	None at the time of visit.
13	Other	Teachers communicate with parents, via mobile phones
14	Sanitary facility & other infrastructure	* Toilets and washrooms for both staff and students. * Community Chapel (1)* Canteen (1)
Source of information: From author's interview with the Assistant headteacher, who is also the ICT teacher of the researched school and from the FGD.		

3.6.2 Computer laboratory / classroom context

The computer laboratory is an ordinary classroom set aside to house the desktop computers. The laboratory does not have air conditioners or the kind of security windows, doors and locks that one would expect for a school's computer laboratory. Where these are absent, the lab becomes prone to burglary (Banini, 2012). Figures 3.4a and 3.4b show two sections of the inner view of the laboratory.



Fig. 3.4a: The school's computer laboratory – picture by researcher



Fig. 3.4b: The school's computer laboratory – picture by one participant

However, in my view, there are enough windows to keep the room well lighted and ventilated. The room has three ceiling fans to blow air around and florescent tubes to light the room in dull weathers. In the front left-hand corner, when facing the classroom, the ICT teacher has his table and chair and a long enough white board on the front wall for writing. There is also a projector fixed on the ceiling for presentations. There is also a mobile projector, which according to the ICT teacher could be moved from one classroom to the other if a teacher wants to use it for presentation.

The foregoing description of the socio-economic context or profile of the researched school, including the types of educational infrastructure available for example, confirms features that one is likely to find in the suburb (short form of suburban) of any city in Ghana, and for that matter the city of Accra. Vaughan, (2015: 81), reiterating her earlier work in Vaughan, et al. (2010), explains that “suburban areas are not homogenous, but potentially express the same properties of differentiation and scaling as the urban whole, only on a smaller scale”. In terms of development, Stanilov and Scheer (2004), point out that a suburban can be regarded as part of a broader process of peri-urban growth that is happening worldwide. In Ashley Dhanani's contribution to Chapter three of Vaughan's (2015) book, *Suburban Urbanities: Suburbs and the Life of the High Street*, he explains that the functions of suburbs need to be viewed in relation to the whole city. He adds that

one should not ignore the intricate processes that occur at the fringes of cities and their vibrant relationships with the rest of the city and that a suburb within the city system bears an 'inherent symbiosis' with the wider city (p. 53). In other words, suburbs should not be seen as isolated settlements from the cities around which they spring. Likewise, the research school should not be seen as isolated from the city of Accra. Thus, despite the presence of some of the classrooms housed under tents, the generally overcrowded classrooms and inadequate desks for students and pupils, it is still not out of place to describe the school and its environs as a relatively mixed and affluent one - typical of the more prosperous urban and suburban settings of Southern Ghana.

3.6.3 Profile of Research Participants

The profile of the research participants has been summarised in Table 3.3. Information from the table reveals that all 5 teach Social science subjects (i.e. 3 teach Citizenship Education at the primary school level and at the Junior High School (JHS) level), 1 teaches Social studies while the remaining 1 teacher teaches ICT at both primary and JHS levels in the whole school. While one teacher has only 1-year teaching experience and another, 3 years at the time of the research study, the remaining four have between 9 and 21 years of teaching experience. Information from the Table 3.3 also reveals that four out of the five participants are first-degree holders and the remaining one holds a Higher National Diploma certificate. Class sizes at the primary level range between 47 and 61 pupils, while at the JHS level, class sizes range between 92 and 93 students. An additional information not on the table is that the ICT teacher holds ICT classes for the primary school pupils, twice a week, and four times a week for the JHS students.

Table 3.3: Shows a detailed profile of the research participants

Tr.	School Name	Town/City & District	Sex	Class Size	Class taught	Subj. taught	Current rank	Function	Acad. Qual.	Prof. Qual.	Age Grp	No. of yrs. of teaching
1	Mondragon Basic School	Pokuase / Accra - Ga West District	F	61	P4	Math. Eng. Lg. RME Ct Edu. Science Creative Arts	Principal Sup.	Teaching	BED	Dip. Ed	30 - 35	9 years
2	"	"	M	49	P5	"	Snr. Sup.	Teaching	HND	Dip. Ed	30 - 35	1 year
3	"	"	M	47	P6	"	Princ. Sup.	Teaching	BED	BED	20 - 25	3 years
4	"	"	M	93	JHS 1-3	Social Studies	Snr. Sup.	Teaching	B.A (Hons)	Dip Ed	> 40	10 years
5	"	"	M	92	All classes	ICT	Snr. Sup.	Teaching & Admin.	B.A	3-yr Post Secondary	> 40	21 years

Source: Data response compiled by researcher from research participants' information

KEY	
B.A. – Bachelor of Arts	Princ. Sup. – Principal Superintendent
BED – Basic Education Degree	Snr Sup. – Senior Superintendent
HND – Higher National Diploma	Eng. Lang. – English Language
RME – Religious and Moral Education	Ct. Edu. – Citizenship Education
Dip. Ed – Diploma in Education	

3.6.4 Getting to know my research participants

In this section, I make brief introduction of the teachers selected to participate, based on the criteria earlier on mentioned, and who offered to be committed and willing to devote their time to take part in the study. They were part of the collaboration to explore producing lesson/context-related films that they could integrate as a new technology into their teaching and learning processes.

Rating all the five participating teachers, the ICT teacher was by far more basic computer literate (because that is his area of expertise). At the time of this study, none of them had ICT integrative skills, even though they were very willing to acquire the skills. All five teachers also admitted that the C21st demands technology integration into teaching and

learning. The following information about each teacher gives a more differentiated detail that can make each easy to locate with respect to other teachers in Ghana.

a) **Aseda** is a pseudonym I gave to the Basic 4 teacher who is also the only female among the participants. She holds a diploma and a bachelor degree in education and teaches Citizenship Education, one of the social science subjects. She had been in the teaching field for the past nine years, at the time of my study. She is a working mother of two young children, who also attend Mondragon Basic School, where their mother is teaching. She is a professional teacher. In addition, she is an advocate of technology integration in teaching and learning, especially in the use of the mobile phone for internet searches to support her lessons.

Even though before the intervention workshop, she confessed that “My confidence level in using the computer was low”, and that “I realised I needed to improve on my basic ICT skill to be able to effectively use it in the training”, she was very eager to be part of the training and was the first to return her Consent Form. Her eagerness could also have explained why her confidence level in basic computing skills improved over the short period of the intervention. “I have built my confidence a bit on the use of ICT as the days went by.”

A study of her lesson plans prior to the review and revision reveals that they were not TPACK-compliant. However, after the workshop she was able to develop TPACK-compliant lesson plans. She has also become an expert in voice ‘*narration*’, (a feature in movie making), which to my knowledge, social science teachers in general at the basic level are not familiar with. On reflection, she confessed that “... what I accomplished and I am happy about is that I am able to prepare a new lesson plan which integrates technology”. Other reflections during and after the intervention were that, “I think my TPACK-compliant lesson plan is more orderly. Now my teaching will be more child-centred”, “Making a movie is not as difficult as I thought” and that “The most significant event for me today is being able to integrate technology (in this case, a film as a learning

resource) in my lesson plan to make it a TPACK-compliant one". These qualities make her unique and differentiated from other social science basic school teachers.

b) **Sir Jonas** is a pseudonym I gave to the P5 teacher. After graduating from secondary school, he enrolled at the then teacher training college, now upgraded to a tertiary status and currently known as College of Education. His interest in civil engineering made him abandon the then teachers' training for the polytechnic to do a Higher National Diploma (HND) in civil engineering. After graduation, he found the need to go back to teach so he re-enrolled into one of the colleges of education to do a diploma in education. He has been teaching since graduation with one year's experience at the time of my visit to the school. He also believes that technology integration into teaching and learning activities is helpful to learners' understanding of lesson topics.

Nonetheless, his lesson plans before the intervention, revealed some learner-centred pedagogic approaches, such as brainstorming and group whole-class discussions. These approaches from my observation, appear not to have been effectively used during the lesson delivery. The lecture method keeps appearing. Another feature reflected in his lesson plans was the integration of PK in CK and the absence of TK, making his lesson plans not TPACK-compliant. During the intervention, Sir Jonas confessed, that "I was able to review my lesson plans to identify portions where I used CK and PK and TK". On reflection, during and after the intervention, Jonas admitted that "I am now able to develop a TPACK-compliant lesson plan to support my teaching and learning activities." He also became an expert in taking lesson-related video films with his mobile phone camera and importing it onto moviemaker storyboard to produce his films. On reflection, he confessed that "I can now use my laptop and mobile phone to prepare a movie to use as a learning resource for teaching and learning activities."

c) **Sir Damien** is a pseudonym I gave to the P6 teacher. He is the youngest teacher in the group and had 3 years of teaching experience at the time of my visit. He entered the university from the Senior High School (SHS) to pursue a bachelor's degree in education.

As a professional teacher, he gained employment into Mondragon Basic School. He also believes that technology integration into teaching and learning activities is very crucial to learners' understanding of lesson topics. According to him, "This, (that is technology integration into pedagogy) must remain as part of our way of life as far as teaching and learning is concerned". A study of Sir Damien's lesson plans prior to the workshop revealed that he also adopted some student-centred approaches, such as brainstorming, group discussions, and 'think-pair-and-share' to facilitate his lesson delivery. These lesson plans, however integrated PK into CK, but did not include TK. On reflection, he confessed that he had never integrated TK into any part of his lesson plans. "I was able to review my lesson plans and through that, I was able to know that I had never used TK in any lesson plan". He confessed the "The review of my already prepared lesson plan and the introduction of the TPACK sample lesson was a new to me". However, after the intervention workshop, Sir Damien reflected that "I have learnt to use pictures I captured on my mobile phone to produce films" and that "The new strategy of teaching with films provoked the pupils in learning." He concluded that "I came to the realisation that a simple and concise way to make the lessons in my class interesting is using technology (a film) to teach. It will enhance pupils' understanding of the lesson". Sir Damian has also become an expert in slide design for making the films, making him differentiated from other Social science teachers in Ghana.

d) **Sir Jalien** – is a pseudonym I gave to the teacher who teaches social studies at the JHS level. He entered the university as a graduate of GCE 'A' level to do a first degree in Sociology. After graduation, he found the need to pursue a diploma in education in order to be a professional teacher. He had gained ten years of teaching experience at the time of my visit. He believes that as a social studies teacher, the use of films to support his teaching will be very beneficial to him in lesson preparation and to his students in them understanding the lessons. Sir Jalien used a number of student-centred pedagogic approaches in the lesson plans he developed and taught prior to the

workshop. These included engaging the students in whole-class discussions and observation and reporting. During the lesson delivery however, I observed intermittent use of teacher-centred approaches, such as the lecture method instead of the teacher being a facilitator. Another feature of Sir Jalien's lesson plan was that while CK and PK were integrated in the lesson plan, TK was missing throughout. Jalien himself corroborated this information that:

Out of this review of my lesson plan, within the TPACK context, I came to the realisation that I had never used or integrated 'TK' into any portion of the lessons I teach. I view this lesson plan review therefore, very useful because I have come to learn that for technology integration, these 3 types of knowledge domains are interwoven and necessary.

By the close of the workshop, Sir Jalien reflected that "I was able to use still pictures to produce a film." He also said "I was able to demonstrate how I can teach my developed TPACK compliant lesson plan." In addition, he became an expert in content preparation for the slides that composed the films on the moviemaker storey board. All these are unique qualities gained that can easily make one locate him among public social science teachers in Ghana.

e) **Sir Benjamin** – is a pseudonym I gave to the ICT teacher. He does not only teach ICT at all the levels in the school but performs administrative roles as one of the Assistant Headteachers of the school, as well as teaching the school choir music. He has the highest number of years (21 years) of teaching experience. He is a professional teacher with the 3-year post-secondary certificate in education. After teaching for some time, he proceeded to the university on study leave to pursue a Bachelor of Arts degree in Information studies. He is a family man of two children. Even though he has the opportunity to teach at the secondary level, he opted to continue teaching at the basic level in a number of schools before ending up at Mondragon Basic School. Thus, he takes delight in teaching both at school and outside school. Being an active member of his church, he has not only once acted as the president of the 'Young Christian Workers',

but also teaches the youth choir music. He believes that as long as the world has gone digital, they as teachers, should expose the young ones to all the technologies that will enhance teaching and learning. Sir Benjamin, just as the other participants noted in his reflections were that:

The idea of using the TPACK framework to review my lesson plans was a significant thing to me. I was able to review my lesson plan and been able to integrate TK into CK and PK to make the lesson TPACK-compliant. I do not have to always draw images and diagrams on the board to use as TLRs. Using films to teach should be spread across the country – every teacher needs it.

Sir Benjamin became an expert in trimming off unwanted portions of video clips on moviemaker storyboard when editing his films before he finally produces them. These qualities have differentiated him from other public basic school social science teachers.

3.7 Data Collection Methods

As pointed out by Cohen, et al., (2011), case studies recognise and accept that there are many variables operating in a single case. As a result, more than one tool for data collection is usually required in order to capture the implications of these variables. This study, therefore, employed a number of methods to collect data. These included focus group discussion (FGD), supported by SWOT analysis, reflective journal entries, non-participant observation, field notes and individual face-to-face interviews. This number of methods ensures the needed triangulation (Yeasmin & Rahman, 2012). Besides, as the study leans on the interpretive paradigm, it used these methods that afforded participants the opportunity to express their views and opinions on issues directly, forming a primary data source for the study. The ensuing sections discuss the various data collection methods employed, starting with focus group discussion.

3.7.1 Focus Group Discussion

Focus Group Discussion (FGD) is one of the qualitative data gathering methods. Focus groups are "carefully planned series of discussions designed to obtain perceptions on a

defined area of interest in a permissive, nonthreatening environment” (Krueger & Casey, 2009). It is an organised discussion – though structured in a flexible way for between 6 and 12 participants (Krueger, 2002). In this study, eight social science teachers from both streams A and B of the school participated in the FGD. Literature suggests that FGDs usually last for one or two hours and provide the opportunity for all the respondents to participate and give their opinions on issues tabled for discussion (ERNWACA, et al. 2006). Literature suggests that FGDs use specific and pre-determined criteria for recruiting focus group participants.

In this study, the pre-determined criteria for selection of participants was that first, the teacher in the selected school had to be a Social science teacher, teaching either Social studies or Citizenship Education or ICT. Second, the teacher must have basic computing skills. This criterion follows the position of Hignite and Echternacht (1992), that it is important for teachers to possess not only positive attitudes but adequate computer literacy skills to be able to integrate technology successfully into the classroom. The issues I discussed with the participants at this FGD, which was also formed the reconnaissance phase of the action research, were decided beforehand and coined in a set of pre-determined open-ended questions. They were arranged in a natural and logical sequence (ERNWACA, et al. 2006), as in Appendix E. Prior to the FGD, the questions and their structure were scrutinised by one of my supervisors, who also held a Skype discussion with me to explain why the questions had to be open-ended and non-prescriptive. Even though two key questions formed the discussion, there were questions asked to introduce and open the discussion, as well as transition questions (Krueger, 2002), posed to keep the flow of the discussion. The use of the focus group discussion method to gather data resulted in gaining understanding of the first research question, ‘To what extent are basic schoolteachers using technology as a tool in classroom teaching and learning.’ In addition, the FGD provided me with a picture of the participants’ experiences in their professional practices. It also afforded the teachers the opportunity

to voice out their opinions and ideas without any prohibitions, on the ban of mobile phone use among teachers and students in the country. In addition, I considered the FGD as reflective because somehow it brought to the fore for discussion some of the challenges in their professional practice. It also confirmed for me the need to go ahead with my action research. All these pieces of information formed useful data for analysis.

3.7.2 SWOT Analysis

From the acronyms, S.W.O.T, the term SWOT stands for Strengths, Weaknesses, Opportunities and Threats. Researchers view SWOT as an essential part of the tactical planning procedure, irrespective of its kind (Valkanos, Anastasiou, & Androutsou, 2009). It is a tool used for analysing the internal and external environment of a company or organisation or a rival company, in order to strategise for its future performance. The SWOT analysis is a process by which the internal and external factors of the entity are determined. The internally generated factors of the organisation are the strengths and weaknesses, while the externally generated factors, which the company has no control over, are the opportunities and threats. Consultants, trainers and educators also use SWOT as a teaching tool analysis (Helms & Nixon, 2010). SWOT analysis has a number of merits. The SWOT as a tool is a quick method of gathering a large amount of information directly from participants within their own context/terrain in a short space of time. In effect, I did not only take the participants' word for it, but together with them, we examined the information on the spot at the gallery station for purposes of corroboration. The SWOT tool also helps to collect detailed information on a company or institution. There was the need to link SWOT analysis in this study to a strategic tool such as the FGD, for two main reasons. First, to fill any information gap created after the FGD. Second, to collect information on the strengths, weaknesses, opportunities and threats of integrating technology into teaching and learning in the school. Responses from the

FGD and the SWOT answered the first research question on the extent to which basic schoolteachers were using technology as a tool in classroom teaching and learning.

3.7.3 Reflective Journals

Reflective Journal writing is one of the qualitative data collection methods. Klug (2002) has described a journal as “a place to record daily happenings”. He further describes it as “a tool for self-discovery, an aid to concentration, a mirror for the soul, a place to generate and capture ideas, a safety valve for the emotions, a training ground for the writer, and a good friend and confidant”. To Mark, (2006), a journal records experiences and events over a period of time. Holly (1989: 20) describes a journal as “a place to ‘let it all out’”. Moon (1999: 4) also describes a journal as “an accumulation of material that is mainly based on the writer’s processes of reflection. It is written over a period, not in ‘one go’”. Holly, (1989: 71) describes journal writing as “a powerful means for teachers to explore practice; to document classroom life as it unfolds and to reflect on experiences past, their life histories and the social, historical and educational conditions that ushered in the present”. One thing very noticeable about these definitions is that they all carry the similar ideas.

Journals have a number of advantages. One is that “it helps us to remember something later; it is a record to look back on” (Holly 1989: 8). Another merit is that journals allow people to look at themselves, their feelings and emotions differently. It can also act as a ‘medium for reflecting on professional successes and failures, rehearsing alternatives, and making knowledge of teaching more explicit (Evans and Maloney, 1998: 29). Beyond merely allowing the participants to report their experiences and reflections, the guiding questions I provided to them enabled them to reflect further on their own professional growth. I felt that adopting this method gave the participants the voice that enabled them gather varied first-hand information, ideas and speculations for knowledge construction Evans and Maloney, (1998). One other benefit was that the method provided them “a

way of conversing with themselves and others as they attempted to make sense of their classroom work” (Evans and Maloney, 1998: 29). In this study, I provided participants with guided questions (Appendix F) that Klug (2002) designed for beginners who have never written a journal, to enable them create their journals from their experiences and reflections over the five-day ‘Learn and Share’ workshop and up to the time of their field practice. The information from each participant’s journal tracked the following guided questions and the responses have been discussed in detail in Chapter 4, Section 4.4.

- ✚ How do you feel, as the activities were unfolding?
- ✚ What are the most significant events of the day?
- ✚ In what way is the day exceptional to you?
- ✚ What were your workshop accomplishments?
- ✚ How useful are things you learned to your professional practice?
- ✚ What challenges did you face while the workshop was going on?
- ✚ What are your solutions and recommendations?

A summary of each individual’s journal entries is in Appendix G, while the journals from which I extracted the summaries have become the Intellectual property of the participants.

3.7.4 Observation

Marshall and Rossman (1989: 79) define observation as “the systematic description of events, behaviours and artifacts in the social setting chosen for study”. It is one of the qualitative data gathering methods. Dunne et al. (2005: 70) describe it as a highly empirical research method, which “generates texts that are potentially rich in their capacity to speak to an audience”. Besides this, observation is viewed as complementing interview data and serves as “hard evidence supplementing subjects’ recollection and sometimes self-serving perceptions gained through interview sessions” (Adler & Adler, 1998: 90). Even though in observing the participants’ practice at the level of material

development (i.e. film production), I was a participant observer in the workshop at the point of demonstrations, this was however, not the case at the point of class observation. I rather assumed the role of a non-participant observer. The use of observation in general as a tool in research, however, has some merits. Firstly, it helps in establishing a balance between subjectivity or bias and objectivity by recognising the centrality of the researcher's experiences in the research process while maintaining objectivity and distance. Ratner (2002) points out that when collecting data through observation, researchers need to be conscious of their own biases in order to understand properly what they are observing. On the other hand, where a researcher does not engage in any observation, the tendency to make partial judgement could be high. Secondly, the observation in the two scenarios, afforded me the opportunity to study the phenomenon under question in its natural milieu, with all the researched in view. Thirdly, I viewed access to participants at the site of the study as a continuing process from the main training, even though there was about two weeks interval between the initial class lesson observations and second.

However, observation entails many ethical considerations. For instance, those the participants observed, as well as those whose pictures they took had to consent in the first place. During the class lesson observations, I chose the structured observation rubric, prepared and tested by Harris, Grandgenett and Hofer, (2010), in (Appendix H) for accessing TPACK in lesson delivery, with the main aim of gathering primary data (information) that provides a rich description (Kawulich, 2012; DeMunck, and Sobo, 1998) of everyday classroom practices (Dunne et al, 2010). This data exposed to me, face to face, how the teachers applied or integrated their self-developed films into teaching their TPACK-compliant lesson plans. When I adopted a non-participant observer's approach, I sat at a convenient place in classroom, where I did not distract the attention of the learners or the teacher. I was watching, listening and writing my field notes, but avoiding eye contact (Cohen, et al, 2011). This method provided me with an

opportunity to collect data on a wide range of behaviours that otherwise might have been taken for granted, to capture a great variety of interactions between teacher-student, student teacher, and student-student (Cooper and Schindler, 2001), even though my focus was on the teacher. At the same time, there was no way I could ignore the learners, as the teaching and learning process is a two-way phenomenon. Besides, the non-participant observation assisted me to understand the context of the classroom activities. It is important to note that I collected data from observation bearing in mind the “physical, human, interactional and programme settings” (Morrison, 1993: 80). My lesson observations were in two parts. I did the first one two weeks after the main workshop, to enable participants to improve on their films and become acquainted with this new way teaching. I did the first two lesson observations for two participants on Thursday, 18th February 2016 and the last on Friday, 19th February, 2016. I conducted the second part of the observation two weeks after the first one on the 29th of February. I was able to observe four participants’ lessons, each person, twice. In all, I was able to spread all the lesson observations within 4 weeks. I have presented the findings of my observations as part of Chapter 4, sections 4.3 and 4.4.

3.7.5 Individual face-to-face Interviews

Interviews are one of the widely used qualitative data collection methods. Kvale (1996: 14) explains that it is an *inter-view*, an interchange of views between two or more people on a topic of mutual interest. Kvale, (1996: 145) explains that the interview is “self-communicating” – it is a story contained in itself that hardly requires much extra descriptions and explanations. Where a face-to-face interview is conducted it becomes more in-depth and Boyce and Neale, (2006) assert that the primary advantage of in-depth interviews is that they provide much more detailed information than what is available through other data collection methods, such as surveys. They further explain that such in-depth interviews provide a more relaxed atmosphere in which to collect

information and people may feel more comfortable having a conversation with the interviewer as opposed to filling out a survey.

I used individual face-to-face interviews as one of my research methods because it was consistent with my methodological position of a constructivist. I stand in a position endorsing the view that, the voices of the researched, coming from the subjective meanings they attach to what they experience around themselves, form a vital source of verbatim quotations for my interpretation (Cohen et al. 2011). Their voices, not only brought life to my narrative (Ibid: 2011), but also formed an important information to answer my research questions.

Additionally, I made use of interviews because of the belief that views of the research participants will be of much importance to explaining a lot of issues relating to technology integration into teaching and learning, which otherwise would have remained buried. In addition, their knowledge and accounts about the school's social context and the learning environment of the classroom, was significant in my study (Dunne et al, 2010). Besides, following my interpretivist methodological stance, my aim was not to generalise but to explore the meanings my research participants placed on the social situations attached to the interview. I thus took a subordinate role because I relied on the participants' information to support the research study. I was, however, at the same time, conscious of the integral role of the interview process, the respondents' position as classroom teachers on one hand, and my own position (Dunne et al, 2010).

My interview schedule was influenced by my research focus, theoretical framework, (TPACK), and the empirical context. Other factors included the research intention, the respondents and my own position (Dunne, et al, 2010) as a curriculum developer, instructional technologist and a teacher trainer from the Headquarters of GES. In addition, was my status as a doctoral student who had visited the school once to make preliminary enquiries prior to the time of data collection. The interview schedule for the respondents was thus semi-structured, formal, individual, one-off and private (Dunne et

al, 2010), taking cognisance of it having three main stages; the introduction, the main questions and the closure, (Bell, 1993; Brown & Dowling, 2001). Apart from information on personal background, I designed the interview items to tap information on the teachers' access and use of technology, personal experiences, reflections and opinions about technology use, challenges and recommendations relating to issues on technology integration, as far as the training and their practices are concerned. Despite making the interview formal, I adopted the conversational approach, (Dunne, et al, 2010), to make the respondent not feel intimidated or jittery but at the same time, being conscious of my own position, in the dynamics (of an interviewer-interviewee) of the interview (Kvale, 1996), in Dunne et al, (2010).

3.7.6 Documentary reviews

The study also involved documentary reviews presented in the form of analysis of relevant literature from several databases such as JSTOR, Google, Google Scholar; ERIC, abstracts of electronic articles, essays, reports and books. Others include writings from blogs, journals from the World Bank, educational institutions such as the Ministry of Education and other research and development institutions such as ERNWACA / ROCARE, which had published research works on technology integration in West and Central Africa (ERNWACA, 2006). These documents were on related issues in general and on technology integration into teaching and learning, in particular. The review also drew considerably on analytic insights compiled and documented in research papers on the dynamics of technology integration and some concepts, such as pedagogy, and the influence of contexts on technology integration. Other data sources included pictures and images, audio and visual recordings, all taken during the workshop and research period. These wide range of available data sources helped in debating the various perspectives, approaches and developments. Thus, reviewing these documents critically on technology integration provides me with an insight into the need for teachers to participate in professional development programmes constantly while on the field of

practice, to improve their lot. This has thrown more light on issues that might be of significance in exploring the ICT4E policy and practice in technology integration in education in public basic schools, in particular, with similar stories. It also helps in identifying further gaps for research.

3.8 Ethical Considerations

To start with, I obtained the Sussex University Institutional Review Board (IRB) authorisation for this study. I got ethical clearance letter from the participating institution. The basis for participation in the research informed consent and on voluntary basis, with rights of withdrawal at any time assured. For us to format to suit our research purpose, including application to go to the field (Appendix I), the University issued ethical review forms to us. This was consequent on Sussex University's approval of the research proposal and issuance of field research certificate or pass to conduct the research. (Appendix J). When I applied to the gatekeepers at the GES Headquarters to conduct the research in one public Basic School in the Greater Accra region, they granted me the permission (Appendix K). I furnished the District Directorate with the approval letter and they, in turn, granted me the permission to enter the school freely to conduct the research. Next, I furnished the research participants with detailed knowledge of what the research was about, through the Information sheets (Appendix L). The content of this information sheet followed a set of agreements with the clients that Davison, et al, (2004) suggested. These included the focus and goals of the project, participants' willingness and commitment, participants' roles and responsibilities, procedures to follow during the project and ethical issues, including consent to participate and confidentiality. The participants had the accompanying Consent forms (Appendix M) which they scrutinised and approved. I explained the content of the Information sheet I issued to research participants to them – that is their right to confidentiality or to withdraw from participating in the research at any time. The information sheet also spelled out the benefits the research will bring to the teachers and students, in particular and to the school in general.

Research participants also received consent forms to confirm their willingness and commitment to participate in the study.

Throughout the research, I was conscious of the ethical considerations and took steps to circumvent offending anyone and avoiding any anomaly. For instance, when it came to the kind of pictures the teachers were to take, I cautioned them not to take any picture against the will of the person. Therefore, all the live pictures participants took of, say, families at an outdooring or a couple at a wedding ceremony were with consent from those involved. Cohen et al. (2011), explain that taking visual images is subject to the same ethical concerns and requirements as other forms of educational research. Particularly when it comes to photographing and reproduction of historical images or images from the general public – like taking pictures of parents, guardians, teachers, house helps, the chief / queen mother, and inmates of a palace, caution needs to be exercised not to offend anyone. All these require consent or permission and I informed the participants. One big ethical challenge I faced was to use the mobile phone, let alone, its camera, (banned for both teachers and students at school), as the key tool in the study. I was, however, able to circumvent this challenge by stating it very clearly in my application to the gatekeepers at Headquarters level that I was going to use it and they consented.

3.9 Data Analysis

3.9.1 Methods of Data Analysis

Qualitative methods were employed to analyse the data gathered from reviewed documents, data generated through focus group discussions, a 'learn and share' training workshop at which reflective journal entries were made, observations, field notes and interviews. The main reason for analysing data is to make sense of the data (Merriam, 2009). In this study, I employed the deductive thematic analysis approach to analyse data, including interview data and data collected from reflective journal entries. Using this approach, I had developed a predetermined framework in conformity with my research questions prior to data collection to analyse the data. Being aware of the limited

time at my disposal, I essentially used a structure consisting of predetermined themes under each research question and proceeded with the analysis and interpretation. Researchers find this deductive thematic approach to data analysis as mostly useful, especially when one has specific research questions, which already identify the main themes or categories used to group the data and then one looks for similarities and differences. The study illustrates this point in Table 3.4.

Cohen et al. (2011: 551) assert that when comparing the deductive thematic analysis approach to other approaches, it is relatively quicker and easier to perform. They further explain that analysing data under themes has the advantage of being economical in handling, summarising and presenting data but admit that the approach stands the risk of one losing the wholeness, coherence and integrity of the individual because comparison across individual respondents becomes impossible. They have, however, identified seven ways of organising and presenting data analysis to include organising data 1) by individuals or 2) groups of individuals (respondents); 3) by issue, 4) by theme; 5) by field instruments; 6) by case studies and 7) by narrative account (Cohen et al., 2011: 551-552). They suggest that each of these approaches has its own merits and demerits and that the approaches are not mutually exclusive. Therefore, researchers may circumvent the shortcomings of any of the approaches by combining it with any of the other approaches. Following this suggestion, I combined data organised under themes with data organised by instruments approach, and then placed them under their corresponding research questions for analysis and discussion. This also has helped in not losing track of addressing any of the research questions.

Additionally, I transcribed all data digitally recorded into text, grouped it under the various themes to present it in a synthesised report. Listening closely and repetitively to the recordings often exposed to me voices in the conversation earlier on skipped unknowingly (Atkinson & Heritage, 1984). In writing up this case study report, I tried to abide by the twin notions of 'fitness for purpose' and 'fitness for audience' (Robson, 2002: 512-13; Yin, 2009: 176-9). I thus chose the narrative style of reporting, not only to convey information in 'storied text' (Bruner, 1986), but also to help researchers and readers to understand the experiences of the participants and myself (McNiff and Whitehead, 2009).

Table 3.4: Shows data categories and corresponding themes for data analysis

Phases of Collaboration	Research Questions / Categories	Themes
Sceptical about teachers' reception and general preparedness at the time of visit	To what extent are basic schoolteachers using technology as a tool in classroom teaching and learning?	Extent of technology use
From doubt to encouragement and delight	How can teachers explore the use of technology as tools to improve the quality of teaching and learning?	'Learning and sharing' workshop
Increased cordiality and motivation	What are the teachers' reflections and experiences during the field practice in the use of the mobile phone cameras and other new technologies, using the TPACK as a process?	Discoveries from the five-day workshop
		Observed field practice
Reflections and experiences	Which challenges do the teachers face in the implementation process?	Challenges and suggested solutions
	What are the teachers' views on the impact of technology use on students' learning?	Teachers' perception of students on technology integration.

For the core part of the action research, I used the first-person plural for the narrative (Zuber-Skerritt and Perry, 2002) as the type of action research was collaborative. Table 3.4 shows the research questions organised under pre-determined categories with themes derived from each question.

In the table, the third research question in the second column for instance, and the corresponding theme in the third row, under the theme, 'Discoveries from the five-day workshop and Observed field practice' was addressed in Section 4.6 of this report, using information from participants' reflective journals.

3.9.2 Trustworthiness of Data and Reflexivity

a) Trustworthiness of Data

Writers contend that the assumptions, on which qualitative research is founded, as far as reality is concerned, are not the same as those positivists hold for quantitative data (Merriam, 1995). Positivists usually question the trustworthiness of data generated in qualitative research probably because they do not accept that the concepts of validity and reliability are handled in the same way in naturalistic work (Shenton, 2004). Due to this conception, the quantitative researcher generally associates qualitative research with biases and their inability to represent larger populations or samples. Qualitative researchers themselves, on the other hand, do not believe in the concept of validity that is usually associated with quantitative research. Both groups use different lenses. In addition, qualitative researchers do not accept the assumption that reality is external of what one perceives it to be (Trochim, 2006). Qualitative researchers have generally agreed that their studies must be credible (Creswell and Miller, 2000), and some like Lincoln & Guba, (1985) and Merriam, (1998), have recognised some procedures for establishing validity for accessing the overall quality of qualitative research. Whichever procedure the researchers adopt, Creswell and Miller (2000: 124) suggest that "the lens researchers choose to validate their studies and researchers' paradigm assumptions" must influence their data validity procedures. Lincoln and Guba, (1985), Shenton, (2004) and Trochim, (2006), constructed one such procedures. They proposed i) internal validity, ii) external validity, iii) reliability and iv) objectivity, for judging quantitative research and i) credibility, ii) transferability, iii) dependability and iv) confirmability for qualitative research, which this study assumes.

i) *Credibility:*

Creswell and Miller, (2000: 125) explain that "... qualitative researchers use a lens not based on scores, instruments, or research designs but a lens established using the views of people who conduct, participate in, or read and review a study". Thus, to judge the credibility of a research depends on the lens (point of view) used. The lens could be from the researcher's viewpoint, or the participant or individuals external to the project (Creswell and Miller, 2000). Where it is the researcher's own lens, she/he determines whether, for instance, the "... data are saturated to establish good themes or categories, and how the analysis of the data evolves into a persuasive narrative". Patton (1980: 339) describes this process as one where qualitative researchers conduct a lot of scrutiny of their data "over and over again to see if the constructs, categories, explanations, and interpretations make sense". Altheide and Johnson (1994: 489) refer to this as "validity-as-reflexive-accounting", which ensures that the researchers, the topic, and the sense-making process interact. Regarding the participants, since the qualitative paradigm assumes that reality is socially constructed, it behoves the qualitative researcher to check that exactly what the participants say is what is represented in the final account. That is showing a strong and coherent link. One expects that those who use this lens involve participants actively, taking the data back to them to assess if the interpretations are plausible and accurately represent them – if they 'ring true' (Merriam, 1998). A third lens ensuring credibility that Creswell and Miller pointed out is from the point of view of accounts of individuals who are external to the study. He explains that reviewers, and target readers who are not associated with the research can also take part in establishing the validity of the research.

In this study, I did verification and confirmation of information from participants through a number of telephone calls to them on various aspects of the data. With their reflective journals, for instance, after I compiled their individual five-day daily responses, I sent the soft copies to them to read through to make sure that what they wrote is what the journal

has. Colleagues who had finished the EdD programme and those outside it went through the work to ensure coherence, consistency and logical presentation. My two supervisors scrutinised my report from start to finish and provided me with very fruitful and relevant feedback. They scrutinised my workshop programme and the questions forming my research tools. In addition, my principal supervisor, while visiting the country for a conference, had the opportunity of visiting the school and meeting all the participants and the Headteacher and interacted with them. He also went around the school to acquaint himself with the environment and to feel the ethos of the school. These helped him in verifying exactly what I wrote in the report.

ii) *Transferability:*

According to Guba and Lincoln, (1998), explain 'transferability' as the ease with which qualitative research results can be transferred or generalised for other contexts or settings. Guba and Lincoln, further explain that this is possible if the qualitative researcher is able to give a vivid description of the researched context, as well as the assumptions that were significant to the research. In such a situation, the one who does the generalising has the responsibility of transferring the results. This study gives a detailed description of the researched school from the point of view of the socio-economic context, school and classroom contexts, touching on the available infrastructural facilities and resources, as well as the profile of the research participants, in section 3.6 and all its subsections. This detailed background information, should be enough to want to transfer or generalise the research findings in the study in other contexts with similar characteristics.

iii) *Dependability:*

Lincoln and Guba (1985), argue that credibility and dependability do not only have a close link, but also in practical terms, the dependability of the research hinges greatly on ensuring that the research in itself is credible. They explain that for a research to attain

dependability, the researcher may have to use 'overlapping methods', such as the focus group and individual interview. Besides this, the researcher will have to write an in-depth coverage of the report, explaining the research design and its implementation and the processes to help future researchers to repeat the work. This will also make other researchers view the research design as an 'exemplar' - a kind of unique model to follow. In addition, the target reader will also have the opportunity, to not only develop an in-depth understanding of the methods employed and their effectiveness, but also assess how far the researcher was able to follow the appropriate research practices. In my view, this study fulfilled these conditions in detail in this chapter, from section 3.4 to the end of the chapter and could serve as a guide for future researchers.

iv) *Confirmability:*

Regarding confirmability, Shenton (2004) explains that the researcher needs to take steps to ensure as much as possible that the research findings are the outcome of the experiences and ideas of the informants, rather than the characteristics and preferences of the researcher. To this extent, this study used methods, such as FGDs and interviews, which collected data from participants verbatim in MP3 format and transcribed into text, still keeping what they said 'word for word'. This eroded or minimised any traces or the effect of investigator bias. The use of triangulation within the research also played an important role in promoting confirmability (Denzin, 1970; Mathison, 1988). In this research study, for instance, I employed multiple data collection methods, including FGD, SWOT analysis, reflective journal entries, observations, interviews and documentary reviews to ensure triangulation. Besides, I introduced practices such as videos and snapshots into the research process to ensure some degree of transparency. This I believed made the data dependable and trustworthy. Miles and Huberman (1994), points out that one key criterion for confirmability is how far the researcher is able to go in admitting his or her own dispositions. In this study, I pointed out in section 5.4 of chapter 5, the role my own limitations played on the research.

b) Reflexivity

According to Finlay, (2003: ix), reflexivity stems from the word 'reflexive', which has an etymological root meaning, 'bend back upon oneself'. As Walford, (2001: 98) puts it, "all research is researching yourself". Hammersley and Atkinson, (1983: 14), further explain that reflexivity is crucial in action research because the researchers are not only participants but also practitioners in the research and are part of the social world – in the world and of the world. The researcher brings to the data, his or her own preconceptions, interests, biases, preferences, biography, background and agenda. However, Finlay (2003) cautions that researchers have to be very careful not to concentrate on recounting their experiences at the expense of how those experiences affect the research process. Personally, what strongly influenced me to conduct the action research element of this study was how pictures, images, objects, lines and graphs enhance my understanding of concepts as a learner. This compelled me to want to share with teachers the use of context and lesson-related pictures for films to enhance their students' learning. I, myself, right from my early years of schooling realised that I could only understand concepts in lesson topics when teachers used diagrams, pictures, lines, graphs and shapes to explain lesson topics or concepts. I saw that the use of these images made me end up pursuing courses in subjects like Economics, which uses line graphs to explain concepts to make it easy to understand. In addition, I was able to do Geography, especially Geomorphology, up to the University level because it uses diagrams and pictures or photos to explain land formations. All these and other reasons convinced me that young learners also could stand a similar advantage of enhancing their understanding of difficult-to-teach concepts if supported with lesson/context-based films. From the point of view of the participants, their reflexivity was top of the agenda for data collection. Hence, I used the reflective journal entries and interviews for data analysis. The essence of exploiting participants' reflexivity is to facilitate an open and democratic research experience for all concerned (Finlay & Gough, 2003). I did this by providing participants

with questions to guide them, since reflective journal writing is not quite popular in our part of the world. For the reflective data entries, I provided participants with guiding questions from Klug (2002), which I modified to suit their context.

3.10 Summary

Chapter 3 is mainly about research methodology and methods. It discussed the justification for the choice of research design, which is a case study with an element of a single cycle action research, and the corresponding research approach and strategies. The chapter also justified the epistemological and ontological positions the study assumed, and the commensurate methodology and methods adopted. It also pointed out and discussed the effects of macro and micro political factors on the research. All these positioned the research study. Other issues the chapter discussed were the sampling and profile of the researched school, its socio-economic context, school and classroom contexts, school facilities and infrastructure. It also discussed the profiles of participants, and the characteristics required of them to participate in the study. The chapter ended with discussions of role of ethical considerations in the research, methods for data analysis and defended the trustworthiness of data used in the study. It also explained the role reflexivity played in positioning the research process.



Chapter 4: Research Activities, Findings and Discussions

4.1 Introduction:

This chapter presents an account of the activities undertaken within the research process, the subsequent findings and discussions in the study, which link to answering the research questions. As mentioned earlier in section 3.9.1, the study adopted the thematic analysis approach in combination with the instrument approach (Cohen, et al. (2011), to organise the findings. I adopted this style in order to keep the research questions in focus. Each section, therefore, opens sequentially with a research question. The first research question was:

4.2 To what extent are basic schoolteachers actively using technology as a tool in classroom teaching and learning?

The section finds answers to the question from findings gathered at a Focus Group Discussion (FGD), conducted among Social Science teachers of the researched school, as well as a SWOT analysis conducted among the selected participants. For the FGD, the school drew the teachers from the two streams (A and B) of the school. The FGD session was the reconnaissance phase of the action research. That is the fact-finding about circumstances on the field (Elliott, 1991). The discussions centre around two key questions. a) The Ministry of Education has banned teachers, students and pupils from using Mobile phones in schools. What is your view on this? b) How would you use the mobile phone camera to enhance your pupils' understanding of lessons you teach them? These two questions did not only uncover the teachers' perception on technology use for teaching-learning, but also gave an insight into the extent to which they actively use technology as a tool in classroom teaching and learning activities. The questions also generated further questions including i) how many teachers have received training to use technology in the classroom. ii) Which IT facilities does your school have to aid technology integration and how many? iii) What challenge(s) do you face in the use of the computer in the school?

iv) What solutions are there to the challenge(s)? The questions were generally open-ended, and took a conversational form. This allowed the discussions to flow to generate numerous and varied responses. The discussion lasted for fifty-five minutes.

The first main question about the ban on mobile phone use generated responses that seem to have undertones of frustrations, disappointments, and feelings of disapproval on the ban. Other responses defended mobile phone use in this digital world to aid teachers' professional practice and students' learning, and teachers striking a compromise with the authorities. One teacher said:

I think the ban is not the best because sometimes when I want to search for an information on the net on my phone to support what I am teaching, especially when a pupil asks a question, which I don't have a ready answer to, I am unable to search. It is important that we are allowed to use the mobile phone for searching for information to support our work and children's understanding of the lessons.

Another teacher stated that:

Sometimes a parent may want to discuss an important and very urgent information or problem with the teacher about his/her child or ward, either concerning the child's learning or health but because we are not allowed to use the phone that interaction is prevented and this could result in a disaster.

This teacher continues to share an event that occurred in one of the schools. She said:

Recently it happened elsewhere; a student was sick but could not contact his parents. The school did not also allow him to seek medical attention at home and detained him at school because they claim, the school will go on midterms and the student passed on.

One other teacher remarked that:

Because the children are not allowed to use the phone at school, they spend the whole night on the phone, either making calls or browsing instead of sleeping, so why don't we rather allow them to use it at school?

Another teacher agreed with his colleagues and commented:

I support what my colleagues are saying. Firstly, we are now in an information age where knowledge is searched for and shared. If we are not allowed to use the mobile phone in school, it means the information we have will be limited as we are not allowed to access it as and when we need to enrich the activities of our teachers and students.

Concurring with colleagues, one teacher commented that:

I support the views expressed by my colleagues that mobile phone use in schools must be allowed. This is because we need very current information to support our teaching and learning activities.

They, however tried to figure out why the ban, but suggested a 'give and take' solution.

To strike a compromise half way with the education authorities to be able to use the phones to support their search for supplementary materials. One teacher remarked that:

I think it is because of the disturbance and interruptions the mobile phone causes when teaching is going on. But I think what the Ministry must do is to look at the policy again, come to discuss the issue with us and meet us half way so that we all come together to regulate its use. The mobile phone helps us, I mean the children, so they, have to come and look at it again so that we all come to a consensus. By that, it will not look like they have come out with a law to prevent us from using it.

The second major question was on how they would you use the mobile phone camera to enhance their pupils' understanding of lessons they teach them?" This question, like the first one, offered the teachers the opportunity to voice out their creative minds (Zhao, 2017). Each response was very blunt, revealing what they and their learners are losing through the lack of access to phones to browse for relevant information or take lesson-related pictures to support their lessons. Their responses reveal some worry that they teach in the abstract, as a result. For instance, one teacher said:

When I am teaching anatomy of the body, I would need to browse for images to show to the children during my teaching. Many times, I teach a lot of things which could have been enhanced if I had pictures to show the pupils but, as I am unable to use these pictures, the pupils are not able to imagine vividly what you are trying to portray. Everything becomes abstract to them.

Confirming this point, another teacher said:

There are a lot of topics in the Social Studies syllabus which could be taught with the support of pictures but I am unable to get these pictures. For instance, if I am teaching students on slums, I can take such pictures in the community to come and show to them instead of trying to explain things to them in the abstract.

Their responses reveal a number of vital pieces of information. i) They do not integrate technology in their teaching-learning activities. ii) They could have been teaching more interesting lessons if they had the opportunity to use lesson-related and context-related pictures to support their lessons. iii) They teach in the abstract, rendering their students

disadvantaged. iv) When they teach, learners '*are not able to imagine vividly.*' v) The teachers said if the authorities gave them the chance to use their mobile phones, they could browse the net to research for information needed to support textbook information to enhance their lesson delivery. v) It is possible for Social science teachers, having access to the phone to browse for pictures to use in teaching science lessons.

Other findings from the FGD reveal a consensus among the teachers that there was the need for them to receive training to integrate technology into their teaching and learning "Yes, we should" was a chorus response. However, one female teacher expressed reservations about their readiness as teachers to teach with technology that, "I believe that we should, but the question is, are we ready?" There was a chorus answer from all her colleagues in the affirmative but it seems as if on second thought, one male teacher made a follow-up observation, to buttress his colleague's question and position on whether they were ready. He admits the importance of technology use in context-related teaching and learning that can support textbook information. He, however, expressed the reservation on teachers' immediate handicap of relying solely on textbooks. That is:

To me, I believe the use of technology in teaching will help a lot, because nowadays, the world is changing and we cannot rely solely on the textbooks. At times, you need to have different TLRs depicting what is taking place within our environment. So, the use of technology is good but how many of our teachers have been trained, is what I want to say.

When, I re-echoed the question "Are teachers ready for technology use in the classroom"? There was a chorus answer in the form of an exclamation. "Hhhhuuuu!" This suggests that the whole group admits that they are not e-ready (Boakye and Banini, 2008). The lack of training was the main challenge for technology integration. The conversation revealed that none of the teachers had any training in integrative skills – a confirmation of earlier researches (Agyei, 2012; Banini, 2012; Boakye and Banini, 2008). In addition, teachers have no access or accessibility to the computer laboratory because throughout the day students use the lab for their ICT classes. "The facilities are not there so how do we use it to teach" - one teacher questioned and went on to say that "It is only

used by the ICT teacher to teach ICT to the students, another teacher stressed” (sounds frustrated).

One other teacher remarked that inaccessibility to the computers was making her forget some of her basic computing skills.

I am forgetting some skills” (Face mixed with a cynical smile, disappointment and frustration). I know at the Training College, I could, eh... but now, I have forgotten everything. Here too, we do not have accessibility to the computers in the lab. It is only used by the ICT teacher to teach ICT to the students (Sounded frustrated).

Hignite and Echternacht, (1992), explain that it is important for teachers to combine both progressive attitudes and sufficient computer literacy skills to integrate technology successfully into the classroom.

In sum, the FGD revealed that teachers in the researched school have no training in integrating technology into their teaching and learning activities and so do not practise it. Christensen, (2002) points out that the confidence level that a teacher has because of using computers and technology in general, translates a great deal into effective use of technology methods in the classroom. This was generally lacking in the school. In addition, teachers were very open in admitting that they do not have accessibility to the computer laboratory that could keep them abreast of the basic computing skills some reported they acquired from the teacher training colleges (now Colleges of Education). They conceded that they needed training in integrative skills, but stated unequivocally and unanimously that the immediate solution to their challenges is for the education authorities to give each of them a computer, preferably a laptop. “Give a computer to every teacher”. One teacher exclaimed on behalf of all of them.

4.3 How can teachers explore the use of technology as tools to improve the quality of teaching and learning? - The 'Learn and Share' Workshop

4.3.1 Introduction

The 'Learn and Share' Workshop signifies what Zuber-Skerritt and Perry, (2002) refer to as the core phase of the action research. It is the material (film) preparation and production component of the action research. It is also important to point out that much as the researched school was eager to release the selected teachers for the training, it was equally conscious of the teacher-pupil contact hours that would be lost. However, the workshop became possible because there were some National service⁷ personnel available to hold the fort for these teachers, while they took part in the workshop for 5 days and not more than that. The presence of National service personnel was not the case in the other two schools. In the researched school, the Assistant Headteacher had to assure me that they would not have a problem if I came to conduct the research, but only for five days because the term's work had to begin. He said:

Taking the sampled teachers through the workshop will not disturb our teacher-pupil contact hours because we have National Service personnel who can attend to the pupils in the classes in the absence of their regular teachers.

I was conscious of how the beginning of a school term could be busy after Christmas, as far as school related work was concerned. I was also conscious of how this could lead to the participants losing the interest in the workshop. I, therefore, decided right from the word 'go', to inform them of collaborating with them in a 'learn and share' workshop to develop films to support their teaching and learning of their social science subjects within the term, and from then on. This delighted them. Due to the limited time of just only 5 days at my disposal to engage the teachers in the workshop, I did not do engage them in any preliminary ICT activities to ascertain and confirm their grounding in basic computing skills. I relied on and trusted the purposeful selection the Headteacher made

⁷ National Service personnel are Ghanaian students who graduate from accredited tertiary institutions and are expected under law to serve the country for one-year (<https://www.google.com/search?>).

for me with support of the school's ICT teacher of the school. I also had the confidence in the selected teachers that they will be committed to the study, since they filled and endorsed their consent forms. My overall aim of the 'Learn and Share' training workshop was to collaborate with the Social science teachers to explore the production of lesson-related films which have pictures taken from the school and community contexts. The pictures relate not only to the social science subjects the teachers teach, but also to the lesson topics in their curricula. The general objective of the workshop was to recognise and appreciate the importance of integrating technology into teaching and learning activities. In this case, it is technology (the mobile phone) that teachers commonly use on daily basis but never occurred to them that they could repurpose it creatively as a learning tool to produce TLRs to support their teaching and learning activities.

The specific objectives were that at the end of the workshop, the participants would be able to:

- review at least two lesson plans to identify portions where CK, PK and possible TK are represented.
- produce lesson-related films using the mobile phone camera and Windows Movie maker software.
- revise the lesson plans by identifying portions where they can integrate their lesson-related films.
- write a reflective journal documenting their experiences at the training workshop.

4.3.2 'Learn and Share' Workshop

The workshop opened with the distribution of workshop materials, (handouts) parked into individual jackets for participants. The list of materials distributed are in Appendix N, including the timetable (Appendix O). I took participants through the handouts, which I arranged in each pack in the order the activities would be conducted on the timetable. This was to acquaint them with what the content of the materials means, and how and when they will use each material.

I began the workshop by allowing the participants to express themselves about their expectations of the workshop. This is what they said.

Sir Jalien (JHS teacher):

I should be able to use ICT in the teaching of Social studies.

Sir Damian (Primary 6 teacher):

I'll be able to identify new and sustainable ways of getting TLRs to support teaching and learning. (b) To get new ideas of how to get students involved in the lesson. Sometimes when you are teaching in class, you need to understand the way the children think so that you can also go about your teaching. (c) To be able to inculcate the use of technology in learning to benefit the children. What we learn or gather over here, we can also be like role models to the children – teach them how to use technology in learning.

Aseda (Primary 4 Teacher)

Hope the workshop will make my lessons to be more interesting and better off than what I used to do in the classroom. Also, the workshop should be able to help me let my children also develop research skills, not that they will always wait for the teacher to bring new ideas. They should also learn the new ways that I am also going to learn so that we all make the class lively every time that we have Citizenship Education lesson.

Sir Jonas (Primary 5 teacher)

Aside the technology aspect of this programme, I am also expecting that I will be able use the technology to make lessons more participatory for the pupils because they love doing things themselves. By so doing, they will love to participate in the lesson.

Sir Benjamin (ICT for all classes)

At the end of the day, I expect to learn how to teach with technology and not only how to teach the technology

These expectations seem similar, probably because the participants had attended the FGD and in addition got the idea about the workshop from the information sheets. In effect, I would say that they have prepared their minds already for the workshop. It was the Headteacher, who did the final selection so it gave the team a kind of confidence that among the lot, they were those selected. This settled them down quickly as power relations were at play.

Essentially, we discussed the issue on awareness of the ICT policy for education. The essence of discussing this issue was first to probe into the extent of awareness of the policy, and to verify how teachers related aspects of the ICT policy to their professional

practices. Three of the teachers, including the ICT teacher, were not aware of the policy at all. Two of these three teachers, including the ICT teacher, further explained that all they knew was that ICT is one of the teaching subjects. The fourth teacher shared the same view but the fifth teacher who claimed he knew about the policy and what it is about, said:

Some time ago, we were made aware that every teacher, (that is a policy from the government) is going to be provided with computer so that we can use that to prepare our lesson notes and also use it to teach our children. The policy was that all teachers should be given computers to enhance teaching.

Findings reveal from this interaction that the teachers are not aware of what the ICT policy for education (ICT4E) is about and therefore, could not relate it to their teaching. Their focus was rather on school authorities providing them with laptop computers to promote their teaching learning activities.

For the next activity, the participants undertook a SWOT analysis that examined the impact of the introduction of ICT in their school on teaching and learning. Section 3.7.2 explains the essence of this activity. Participants recorded their responses on coloured pieces of paper stickers that I provided them. Each colour of paper represented a component of SWOT. For instance, in no particular order, yellow paper sticker represented strengths and opportunities and pink represented weaknesses and threats. I created a gallery station at the front of the class on the board with a four-columned figure representing SWOT as in Figure 4.1a with instructions on the right-hand side for participants to follow.

In figure 4.1b, a participant pastes his responses in the segments assigned to each issue at the gallery station. After the participants pasted their responses in turns in the appropriate segments, I invited all of them to the gallery to read what each person's

SWOT Analysis Activity

STRENGTHS	WEAKNESSES	<p>Module 1, Unit 2, Activity 2 – Whole-class (20 mins.).</p> <p>Step 1: What are the Strengths, Weaknesses, Opportunities and Threats in the introduction of ICT into your school's teaching and learning-activities?</p> <p>Step 2: Participants individually conduct a SWOT analysis by class level (Primary and JHS). They write their responses on coloured paper stickers provided and paste them at the appropriate columns indicated on a flip chart pasted on the white board in front of the class (12 mins).</p> <p>Step 3: Participants visit the gallery station to read other responses provided by colleague participants and make further comments (8 mins).</p>
OPPORTUNITIES	THREATS	

Fig 4.1a: SWOT frame drawn on the board with activity for participants to follow.

responses are. This enabled all of them to peer review each other's submissions on the strengths, weaknesses, opportunities and threats of ICT introduction into their school and agreed with responses



Fig 4.1b: Participant pastes his SWOT responses in the assigned segments.

A small section of the responses from the strengths, weaknesses, opportunities and threats of the SWOT analysis at the gallery station is in Fig. 4.2. Other responses are in Appendix P. Some other information, which corroborated the general picture revealed from the FGD, was that “many of the teachers are not computer literate”. Another was that “class teachers do not have the opportunity to use the ICT tools and equipment”.

SWOT Analysis

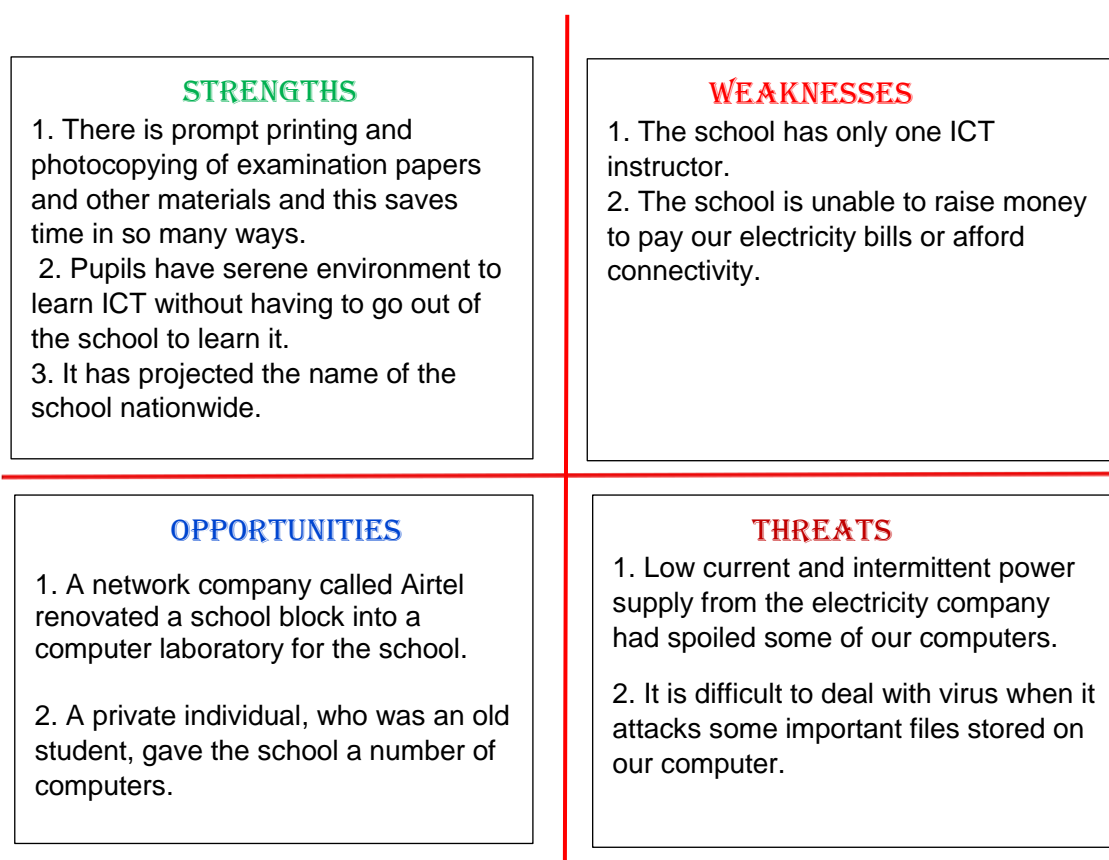


Fig 4.2: Showing some of the responses from the SWOT at the gallery.
(Author adopted the creation of gallery station from a 2012 GeSCI workshop)

Christensen, (2002) explains that when people become familiar with computer and other ICT tools, anxieties and fears in them is likely to reduce, and their confidence level rises. She further asserts that the amount of confidence a teacher possesses in using computers and other ICT tools and equipment, may have a great influence on his or her application of technology methods in the classroom (Christensen, 2002: 411). From the

participants' own responses, this was not the case in this school. It was, therefore, not surprising that at the workshop, the teachers' said their confidence level was low initially and some even confessed that they were scared. These were some of their responses.

I was a little jittery because these were new things I was learning. I realised that I was not up to the level of basic computing skills necessary for making a film.
(Sir Jonas).

I have built my confidence a bit on the use of ICT and hope to be able to use it more from now on **(Sir Damien).**

I realised I need to improve on my basic ICT skills to be able to effectively use the training am being given to engage in my classroom teaching-learning activities **(Sir Jalien).**

What I found worrying today was that my confidence level as to using or manipulating the computer was low. My ICT skills were weaker than I thought so I faced some challenges at first trial. This problem was addressed at the end of the class today, as I have been advised by the facilitator to do more practice in basic computing skills **(Aseda).**

Some other weaknesses are that the school has only one ICT instructor. In addition, even though the school had a good number of computers, they had not been upgraded or updated for some time. This had affected the quality of performance of the computers and as a result, participants could not install the Windows Live Moviemaker on the computers. Canuel, (1999) and Valiente, (2010) argue that for a successful technology integration in an institution, technical and financial support is crucial. This was not the case in the researched school. Apart from that, responses from the SWOT analysis revealed that even though the participants 'boasted' of opportunities of receiving computer donations from an alumnus of the school, evidence revealed the teachers do not have access and accessibility to the computers.

4.3.3 Assessment of Participants' TPACK Development & Film Production

The set of activities in this sub-section are three-fold. Participants i) assessing their own TPACK development by reviewing their traditional lesson plans, using the TPACK

framework as the process, ii) preparing and producing films to use as TLRs; and iii) revising their traditional lesson plans to make them TPACK-compliant.

i) Assessment of Participants' TPACK Development

First, I relied on the premise that there is scanty information about how digital educational technologies are integrated into teachers' planning (Tubin and Edri, 2004). Based on this premise, I made conscious efforts to be as flexible as possible with participants, allowing them the space to express their own opinions and ideas within their contexts and professional experience. Thus, I left the identification of lesson plans they have developed from topics in the curriculum for them to determine, which in their opinions, they could have taught better if they had had films to support the lessons. Within a very short time, each participant came up with at least two lesson plans at their class level.

Following the recommendations of Roblyer & Doering (2010) that developing teachers' TPACK assessment must be the first step towards technology integration, I engaged the participants in an activity that made them assess their own TPACK levels. They did this by reviewing their already developed and taught lesson plans⁸, which they identified were in line with the corresponding topics in their curriculum. Harris, et al, (2010), argue that "self-report (via interviews, surveys, or other generated documents, such as reflexive journal entries), observed behaviour and teaching artifacts, such as lesson plans", are the three kinds of data that can be used to assess teachers' TPACK. In this study, the participants' lesson plans were the artifacts they reviewed against the TPACK framework. Before the review, participants watched a presentation explaining TPACK, followed by two films reinforcing the explanation of TPACK, and then another presentation on a sample ICT integrated lesson plan I developed as an exemplar from a template provided to us at a workshop by Microsoft partners in learning, 'LearnThings'

⁸ Due to limited time of only 5 days for the workshop, we used already developed and taught lesson plans.

Ltd, Africa, (2006), (Appendix Q). I was confident to use this exemplar because GeSCI (UN task force) uses it as an exemplar at similar international workshops. Using the sample ICT-integrated lesson plan (I gave them as one of the handouts), against their traditional lesson plans, participants were able to discover that apart from the pedagogical knowledge (PK) and content knowledge (CK) represented in their traditional lesson plans, they had never developed any lesson plan to include technological knowledge (TK). These are their comments.

Out of this review of my lesson plan within the TPACK context, I came to the realisation that I had never used or integrated 'TK' into any portion of the lessons I teach (**Sir Jalien, JHS teacher**).

This activity helped me to assess my own lesson plan to ascertain if the lesson plan is TPACK-compliant or not (**Aseda, primary 4 teacher**).

I was able to review my lesson plans with support of a sample TPACK-compliant lesson plan. Through that, I was able to know that I had never used TK in any lesson plan (**Damian, primary 6 teacher**).

One can conclude from these comments that the participants recognised and appreciated the importance of developing lesson plans that would integrate TK into CK and PK to make them TPACK-compliant.

Consistent with this integration, Harris and Hofer, (2009: 99) confirm that:

Successful technology integration is rooted in curriculum content and students' content-related learning processes primarily and secondarily in savvy use of educational technologies. When integrating educational technologies into instruction, teachers' planning must occur at the nexus of standards-based curriculum requirements, effective pedagogical practices, and available technologies' affordances and constraints.

They argue that technology integration should be 'content-keyed and activity-based' (Harris and Hofer, 2009). Meaning the lesson content and its related activities must be commensurate with the technology used. It is important to note that teachers develop their lesson plans from their subject teaching syllabuses in the curriculum. Thus, an example of a page extracted from the Primary four Citizenship Education curriculum (Fig. 4.3), reveals that even though there are Content and Teaching Learning Activities (TLA) columns, which in my view one could label as, CK and PK respectively, TK is completely

missing. In other words, because the syllabus is silent on technological knowledge (TK), the participants' traditional lesson plans are also silent on it. The participants showing appreciation of the review of their own lesson plans against the TPACK framework reflected in a number of responses as follows.

The activities were very interesting and the idea of using the TPACK framework to review my lesson plan, made the day exceptional to me. The exercise exposed me to develop lesson plans, which integrated Technology into Content and Pedagogy (**Sir Benjamin, the ICT teacher**).

PRIMARY FOUR				
SECTION 2				
RESPONSIBILITY				
General Objectives: The pupil will:				
1. internalize acceptable values in society.				
2. acquire the sense of belonging.				
UNITS	SPECIFIC OBJECTIVES	CONTENT (CK)	TEACHING AND LEARNING ACTIVITIES (PK)	EVALUATION
UNIT 1	The pupil will be able to:			
VALUES AND RESPONSIBILITIES IN OUR COMMUNITY	2.1.1 explain what is meant by 'values'.	A value is an idea or anything, which is cherished by an individual or a group of people.	Pupils to discuss the meaning of value.	Using "What are values worksheet" pupils to prioritize their values and give reasons for their priorities
	2.1.2 identify some values cherished in the community.	Some of the values cherished by individuals in the community are: Obedience, Love, Peace, Honesty, Tolerance, Respect for others, High achievement, Patriotism and Hard work.	Pupils work in groups to identify their individual values, values in the: <ul style="list-style-type: none"> • Home • School • Community. 	Oral exercise How do our values promote our responsibility to the community?
	2.1.3 demonstrate how societal values guide his/her decisions and actions.	Our values guide whatever we do. E.g. <ul style="list-style-type: none"> • If you value hard work, you will always do your best to every task assigned to you. • If you value peace, you will always do things that will promote peace 	Pupils role-play the following: <ul style="list-style-type: none"> • Patriotism • Tolerance • Volunteerism • Love NOTE: Teacher to observe the various values pupils portray and discuss with class.	Reacting to situation What will you do in the following situations: <ul style="list-style-type: none"> • You find money in the Classroom. • Somebody steps on your toes • You see someone tearing the Ghan Cedi. • Someone gives you a gift.
	2.1.4 explain why they should uphold their values.	Importance of Societal Values <ul style="list-style-type: none"> • Preserves the society • Finds us together as one people • Gives us a sense of identity • Promotes law and order • Prevents child delinquency • Makes people responsible 	Pupils to discuss the importance of upholding societal values. NOTE: Stress that pupils have the responsibility to uphold values in the community.	

Fig. 4.3: Showing Page 11, of the Primary 4 Citizenship Education Curriculum.
Source: Ministry of Education Science And Sports (2007). Teaching Syllabus For Citizenship Education. (Researcher adds (CK) and (PK) in red font colour).

The most significant event of the day for me was the presentation done on the TPACK concept and being asked to use the concept to identify TK, PK and CK in two of my lesson plans, which I have been using to teach all these years (**Sir Jalien**).

The most significant event in the day for me is the importance of the TPACK framework in the teaching-learning process. That is, I learned about the importance of the use of technology, content and pedagogy in teaching-learning. (**Sir Damien**).

The most significant event when I look back on the day's activities was being asked to go through my lesson plan to identify portions where I used Content, Pedagogy and Technological Knowledge or a combination of them. This activity helped me to assess my own lesson plan to ascertain if the lesson plan was TPACK-compliant or not (**Aseda**).

Findings from participants' TPACK assessment confirm what most researchers advocate that there is the need to conduct a TPACK assessment, as an activity in order to have a successful technology integration (Roblyer & Doering 2010). Fig. 4.4 shows an example of a participant's traditional lesson plan (reviewed), which she discovered addressed only content knowledge (CK) and Pedagogical knowledge (PK) and not the Technological knowledge (TK).

The portions indicating PK and CK in figure 4.4 refer to pedagogical knowledge (PK) and content knowledge (CK) respectively. It is worth noting that asking the participants to examine carefully the technology-integrated sample lesson plan (provided in the handouts) helped them to self-assess themselves truthfully and very quickly. That is, they were able to 'pass a verdict' on themselves that their lesson plans over the years have never been consistent with the TPACK framework.

The image shows a handwritten lesson plan on lined paper. The title is 'Values and Respectability in Our Community'. The plan is organized into columns: DAY, TOPIC, OBJECTIVES, REFERENCE, TEACHER - LEARNER, ACTIVITIES, EVALUATION, and CONCLUSION. The plan is for a 6th-grade class, week ending 16th October 2015. The subject is Citizenship Education, and the reference is the CLE Syllabus for 6th Class. The teacher is A.A. Seles, and the class is 6th. The plan includes an introduction, a presentation of values, and a group activity where pupils identify values in their homes, school, and community. The plan is annotated with red boxes and labels: 'CK' (Content Knowledge) is placed next to the presentation of values, 'PK' (Pedagogical Knowledge) is placed next to the group activity, and 'PCK' (Pedagogical Content Knowledge) is placed next to the evaluation section. The evaluation section includes a list of values: honesty, readiness to run errands, etc.; punctuality, neatness, high academic achievement; societal values: hardwork, patience, patriotism, etc.; and punctuality is arriving at a place at the agreed time. The conclusion section includes a definition of honesty as being truthful and a definition of patriotism as showing love for one's country.

DAY	TOPIC	OBJECTIVES	REFERENCE	TEACHER - LEARNER	ACTIVITIES	EVALUATION	CONCLUSION
6th	Values and Respectability in Our Community	The pupil will be able to: a. explain what is meant by values and b. identify some values cherished in the community.	CLE Syllabus for 6th Class	Teacher - Learner	Introduction Ask pupils to mention behaviours appreciated in their homes. Presentation Lead the class to discuss the meaning of values. Put pupils in three groups to identify their individual values in their homes, school and community. Explain each value identified by pupils with examples.	Expected answer: honesty, readiness to run errands, etc.; punctuality, neatness, high academic achievement; societal values: hardwork, patience, patriotism, etc.; punctuality is arriving at a place at the agreed time. Honesty is being truthful. Patriotism is showing love for one's country.	What is a value? a. Share your value b. What is a value? c. Being you best d. Every work that is given you is to be done e. Honesty is being truthful f. Patriotism is showing love for one's country

Fig. 4.4: Showing an example of a participant's lesson plan that addresses only CK and PK

ii) Preparation and production of Lesson-related films

At the film production (material production) stage, we employed the participants' mobile phone cameras and the Microsoft Live Moviemaker software, as the technologies. Besides, being the facilitator sharing technical knowledge with the team, I was conscious of the need to be flexible, as much as possible, to learn from the team and not to impose any ideas on them. Thus, I allowed them to explore their school and community's environment to take pictures, which relate to the lesson topics of the lesson plans developed from their teaching syllabuses. In other words, the lesson topic from the curriculum content, determined the kind of pictures to gather for the film production. As noted earlier in Chapter 2 of this study, a number of researchers like Dockstader, (1999) argue that it is the curriculum, which drives the technology and not the other way round.

Before I started demonstrating the filmmaking, I showed the participants two films I had produced earlier, with no particular reference to any of the social science content. Showing them films, which were not social science, was deliberate. First, it was how to make a film I was sharing with them. Second, I did not want them to think that their films should necessarily be like mine. Third, I wanted them to explore their innate creativity and potentials to produce a film. Fourth, I wanted to create the space for them to raise their anxiety, curiosity, and interest in filmmaking. These films, therefore, challenged them to the task. Following the filmmaking procedures outlined in one of the Movie Maker guides⁹, coupled with the experience I have in sharing filmmaking with some lecturers at the polytechnic level, I customised the procedures in a simple comprehensible language to direct the group to use in producing their films. I also tried to avoid creating any formal and academic atmosphere or making the presentation sound too academic. This made the participants relaxed.

⁹ <https://www.lib.ncsu.edu/documents/digitalmedia/GuidetoWindowsMovieMaker.pdf>

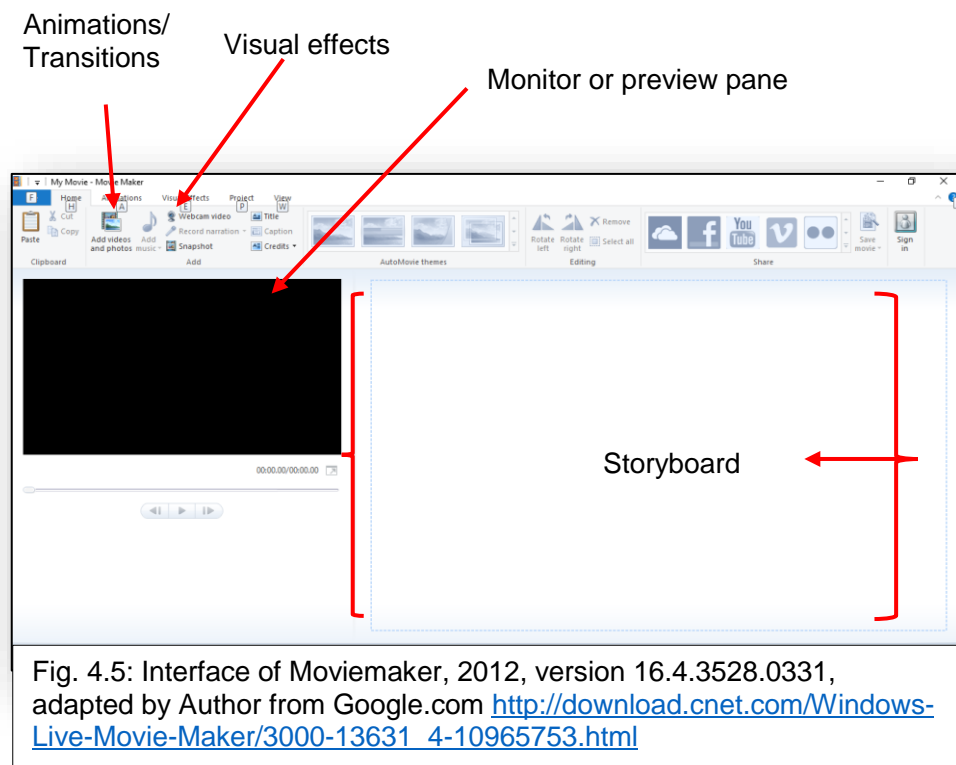
The procedures included the following steps, which I modified in simpler and less technical language to assist the participants' comprehension.

1. Take your relevant and appropriate pictures with your mobile phone camera.
2. Transfer the pictures from camera to a folder you create on desktop or anywhere on your computer
3. Import all the pictures you will need from folder onto storyboard, which is invisible. (The moment you click on 'Add videos and photos' pictures pop out on the storyboard).
4. Also, import music and any sound that you will incorporate into the film, by lowering a dropdown arrow indicated by the 'Add music' button.
5. Position the indicator at the beginning of the storyboard and click on the 'Title' button for the title slide to drop down on the storyboard as the first slide.
6. Give the title slide a background colour if you choose. Add text of contrasting colour.
NB: What you write introduces the film.
7. Arrange all other relevant picture slides/video clips sequentially on the storyboard to ensure a link/flow of the content of your lesson plan.
8. Add 'Effects' and 'Transitions' to each slide.
9. Add sound, either in the form of a narration and/or music
10. Add text in appropriate colour that is legible where necessary.
11. Add a credit slide (end slide) and acknowledge all who contributed to making the film.
12. Edit the film on timeline, to adjust how long each slide should play. (By default, each slide plays for 7 seconds).
13. Save a copy of the film as a project, and a copy as an editable file for future editing.

* (Participants can still use their discretion to improve on their films).

It is worth noting that carrying out this activity, for me, was not a problem because of the small number of participants. It was thus, easy to involve all participants and give each individual the needed attention to grasp the processes involved. I realised the participants already have the skills of transferring pictures from their mobile phones onto desktop.

Therefore, the next thing was to introduce to them, the Moviemaker, 2012, version 16.4.3528.0331 software interface adapted from google.com. Next, I explained the functions and uses of the key features. These features include the Monitor or Preview pane, the Storyboard, the timeline, the animations (transition) and visual effects commands (Fig, 4.5). Other information included how to access the beginning and the end or credit slides, etc. In addition, I introduced them to how to import the pictures, or sound or music to the storyboard and how to do a narration. Then for the film production, I shared with them a systematic demonstration, following the outlined steps.



For each step I performed, the participants watched it and I invited each of them in turn to the front to repeat the same step after me. Therefore, each participant watched a peer perform a step. We followed the procedure from step 1 to 10 and I observed that their interest and confidence grew as the activity progressed, more especially when we introduced the effects and transitions to animate the slides and added a background music.

At the end of this procedure, participants owned the film because they were the ones who performed all the steps and I only facilitated the process. Interestingly, at the end of this group production, each individual became an expert in a particular step. For instance, the female participant in the team became competent at narration. One male participant became competent in editing, trimming off unwanted pieces of the film on the screen; another person, took interest in slide design and text colour management; another person, content arrangement on the slides. This took place within a very short period, to my surprise. The implication of this is that, given the resources and training, this group could form a collaborative learning community to share this knowledge with their colleagues who were not part of this workshop. Lave and Wenger, (1991: 31) describe this as Communities of Practice, (CoP) which characterises a situated learning framework. Lave and Wenger described 'situated learning' as "more encompassing in intent than conventional notions of 'learning in situ' or 'learning by doing'".

Communities of Practice describes a group of people who share similar interests in something they do. An example could be a group of public Basic school Social Science teachers who share similar interest in developing lesson/context-related films to use as TLRs to support their traditional teaching-learning methods. With this common interest, they learn new knowledge about their interest through interaction with each other and team work. Thus in Fig. 4.6 for example, the teacher participants united as a team to work on a common film, even though they teach different classes. Clarke, (2016: 12) asserts that "the use of CoP affords the opportunity to explore the socio-cultural influences on teachers' knowledge development and changes in their technological pedagogical practices and identities".



Fig 4.6: Showing four of the research participants as a team to produce a film.
Source: Photograph taken by author

One important thing, however worth noting is that when I initially projected the Movie Maker interface on the screen, the only female participant among them was so scared that she interjected the presentation. She said (with a skeptical smile on the face, and showing some frustration quite strongly and bluntly), “This is where I think, at least, some basic computing skills must be introduced before you come out with ...” (using the right hand stretched out in gestures). This comment confirms the general findings having basic computing skills as a prerequisite for integrative skills training (Hignite and Echternacht 1992). It also confirms from an MOE’s study reported by Agyei (2012), that very few teachers have basic computing skills. I suggest that future facilitators in a similar study should not take things for granted. It also goes to confirm research findings, that there is the need to have basic computing skills before venturing into technology integration.

The main problems faced during the training workshop were the lack of teachers’ own laptops to continue working on the films at home, poor functioning of laboratory computers and intermittent power supply to enable smooth presentations via the

projector. Apart from these, even though the participants did not encounter much problem arranging the still pictures sequentially on the storyboard, they found merging text, pictures, music or narration or sound, transitions and effects, for example, quite challenging. They also found readjusting the time each slide should play on the timeline quite challenging, as they were not too sure of how long a slide should play. These challenges were probably because it was the first time they ever used the Moviemaker software. Nevertheless, I left that to their own discretion, because they know the duration required to teach a lesson topic. In addition, I felt with their experience regarding explaining concepts in lesson topics and the learners' level of reception to the topic, would help them to determine which part of a film should play for a longer period. I did not impose any time on them. In the end, even though they were able to produce lesson-related films to support their teaching and learning activities, they needed much support to achieve it.

iii) Revision of traditional lesson plans into TPACK-compliant lesson plans.

The objective of this activity is that:

By the end of the activity, the teachers will be able to integrate their lesson-related films (the Technology) into Content and Pedagogy, to make it TPACK-compliant.

Having conducted a TPACK self-assessment and appreciated the need to include TK for successful technology integration, the participants tried to revise their reviewed lesson plans to accommodate TK, thereby developing TPACK. With the facilitator's support, they looked for portions in their lesson plans where they could use TK (the film) as a TLR to reinforce teaching and learning. In our own way, we believed we have cleared two hurdles. The first, being TPACK self-assessment, and second, identifying portions of the lesson plans, where the participants can use films to reinforce teaching-learning activities. To guide the participants to revise their reviewed lesson plans, I paid attention to Harris and Hofer's, (2009: 100) admission that it is complex and difficult to apply, learn

or teach TPACK in practice because of the interwoven and interdependent nature of the seven constructs. Guzman and Nussbaum, (2009) echo this complexity, pointing out that integrating technology into classroom work is a complex one. I also relied on Koehler & Mishra's (2008) assertion that one can only express the TPACK in varied ways in various contexts, for varying levels of students and at different times, to leave the teachers with all the space to use their own discretions and professional experience to explore their creativity.

The participants were able to identify these portions because their lesson plans have already integrated CK and PK. I followed Harris and Hofer's (2009: 101), Learning Activity Types (LAT), which acts as a conceptual planning tool for teachers because it focuses on students' learning-related activity such as group discussions and role-plays.

iv) Exemplar One of a Teacher's TPACK Development: In the teacher's revised lesson plan (Fig 4.7), for basic 4 learners, which is lesson content-related, the activities the teacher engages the students included brainstorming, watching and interacting with a film, 'Think-Pair-and-Share', 'question and answer' techniques and group discussions. For homework, the teacher gives the pupils the instruction to match values with their meanings.

The lesson plan also indicates that with a matching educational technology, (in this case, teacher-made lesson/context-based film), the teacher is able to weave or combine three knowledge sources together – i.e. technological knowledge (TK), content-based knowledge (CK) and knowledge of instructional strategies (PK) to teach the lesson. In doing so, the teacher is able to develop four other kinds of technology integration knowledge, three of which are TPK, TCK, and CPK. The fourth knowledge, TPACK, which is also a product of the intersection, (the orange colour shaded portion of Fig. 4.7) was necessary to complete the integration. It is important to note that: "... each and all of these types of teacher knowledge are shaped by a myriad of contextual factors, such as culture, socioeconomic status, and school organizational structures" (Harris and

Hofer, 2009). In this instance, as can be seen from the figure, the teacher in step 5, asks learners to identify the values exhibited in the film they have watched and list them in their notebooks. This shows how the TPACK was not limited to the use of movie-maker produced films alone, but enabled the teacher to integrate technology holistically to create a more powerful pedagogy and enhanced learning.

Lesson activity section of Aseda's Basic 4 Citizenship Education Revised Lesson plan – 70 mins.	
Step 3: Meaning of Values	
Teacher leads pupils to brainstorm to come out with the meaning of the word 'Values'. A value is an idea or anything cherished by an individual or group of people.	(PCK)
Step 4: Examples of values.	
Teacher prepares a film for class to use as a TLR to support pupils' understanding of the concept of Values. Teacher clicks on 'play' to pupils to watch the lesson-related movie (TPK).	
Step 5: Discussions on values	
Pupils in groups to: 1) discuss the values seen in the movie. 2) list the values out in their notebooks and add other values not seen in the movie.	(TCK)
Teacher explains each value and leads the class to group the values identified under those cherished at: a) Home, b) School and the c) Community.	(TPACK)
Step 6: Evaluation	
Teacher shows each slide of the movie to pupils again and selects pupils at random to mention the value portrayed on the slide in the film. i) Explain values. ii) State and explain two societal values you identify in the film.	(TPACK)
Step 7: Homework	
Pupils to match the following values to their meanings (PCK)	
Values	Meaning
1. Honesty	The ability to stay calm for a long time without complaining
2. Patience	Always doing your best at every work that they give you to do.
3. Hard work	Telling the truth always.

Fig. 4.7: Technology integrated into lesson plan to make it consistent with TPACK.

Source: Aseda's Basic 4 revised lesson plan, that used the LearnThings lesson plan outline - copied and drawn out by author.

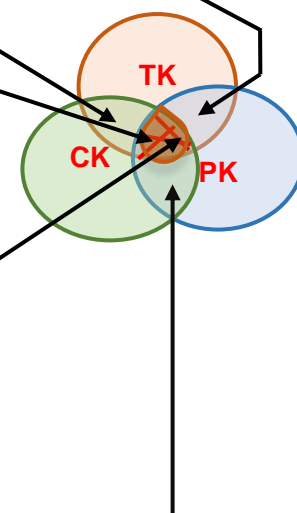


Fig. 4.7: Technology integrated into lesson plan to make it consistent with TPACK.

Source: Aseda's Basic 4 revised lesson plan, that used the LearnThings lesson plan outline - copied and drawn out by author.

Before this intervention, the teachers' traditional lesson delivery was mainly behaviourist, and she would rather have copied out notes she has prepared (teacher-made notes) on the topic on the board for the pupils to copy into their notebooks.

In this instance however, the teacher gave the learners the opportunity to engage in learner-centered activities such as whole-class discussions and 'Think-pair-share'. This enabled the learners to develop critical thinking and problem-solving skills leading to construction of new knowledge to accomplish the task. The teacher has thus, in my view succeeded in blending technology with pedagogy and lesson content to enhance learner engagement. This is one example of the teachers' development of TPACK.

I was aware of the caution researchers like Mishra and Koehler (2006) and Harris and Hofer (2009) gave about the complexity of integrating technology into content and pedagogy. I was also aware that Mishra and Koehler stated that there is no single way to do integration. Therefore, I made conscious efforts not to use any technical language or make things sound and/or look academic to the participants, to avoid scaring the participants. I sounded very casual, using everyday classroom language and rather left them to apply their professional experience to explore their creativity potential. From my observation, they enjoyed the exercise also because it was new to them and they wanted to see its outcome.

One participant (the School's ICT teacher) said:

The activities were very interesting and the idea of using the TPACK construct to review my lesson plan, made the day exceptional to me. The exercise exposed me to develop lesson plans, which integrated Technology into Content and Pedagogy (**Sir Benjamin**).

The primary six teacher said,

I was excited and the reason being that the presentation skills used by Madam Dzigbodi Banini was simple and participatory, making it easy for me to understand the issues (**Sir Damien**).

The class five teacher also commented that,

The review of our lesson plans was exceptional to me because it contributed to knowledge I did not have before. It sharpened my learning skills because I came to the realisation that my lesson plans must have CK, PK, and TK integrated **(Sir Jonas)**.

The primary four teacher's state that,

The most significant event was being asked to go through my lesson plan to identify portions where I used Content, Pedagogy and Technological Knowledge or a combination of them. This activity helped me to assess my own lesson plan to ascertain if the lesson plan was TPACK-compliant or not **(Aseda)**.

From my own viewpoint, I argue that if integrating CK, PK and TK constructs, TPK, TCK, PCK and TPACK emerge, then it makes sense to think that once a teacher is able to integrate the TK successfully into the CK and PK, the blends will emerge, seamless and represented, making the lesson a TPACK-compliant one. Thus, if teachers (in Ghana) develop lesson plans from their curricula or teaching syllabuses, which already blend CK and PK, then it follows that the moment a context and lesson-related film (TK), is used or applied to support the teaching of that lesson, TPACK is already seamlessly in operation. This, in my view follows from what Harris and Hofer's (2009) Learning Activity Type (LAT) recommends for successful integration – that the activities link up to the curriculum / lesson content and that will determine the type of technology the teacher would use. Summarising this into an equation, we have student-directed activity (PK) + Curriculum content (CK) + a matching educational technology (TK), the interweaving of all three is = TPACK.

For the participants' teaching strategies (PK) adopted during their teaching practice, I observed that they could not help but use activity-based and student-centred (constructivist) approaches (see the PK construct in Fig 4.8) to conduct their lessons. This was because they used lesson/context related films to support their teaching, even though occasionally, they slipped into adopting the lecture and other teacher-centred (behaviourist) approaches they were very much used to practising (Akyeampong, Pryor

and Ampiah, 1999). For instance, in step 5 of figure 4.7 lesson plan, when the teacher asks pupils in groups to discuss the values seen in the film, one would expect the teacher to go further to ask the pupils to explain or describe the values they have identified. However, it was the teacher rather who, in the lesson plan intends to explain each value the pupils identified.

Another phenomenon I observed during the participants' practice was that even though they integrated the TK at portions of their lesson plans, they all found it helpful to introduce their lessons by playing the whole film first. Then as the lesson progressed, they paused the film at various stages to apply teaching techniques such as whole-class discussions, 'think-pair-and-share', and question and answer to move the lesson on. As mentioned in section 2.6.1, moviemakers have the interactive features, which make playing the film back and forth and pausing at intervals possible and this facilitated 'active viewing' approaches with the pupils/students (Galbraith, 2004).

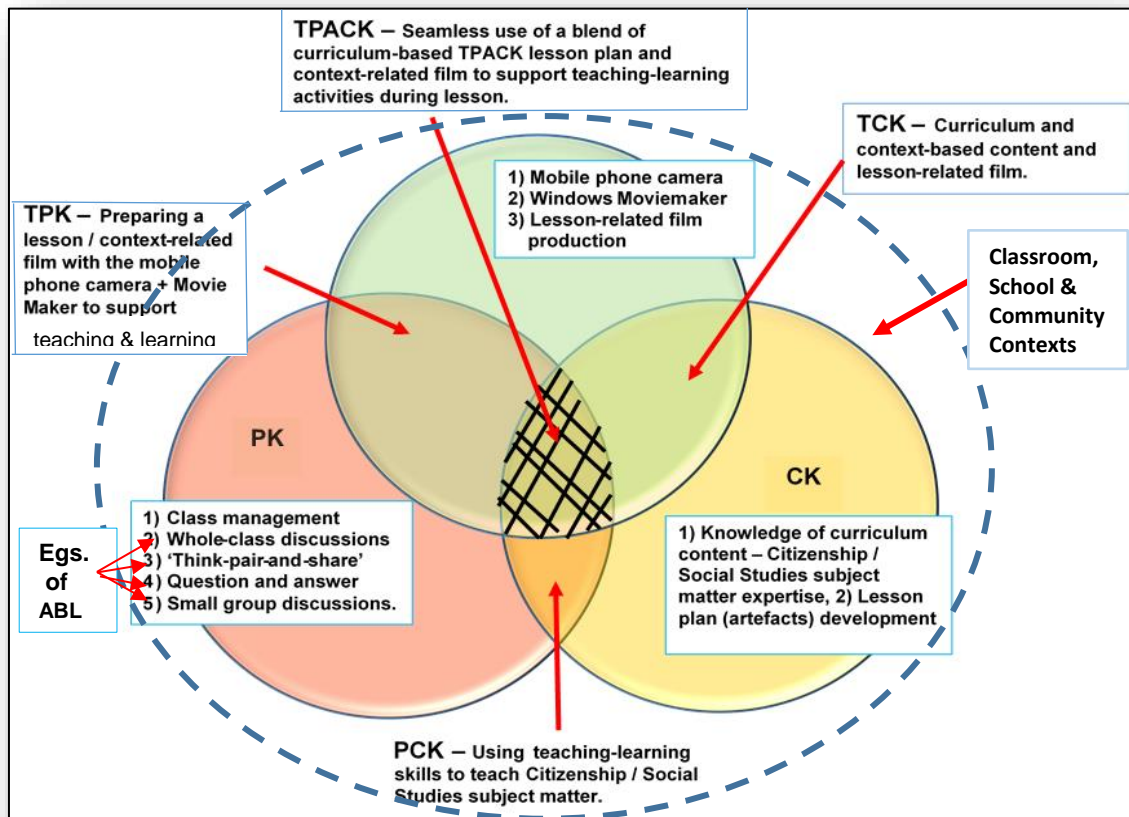


Fig. 4.8: TPACK framework in practice – Some activities the participants undertook..
Drawn by author

Overall, Fig. 4.8 shows a broad picture of what went into each construct as the researcher guided the teachers through the activities, leading to the development and implementation of the TPACK framework in practice.

v) Exemplar two of a teacher's TPACK development – a story of teaching the concept of 'Governance'. This was demonstrated in the teacher's ability to prepare and blend teacher-made lesson/context-based films, (i.e. technology) with lesson content and teaching strategies to support teaching and learning activities. In this instance, Sir Jonas developed a lesson/context-based film to support the teaching of the topic, 'Governance in Ghana' for Basic five pupils (boys and girls), of average age 10 years, mixed ability, in a Citizenship Education class.

Lesson Planning:

Sir Jonas' lesson plan indicated a film preparation and development, in which he capitalised on two issues. Firstly, the pupils' previous knowledge of ever engaging in election of school prefects to take on roles the school authorities assigned to them.

Secondly was the pupils' previous knowledge of experiencing how the elected prefects carried out their assigned roles and responsibilities by involving their fellow students to perform their daily routine. Sir Jonas used these two pieces of information related to the concept of 'Governance' to prepare the content of his film. He went ahead to organise some of his pupils for a role-play that depicted how elected prefects governed the student body to perform their daily assigned duties. He then took still pictures of these instances with his mobile phone camera and using Windows Moviemaker, he prepared his lesson/context-related film to support his 70 minutes (double period) lesson.

It is important to note that basing the content of the film on learners' previous knowledge and experience, is consistent with Richardson's (2003: 1623-24) view on Constructivist Pedagogy. She explains that in the field of Constructivist Pedagogy, individuals create their own new understanding on the basis of the interaction between what they know

already, their experiences, beliefs and worldviews, and ideas and knowledge with which they come into contact. The environment for almost all the slides composing the film, therefore was the same as the environment the pupils were already conversant with. One can reason that the teacher exhibited creativity in his lesson content planning - an example of the creativity Dr Zhao (2017) points out that everyone is potentially and innately creative and given the chance will exhibit that creativity.

Another feature of the film was its background music, which was a little bit distracting because of its loudness and the lyrics was also not particularly relevant to the content. However, these shortcomings were negated by the effects and transitions introduced into the film from the affordances inbuilt in Moviemaker. These gave the film a pleasant animation, which also drew the pupils' attention and focus on the lesson. The teacher also labelled the slides appropriately with text to enhance the pupils' interpretation of what each slide was about.

Lesson Implementation:

Sir Jonas' lesson plan stated a lesson objective that "By the end of the lesson, the pupil with the aid of a film, will be able to explain what Governance is in Ghana and its importance".

Before showing the film, Jonas introduced the lesson by informing the class about the topic for the day, 'Governance in Ghana', which he wrote on the board. He did not begin the lesson by asking the pupils to state the meaning of a technical term as 'Governance', as he would have done previously. He rather introduced the lesson with a ten minutes discussion, which probed the pupils' understanding of governance, first at school level, through a 'Question and Answer' technique. He then asked the pupils to pair up as he projected the film on the screen (white board) for them to watch. The film formed the 'hook' that inspired and challenged the pupils to describe in their paired groups what they

watched and to come out with their own understanding of governance, to report to the class.

The film in itself helped in managing attention of the class probably because of a number of reasons. First, being that the pupils said they had never experienced a film-supported lesson. Second, they identified with the context within which the film was set. Third, some saw themselves in the film, while others saw their colleagues so they were eager to watch everything the film was about. Bramwell, Reilly, Lilly, Kronish, and Chennabathni (2011: 131), explain that “To some extent, creative teaching ... means solidifying students’ ideas, attitudes, and beliefs, that are already being formed and further maximizes the outcomes of teaching excellence”. Sir Jonas reinforced this with ‘Question and Answer’ and ‘Think-Pair-and-Share’ techniques to initiate discussions after the pupils watched the film. He also applied the interactive features built in moviemaker to promote ‘active viewing’ among the pupils (Galbraith, 2004). He explained that “the activities I introduced in facilitating the lesson were to enable the pupils to come out with their own understanding and construction of knowledge about the concept of Governance”. One can describe the use of these teaching strategies as an aspect of Jonas’ creative potential, which Bramwell, et al., (2011), explain that “Teachers’ creative processes emerge from the interaction between their personal characteristics, including personal intelligences, motivation, values and the communities in which they worked and lived”. The slides which composed the film are sequentially arranged from slide 1, 2, 3 to slide 9, and for ethical reasons, I extracted the pictures directly from the finished film, thus making them a bit blurred to conceal the identity of the pupils. I also redesigned their school uniforms clothes, the triangular flag and table clothes, using the paint software. Where it was necessary to conceal the pupils’ faces, I did.

It can be seen from each of the slides that their labels are self-explanatory and depict or give an idea to the reader about what governance entails from slide 1 to 9.

Slide 1



Title/Lesson Topic Slide

Slide 2



Head prefect & other prefects conducting assembly.

Slide 3



Pupils at assembly under the command of the head prefect

Slide 4



Girls' prefect making announcement at assembly on next line of action

Slide 5



Sports prefect spelling out rules for a sports programme.

Slide 6



Entertainment prefect on duty, informing colleagues

Slide 7



Compound prefect instructing students

Slide 8



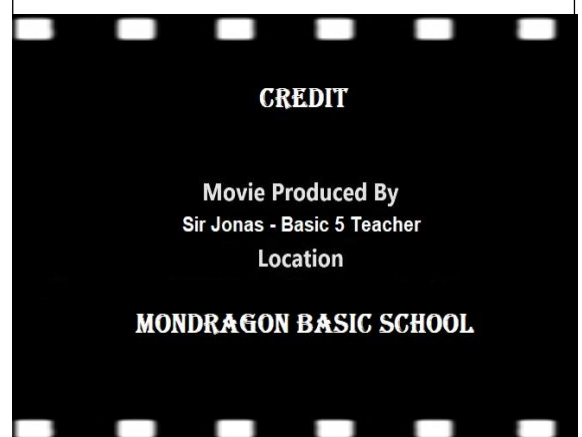
Compound prefect leading colleagues after instruction to pick litter around

Slide 9



Pupils picking litter under the instruction of the compound prefect to keep the school compound clean

Slide 10

Slide 10
Credit Slide

After describing what they watched in the film, Sir Jonas asked his pupils in what ways they think the everyday roles of the prefects helped in running the school. Sir Jonas summed up the responses of the pupils, that when people are assigned work and they take decisions in order to manage and do the work, it is 'governance'. For further reinforcement of the pupils' understanding of the concept, he asked them in their paired groups to report their understanding of governance to the class in their own words, through examples. The responses included the following:

- i) When we elect prefects to help keep order in the school.
- ii) When the prefects make sure we obey school rules every time.
- iii) Governance is when our prefects tell us to sweep the compound to keep it clean and we obey.
- iv) The prefects make sure we don't make noise in class or at assembly.
- v) The compound prefect tells us to collect rubbish every day to keep the school clean. That is governance.

The teacher wrote out the responses – that is pupils' own construction of new knowledge on 'governance' on the board for them to write out in their notebooks. Previously, it was the teachers who would construct the definition on the board for the pupils to copy, whether they understood the meaning or not.

The next sub-topic discussed was Governance in Ghana. The teacher guided the pupils to transfer the knowledge they constructed on governance at school level to national level. The pupils were able to mention the roles of various institutions like the police maintaining law and order, the armed forces keeping peace, the doctors seeing to patients and others. Sir Jonas again summed up the pupils' responses that the collective efforts of all these institutions to perform their roles is governance. The lesson concluded with a discussion on the Importance of Governance, which the pupils actively participated in because of the grounding they had in understanding the concept of governance.

Essentially, the teacher showed evidence of TPACK development, in that he was able to incorporate or integrate the lesson topic and context (the pupils' prior knowledge and experiences), into developing the content of the film (TCK). Then he used the film to facilitate the lesson, by letting the pupils watch it (TPK) while applying the appropriate and relevant, pedagogical techniques such as 'Question and Answer', whole-class discussion and 'Think, Pair-and-Share' to explain content (PCK). All three 'knowledges', TCK, TPK and PCK, were all interwoven to enhance lesson delivery. Jonas remarked that "... I view the TPACK as relevant for classroom work". He also observed that "Teaching technology-integrated lessons should be encouraged because it captures the

pupils' attention in class". One can agree with Richardson, (2003: 1627), that the classroom environment Sir Jonas created and the activities, strategies and methods he applied in this lesson are grounded in a constructivist theory of learning. The lesson resulted in a learner-centred pedagogy, a feature confirmed by the pupils' active engagement and participation in the lesson, and further suggested their deep understanding of a topic, which otherwise was quite complex for their age and level to understand.

Sir Jonas remarked that:

I learned how to use pictures to make films suitable as Teaching-Learning Materials for pupils. It was an activity helpful as far as classroom TLM preparation is concerned, because such TLMs have the tendency of drawing pupils' minds to the lesson for a very long time. It can really capture children's attention in class.

He, and the other participants however admitted that planning a TPACK-compliant lesson, especially preparing a film, which demands taking appropriate and relevant pictures/videos was time consuming, but using the film as a TLR to teach a lesson becomes easy in the end.

4.4 What are the teachers' reflections and experiences in the use of the mobile phone cameras and other new technologies, using the TPACK as a process?

In addressing this question, I relied on the participants' own reflections and experiences they documented in their individual reflective journals and some responses they provided at the face-to-face interview. The journal entries began on the first day of the 'Learn and Share' workshop, which lasted for five days. In the first place, it is important to note how the participants felt when the activities started unfolding at the workshop. Generally, they expressed similar sentiments of excitement and gladness, though one participant, the class 5 teacher, expressed nervousness, that

While the activities were going on, I felt a bit nervous because many of the things were quite new to me. I was a little jittery because these were new things I was learning (**Sir Jonas**).

On the contrary, the other participants who expressed excitement and gladness on reflection indicated that:

As the day's activities were going on, I felt glad to be part of the training programme because I have realised that I can also use my phone to help in my lesson (**Aseda**).

As the activities were going on, I was very excited that I was learning new things (**Sir Jalien**).

I was very happy with all the activities because even as an ICT teacher, I felt I was learning new things. I felt very enthusiastic and eager to learn more as the activities were going on. (**Sir Benjamin**)

As the activities were going on, I was excited because the presentation was made simple for me to understand (**Sir Damien**).

Despite these admissions, three of the five of participants conceded that their confidence level was low in basic computing skills.

My confidence level as to using or manipulating the computer was low. My ICT skills were weaker than I thought so I faced some challenges at first trial. I needed to improve on my basic ICT skill to be able to effectively use the training (**Aseda**).

I am not too much conversant with using my computer. I need more constant practice in my ICT lessons (**Sir Jalien**).

I realised that I was not up to the level of basic computing skills necessary for making a film (**Sir Jonas**).

Christensen, (2002), points out that basic computer skill should be a factor to consider for technology integration into classroom activities. She agrees with Collis, Knezek, Lai, Miyashita, Pelgrum, Plomp, and Sakamoto, (1996: 31) that 'since teachers are the channel through which educational innovations pass into classrooms, there is the need to consider teacher training essential for effective technology integration in school curriculum'.

All five participants in their reflections seem to appreciate the use of the TPACK framework to self-assess their TPACK development, as far as their professional practice was concerned. This was evident in the following individual responses participants gave when asked what their most significant activity on the first day of the workshop was.

- i) The idea of using the TPACK framework to review my lesson plans.
- ii) Reviewing my lesson plans to identify CK, PK and to integrate TK,
- iii) My lesson plan review leading to TPACK self-assessment,
- iv) The introduction of a TPACK-compliant sample lesson to us followed by reviewing my already prepared and previously taught lesson plan.
- v) Examination and review of my lesson plans to identify CK, PK and TK in them.

These events were very significant and made the day very exceptional to them.

Participants recorded numerous accomplishments regarding the use of the mobile camera and the moviemaker. Individually, they reported that they could now take lesson-related pictures (still and motion) with their mobile phone cameras and import the pictures onto moviemaker storyboard. They could arrange the pictures systematically and in storied form, add text, motion, music, voice (narration) to the pictures on the storyboard to produce lesson related films.

I was able to use still picture to produce a film. I was able to change the font colours & background colours of the slides. I was able to demonstrate how I can teach my developed TPACK compliant lesson plan. Films will assist me in my lesson delivery and make it more participatory and lively for both students and I. **(Sir Jalien)**.

I can add motion to still pictures. I can now take pictures, using my own mobile phone and developing a film out of them for my children to support my teaching. Films will support my lessons. I do not have to always draw images and diagrams on the board to use as TLRs. **(Sir Benjamin)**.

I have been able to add text and animation to pictures as well as voice narration and credit I am able to prepare a new lesson plan, which integrates technology I was able to use a moviemaker to prepare movie for a lesson. I felt absolutely relieved because I will do no more drawing. I think my TPACK-compliant lesson plan is more orderly. Now my teaching will be more child-centred **(Aseda)**.

I was able to assemble pictures to produce a film that I can use to teach. I was able to review my lesson plans with support of a sample TPACK-compliant lesson plan. Through that, I was able to know that I had never used TK in any lesson plan. Films can help me elicit my pupils' interest in the classroom. I came to the realisation that a simple and concise way to make the lessons in my class interesting is using a film to teach. It will enhance pupils' understanding of the lesson **(Sir Damien)**.

I can now use my laptop and mobile phone to prepare a movie to use as TLR for teaching and learning activities. I am now able to develop a TPACK-compliant lesson plan to support my teaching and learning activities. Films are likely to invoke the C21st skills in my pupils and capture their attention for learning **(Sir Jonas)**.

These testimonies confirm and are consistent with several research findings (Hernández-Ramos 2005; Oliver and Omari 1999), and literature reviewed in Chapter two that technology integration has potential benefits for both the teachers and the learners. The impact of using mobile phone cameras in conjunction with the moviemaker software to produce lesson-related films on pupils and students in the researched school has been treated in details in section 4.6 of this chapter.

4.5 Which challenges did the teachers face in the implementation process?

a) Poor quality computers:

The challenges the teachers faced as they reported started before the implementation period and continued into the time of their practice. As mentioned earlier, only 30 out of the 40 computers in the laboratory were reported working, though none had received any updates or been upgraded for a long period, contrary to the impression I got from the school. This affected the participant's ability to install the Moviemaker software, which I brought for them on pen drive to install on at least four or five of the desktop computers. Luckily for us, this was the experience they had the day before we used the computers. The mistake was that I relied too much on the ICT teacher to make at least four computers functional before I arrived for the workshop. In the end, apart from my laptop and that of the ICT teacher's, one desktop and one participant's laptop was working. Canuel, (1999) explains that for effective and sustainable technology integration, an institution should have professional, technical and financial support for the overall competencies in installation, operation, and maintenance of technical equipment to cushion any technical breakdowns.

b) Access and Accessibility to other equipment:

During implementation, the teachers continued to face the problem of access and accessibility to the computers in the laboratory to prepare the films. Even where there

was access after regular class hours, the teachers could not use the computers to add voice (narration) to their films because the computers' speakers were faulty. They lamented that if they even had individual laptop computers, they could have squeezed some time at home, especially at the weekend to prepare the films.

c) Intermittent electricity supply

During the period of the workshop and the implementation period, the country was going through a power rationing exercise. Therefore, the teachers suffered from intermittent electricity supply as the school has its lines hooked to the national grid. This affected some of the presentations, which I did directly from the computer. It also affected the times they could work on their films. All five participants reported this in their reflective journals and their face-to-face interviews that the only worrying issue was the power failure we experienced. 'The on and off power supply prevented the use of the projector throughout. There was the problem with the lighting – electricity supply was intermittent'.

d) Lack of enough time for material (lesson/context-related film) preparation

The teachers said the preparation of films was time consuming, because it included having to go around to take pictures that would use to prepare the films. Watkins and Mortimore, (1999: 9) expound on the issue of lack of time associated with technology integration. They pointed out that the issue of lack of time to devote to other issues outside the curriculum is a priority concern that teachers complain about most of the time. Watkins and Mortimore, (1999) further explained that teachers are usually concerned about time for 'covering the curriculum' and that they prefer to concentrate on their own teaching activity to the learning activity of their students.

e) Inadequate educational infrastructure:

One participant lamented that the possibility of continuity of technology integration in his lessons was slim because his classroom is under a tent. Moreover, regular ICT classes

always occupied the computer laboratory, so there was no way he could ask for cancellation of those ICT classes for him to bring his pupils in to teach.

f) Overcrowded classrooms:

Generally, the issue of overcrowded classrooms was another challenge a teacher pointed out. This teacher had 93 students in one class so he was unable to bring all of them to the laboratory to experience the technology-integrated lesson. The majority of them were disadvantaged as a result, in terms of class accommodation and class participation.

On another occasion, when I was on a lesson observation, the teacher tried to solve the problem by moving the mobile projector and extension cord to his regular classroom so that all the students could take part in the film-related lesson. However, things did not really turn out well, as some plugs could not fit some wall sockets so he had to improvise to fix things, though with the help of the ICT teacher. This took much of the lesson period and even in their regular classrooms, there was still overcrowding, as in some instances, either three students shared two desks or five students shared three desks, as can be seen from Fig. 4.9a & 4.9b respectively.



Fig. 4.9a: Three students sharing two desks
Source of pictures: Taken by author



Fig. 4.9b: Five Students sharing three

4.6 What are the teachers' views on the impact of the technology (films) use on students' learning?

Gathering data to answer this research question was possible from the teachers' double role as participants and at the same time, as researchers on the field of practice. From my own end, to corroborate their views, I gathered my data through non-participant observation. As a guide, I used the Technology Integration Assessment Rubric mentioned in section 3.7.4 to assess the teachers' technology integration. However, it is important to point out here that even though this rubric was one of the handouts for the teachers, I did not dictate to the teachers any particular teaching strategies to adopt to teach with a film. I rather gave them the space to apply their professional experience and expertise and their innate creativity, which Zhao (2017) earlier on explained in an interview he granted Richardson, (2017), that each individual has the potential of being creative. The Technology Integration Assessment Rubric, thus only guided us to be aware of what to look for but not how to teach.

Regarding the teachers' impressions on the use of films to teach their students, the teachers reported that their students reacted positively to the use of films to teach them. Generally, they said their students were very excited when they taught them with films.

In fact, they were very pleased, happy and were more than willing to do so. (That is to supply pictures, which the teacher will use to produce lesson-related films (**Sir Jalien, JHS teacher**).

The pupils demanded for the use of films to teach them (**Sir Jonas, primary 5 teacher**).

The pupils enjoyed the lesson - the lesson was well participating by the pupils as they were able to come out with their own definitions. They demanded for the use of films to all the lessons (**Aseda, primary 4 teacher**).

I realised that the children are willing – they want to use it; they want us to use this method in teaching. So it's something we need to encourage and use it in schools. Students can even assist some of the teachers. Most of our children have laptops. They can even go for the pictures, also come, and transfer the pictures onto the teachers' laptops, for us to use. So we have to use this method of teaching in schools. It can really work (**Damien, primary 6 teacher**).

The teachers said it was the first time they ever used films to teach. Thus, after Sir Jalien, the JHS teacher taught for the first time with a film, and was escorting the students back to their regular classroom, the students halted him and warned him never to teach them again without a film. They told him they understood the lesson better and could contribute to it. Sir Jalien left them and rushed back to me in the computer lab, panting and said:

"Madam, we are in trouble". I asked which trouble and he said: "The students said I should never teach them again without a film".

According to the other teachers, their pupils became very enthusiastic about this new way of teaching and learning. The pupils therefore did all they could to support their teachers in various ways to continue using films to teach them. For instance, the class six teacher, Sir Damien, showed me a brand-new laptop computer one of the girls brought for him to use, if that was what would take him to produce the films to teach her. The girl's father allowed her to bring her laptop computer to school.

Sir Damien stated that:

Another parent wanted to know more about it ('it' referring to the teaching the pupils with a film), and I did explain everything to the father, and the child was also very happy. The child came again with a laptop and said that she wants me to use it because she realised I don't have any laptop myself.

Sir Jalien said he was shocked about the number of students in his class, who indicated that they owned mobile phones and laptops. He remarked that:

The pupils demanded for the use of films to all the lessons – that is the use of films to teach them. Many of them claimed they have access to mobile phones and personal computers, which I was very much amazed about. They were even ready to bring their mobile phones to school for picture taking if they would be permitted to do so.

It seems evident that students found the use of film-supported lessons particularly useful in developing deep understanding of their subject. This is a confirmation of what Akyeampong (2016) and Wood & O'Malley, (1996), point out that technology as a powerful tool can result in an array of potential benefits to students' learning.

The class 4 teacher passed a comment to buttress this point that:

I could see that my pupils enjoyed the lesson because they participated in the lesson well. They were able to come out with their own definitions of concepts they would normally not have understood easily (**Aseda**).

Two of the participants reported that some of their pupils/students informed their parents immediately after school that their teachers taught them with a film for the first time. The participants themselves confessed that they had never taught any lesson with a film. They reported that parents were very excited over this new way of teaching when they heard about it. Some of the participants reported that some parents sent WhatsApp messages to them saying that they were willing to help support the new way of teaching their children. For instance, one participant said a parent helped his child to take some pictures and he sent the pictures to him through WhatsApp, to make the films to support his teaching. The participant said, "My children were very happy. Even one child, I

remember went to inform the parents. The parent called me and said that he wanted to send me pictures through WhatsApp. So, I even received the pictures”.

A second participant reported that: “Another parent allowed his daughter to bring her brand-new laptop to me to use in preparing the films to teach her.” She said “I realised you don’t have a computer to make the films so use mine to make the films to teach me.”

All these go to support what McNiff says, echoing Lave and Wenger, (1991) that knowledge is socially constructed and “situates itself within the groups of people who create it, and that it is a collective endeavour among individuals who share the practice”. Additionally, teachers said they were shocked at the way their students reacted during and at the end of the lessons.

I had the perception that the lesson would end soon when pupils view the movie produced because it was self-explanatory. On the contrary, it exceeded the stipulated time as it got pupils involved. Pupils were eager to contribute more to the lesson and very reluctant to go for the next lesson. Also, I felt more professional, because of the new method I used in delivering the lesson; I also felt my skills and creativity had been changed **(Sir Damien)**. Figure 4.10 shows an example of class 5 learners eager to contribute to their lesson.



Fig. 4.10: Showing a picture of Basic 5 learners, participating in a film-related-lesson.

Fig. 4.11 shows teachers' interview report on some of their students' reactions to film-supported lessons. All four teachers whose lessons I observed reported that their learners' participation increased. Their understanding in the lesson has also improved and they were excited that the teacher taught them with a film.

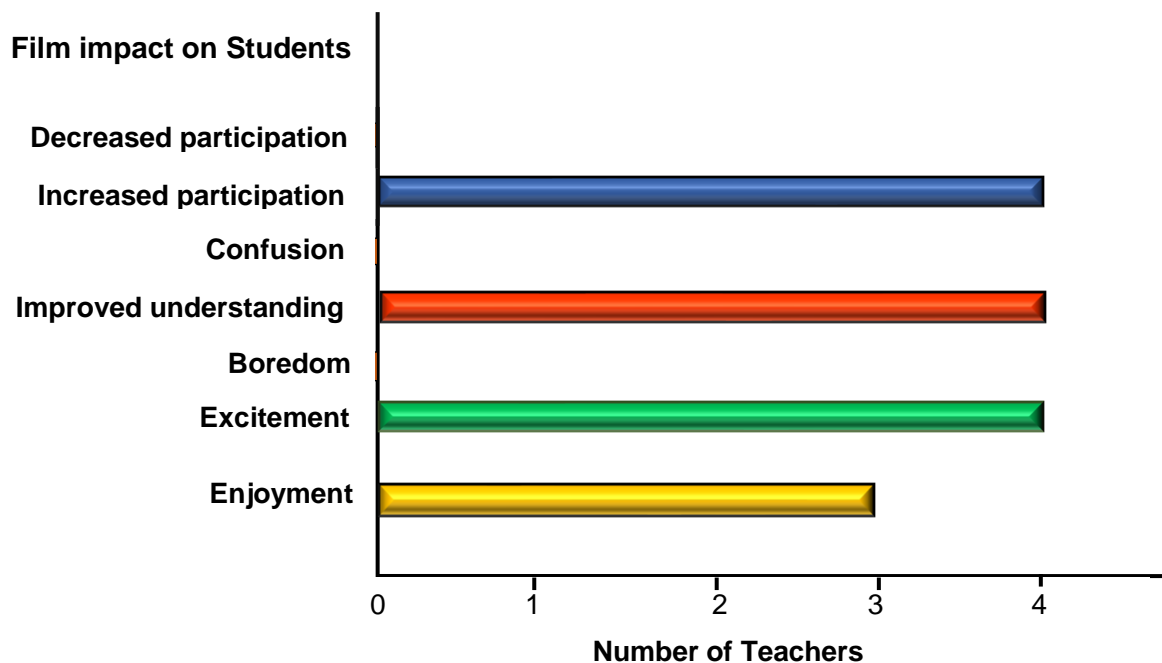


Fig. 4.11: Graphical representation of teachers' reported responses on their pupils/students' reactions to participation in film-supported lessons.

Source: Data from Author's Face-to-face interview of participants

This is a confirmation of what Mishra and Koehler, (2006); Koehler and Mishra, (2008, 2012); Harris and Hofer, 2009, 2010), pointed out that learners get very much involved in the lesson, because they understand the lesson better. Fig.4.10 shows a section of one class, where the pupils were eager to participate in answering a question.

Three of the teachers also confirmed that the learners enjoyed the lesson they taught. There was no sign of confusion or boredom. A teacher reported that the pupils were able to cite specific examples of a concept she was discussing with them. Two of the teachers admitted that the movie increased the pupils' understanding of the lesson because they contributed unusually more to the lesson discussion than in lessons not supported with films.

The movies we used depicted real situations in which the learners saw themselves or their own colleagues, or images, materials and objects, from the environment with which they were familiar. This made them understood what we were discussing **(Sir Jalien)**.

In all, these findings reveal that public basic school pupils and students embraced the use of films to teach them. In addition, the students contributed to critical decisions that could ensure that their teachers sustained the use of films in their day-to-day teaching-learning activities. This suggests that they became so much deeply involved in such a way as to take control of their own learning (George Lucas Educational Foundation, 2007). Other signs exhibited that learners have taken control of their own learning, as their teachers reported are that some students informed their parents to get involved in ensuring that their teachers used films to support their learning. Some even went to the extent of offering themselves to act short sketches, under the teacher's direction, to use as video clips producing the films.

After sitting in a film-supported lesson, a 10-year old basic five pupil confessed to all of us at the end of the lesson that it never occurred to him that he could use his mobile phone to take pictures to send to his teacher to prepare films to teach him. He instantly vowed that from then on, he would stop using his phone to watch pornography. He said, "I never know that the mobile can be used to make a film. I use my phone to watch pornography. I'll stop and rather take pictures for the teacher to prepare films." This attitude confirms what literature suggests that film-based lessons deliver photographic background and that they are fascinating, entertaining to learners, and stimulate them (Donaghy, 2014; Joyce, 2007; Kubey, 2004 and Paris, 1997). Films also make lessons participatory and less teacher-centred. The example of this basic five pupil indicates that he has become eager to own his lesson, by offering to contribute a part of the whole to ensure that he attains the full benefits of his learning. As I was sitting quietly at the back of the class as a researcher, I picked my own impressions about the students' reactions to each film-supported lesson from observations and directly from interacting with them

in the presence of their teachers. My findings aptly corroborated the teachers' reports on their students.

4.6.1 Researcher's comments on lesson observations

Even though the scope of my study did not extend to cover learners directly as my target respondents, I became very curious about their excitement over the film-supported lessons. I, therefore, engaged in a brief interaction with them to learn about how they felt after the film-supported lesson. Almost the whole class raised their hands to reply to the question, out of excitement. I recorded the following answers, which many of them told me.

- We understood the lesson better.
- We were able to talk. (I suppose, they mean they were able to contribute to the lesson).
- We paid more attention.
- We can do more research.

From my own observations, the students were very anxious and curious about what the teacher wants to do at the beginning of the lesson. They glued their eyes on the board. They were excited to watch a film in a lesson for the first time and to realise, to their surprise, that they were familiar with the images in the films. Their concentration level was high leading to high participation and according to them, better understanding of the lessons. The class was active. When we go for class observation, students will normally not concentrate on the lesson but will be stealing glances at us. This was not the case this time with a film to support the lesson. The students told me they were willing to assist their teachers with pictures and that theirs will even be far better in quality than what their teachers used for the films. In addition, they demanded that their teachers should use films to teach them all subsequent lessons and preferably, they would want to have their classes in the ICT laboratory.

These reactions confirm what researchers like Oliver and Omari (1999) and Dellit, (2002) pointed out could result from teachers integrating technology as a tool into teaching.

4.6.2 My field notes from lesson observations

All the teachers had very active participation from the classes they taught with film support. On one occasion, I observed that when the class was over and the teacher asked the students to move out to their regular classroom, they expressed disappointment and reluctance by shouting. Some shouted “Oh!!!!” and others “No!!!!” in unison and walked out reluctantly.

One could feel behind them that they were waiting to hear “*Okay, come back*” from the teacher. It was clear they did not want the class to end. On that occasion, the teacher told me he was very much surprised himself at the increased level of participation in the class, which was to him out of the normal situation he used to experience. Advocates of technology integration into pedagogy like Mishra and Koehler, (2006); Koehler and Mishra, (2008, 2012); Harris and Hofer, 2009, 2010), point out that learners get very much involved in the lesson, because they understand the lesson better. They are able to engage in critical thinking and problem solving (Akyeampong, (2016); Moskovich and Sharf (2012); Wood & Malley, (1996). I also noticed that learners got more involved in the lesson when they realised that some artefacts they were familiar with within their own context (Jackson, 2009; Leach and Moon 1999) or their colleagues appeared at portions of the films. One interesting thing I noticed also was that all four teachers, most of the time, unconsciously tried using their usual behaviourist teaching approaches, like lecturing. However, the use of the films to support their teaching seems to whip them back to use constructivist approaches.

4.7 Summary

This chapter describes the research activities undertaken, leading to findings and discussions. It attempts answering the research questions by the research tools used to arrive at the findings. The chapter commenced with a description of the FGD and the issues that emerged from the process. The selected participants proceeded to conduct

a TPACK self-assessment, using their lesson plans as artefacts. The essence was two-pronged. One was to raise awareness of the importance to TPACK in developing technology-integrated lessons for teaching and learning. The other was for them to appreciate the need to develop a TPACK-compliant lesson if teachers want to have a student-centred, participatory and active lesson. Teachers developed lesson-related films to support their teaching, though with assistance from the researcher. Their reflections indicated new things they reported learning, how these will benefit their professional practice, their accomplishments and some challenges faced during the intervention and implementation. Teachers also reported that the reactions of their students to film-backed lessons excited and surprised them. Teachers reported that lessons became more active, participatory and student-centred.

In addition, students wanted their teachers to support teaching all their lessons with films and that they could help them with the pictures. Other students linked their parents in various ways to sustain the innovative way of teaching. Some helped their teachers with their personal computers and this showed clearly that students, all of a sudden discovered that their teachers used teaching strategies that met the achievement of their learning objectives.



Chapter 5: Summary of Findings, Policy Implications for Practice, Research Limitations, Contributions to Knowledge Conclusions and Recommendations

5.1 Introduction

This research study conducted an exploratory enquiry into how public Basic School Social science teachers in Ghana could use their mobile phone cameras to produce lesson-related films as TLRs, using the TPACK framework as the process, and integrating the films into their lesson plans for teaching and learning activities. Employing a case study design with an element of action research, I collaborated with five teachers, to conduct the study. The collaboration aimed at three main goals. First, to empower the teachers to come out with their own creative and innovative ways of teaching and learning. Second, to give them the opportunity to voice out their opinions and experiences and reflect on their practices. Third, to increase my own knowledge and make a contribution in the field of educational research. My personal background and experience as a professional teacher, curriculum developer, an instructional technologist and a teacher trainer at the pre-tertiary level of education informed the study. Several times on my monitoring rounds, teachers on the field of practice would always complain of inadequate TLRs to support their classroom work. Then it occurred to me that social studies teachers could take advantage of their mobile phone cameras to create very picturesque lessons at virtually no cost to arouse the interest of the learners, especially at the basic level. It is the phenomenon of inadequate TLRs to complement inadequate number of textbooks, (Essuman, & Osei-Poku, 2015), my own educational background and the zeal to create C21st classrooms for 'digital natives' to engage in critical thinking and problem-solving, among other reasons, which triggered this study.

The chapter begins with an overview of the salient findings of the study. Following this is the concluding part of the study, which highlights on the contributions to knowledge in

the field of education. The chapter finally ends with the implications for practice, limitations of the study and recommendations.

5.2 Summary of Key Findings of the Study

5.2.1 Teachers' perception of Technology Integration into pedagogy

The study revealed the perception teachers held that introducing technology integration into teaching and learning would support their research for supplementary materials to enhance their teaching and learning activities. The research also found that teachers were very eager to receive training in both the basic computing skills and integrative skills. As far as the use of the mobile phone as a learning tool is concerned, the case study teachers felt that the ban on its use was misplaced, because it deprived them and their students of using the technology to research and gather extra information to supplement material in the recommended textbooks. Besides, the teachers believe that the digital world demands a shift from using old approaches that limit learning and narrow learning experiences. Adopting innovative instructional approaches including the use of mobile phones would afford learners the opportunity to engage in critical thinking, problem solving and teamwork, which are key for successful participation in the world of work. Furthermore, the teachers felt that banning the use of mobile phones is a violation of the students' rights to communicate with the outside world including contacting their parents and important family members, especially in cases of emergency.

5.2.2 Extent to which Basic Schoolteachers are actively using technology as a tool in classroom teaching and learning

The focus group discussions revealed that teachers are not actively using technology as a tool in classroom teaching and learning. This is because they do not only lack basic computing skills and integrative skills, but also the access and accessibility to the computers to practise. Although there was a computer lab in the school, teachers could not make use of it. The school uses its ICT laboratory for teaching ICT as a subject - and not as a tool to teach. This, in effect, has deprived the teachers of the ability to use the

technology to improve the quality of their lessons. Even for those who said they learned some amount of basic computing skills at the colleges of education, where they received their teacher training, lack of constant use has made them forget even the skills they said they have acquired. Christensen, (2002: 411) confirms this situation by echoing Loyd and Gressard (1986) that positive attitudes toward computers are positively correlated with teachers' extent of experience with computer technology. There appears to be a gap between what teacher training is trying to instil in teachers and the policy on the use of technology in basic schools, part of which is because ICT in schools is rarely viewed as a resource for improving learning more broadly.

5.2.3 How teachers explored the use of technology tools to improve the quality of teaching and learning.

With support, social science teachers were not only able to appreciate the importance of technology-integrated lesson plans through a TPACK assessment procedure, (Roblyer & Doering 2010), but successfully revised their traditional lesson plans to develop those that were consistent with the TPACK framework. They were able to produce lesson-related films that aided their teaching and learning, though they needed much support to achieve this. They were also able to indicate portions of their lesson plans, where they thought they could use the films they produced (TK), though they were not sure on exactly when they should play the films during implementation of their lesson plans. This goes to reinforce the need to engage teachers in constant and regular in-service professional development. Christensen, (2002) echoes researchers like Pelgrum and Plomp (1996), who point out that when teachers receive adequate training in working with new technology tools in their day-to-day practices, they would be able to affect integration of computers and other technologies in the school curriculum.

Teachers' were able to unearth their creative and innovative talents and potentials at the spur of the moment, as they were able to organise their pupils and direct them to act in short video sketches that they incorporated into the films. For the teachers, even though

making lesson/context-related films to support teaching and learning was time-consuming, they found the use of films very useful to supplement or totally replace pictures in their textbooks, because they said sometimes learners found it difficult to relate to the textbook pictures (Essuman, & Osei-Poku, 2015). In practice, the teachers were able to shift from behaviourist approaches and strategies to apply constructivist approaches to teaching and learning, even though they did this with some struggle, as they were still used to using lecture methods for teaching (Akyeampong, Pryor and Ampiah, 1999).

The teachers made use of lesson-related films to increase the pupils' participation and understanding of the lesson. The teachers said they noticed this change from the unusual magnitude of contributions the pupils were making towards the lesson discussions. The lessons became more student-centred.

The study also documented how learners on their own decided to involve their parents to assist them to take lesson-related pictures and provide laptops to teachers to sustain film production and the application of new ways of teaching them.

5.2.4 Teachers' reflections and experiences in the use of the mobile phone cameras and other new technologies using the TPACK as a process

Teachers' reports on their reflections and experiences reveal that going through the training paid off as they confirmed severally that they could now prepare TPACK-compliant lesson plans, which integrate TK, CK and PK. They could also produce lesson-related films to support their traditional lesson plans and teaching strategies to create more active and participatory lessons than before. One teacher even confirmed that such classes could result in "invoking C21st skills in my pupils and capture their attention for learning".

5.2.5 My Review and Reflections on the Action Research

I must admit that when I embarked on this research journey initially, little did I know the volume of work involved. I thought I was just going to a school to share with them how to produce a lesson/context-related film and ask them to use it to teach and I would sit down to observe the teaching and collect my data and leave. Right from the word 'go', the reality was staring in my face. I remember at the time the University gave me ethical approval to enter the field, I asked my principal supervisor if I could remove the action research element from the study, while retaining the research topic. He said in a cool voice that "That will mean rewriting a new proposal." I reflected on the months I spent to put the proposal together and the scrutiny it went through by the vetting committee, the corrections and the queries etc. I therefore, decided to abandon going back and rather forge ahead with the case study, which has an element of an action research. However, for my supervisors, I would have said I had embarked on a perilous journey with tempests to go through.

Again, within this planning stage, my two supervisors and a third lecturer, the then coordinator of research projects, scrutinised my training programme to make sure that the activities I lined up were consistent with the objectives of the workshop, relevant to the research topic and realistically achievable in a 5-day workshop. They also scrutinised my FGD tools, the reflective journal guiding questions and the interview schedule and offered very crucial inputs towards a successful conduct of the workshop. I have learnt a lot at this stage also. For instance, I lined up numerous activities to undertake at the training workshop and both supervisors and the coordinator detected I have overcrowded the five days with unnecessary activities. Consequently, they helped me to strike out the activities, which do not relate to the objectives of the workshop. Similarly, they pointed out that I had lined up too many questions for the FGD and one of the supervisors noticed that the questions were 'prescriptive' – he used the word 'prescriptive' and asked me not to only reduce the number of questions to say, two, but also to recast them to make them

discursive. However, finding a public Basic school with a well-furnished computer laboratory and with majority of social science teachers having basic computing skills was a big challenge. For instance, one could get a public school with social science teachers, but without a well-equipped computer lab. Alternatively, even where there is a computer lab, the social science teachers, may not have basic computing skills. It is also difficult for one school to allow as many as four or five of its teachers to leave their classes to attend a workshop for five days unless there are other teachers to hold the fort for them. In the research school I finally settled at, I had a leeway for two reasons. i) There were then National Service personnel¹⁰, who held the fort for the participating teachers and ii) probably because we held the workshop on the school premises, so the teachers during short breaks could run to their classes to see whether the service personnel needed any help. The use of the FGD at the reconnaissance stage afforded the teachers the voice to express their thoughts about their professional practice and picking the responses verbatim added to the credibility of the data. The responses also paved the way to introduce the TPACK framework, (Mishra and Koehler, 2006), which formed the basis of the ‘Learn and Share” workshop. It gave the participants the opportunity to learn about the TPACK concept, and its agency and importance to technology integration into pedagogy. Engaging in the development of TPACK by reviewing one of their key artefacts – lesson plans - was a first step and useful way they were able to assess their TPACK status (Roblyer & Doering, 2010). In my view, this exercise triggered their eagerness to want to learn more, as they realised their lesson plans have never integrated TK into CK and PK. This way of developing TPACK in teachers was an ‘eye-opener’ to me. Therefore, it was not only the participants who were learning but myself also. What frustrated me at the workshop was the school’s obsolete machines in the lab, and intermittent power supply. What I was delighted about though, was that we were able to develop TPACK-compliant lesson plans and produced films, using the mobile

¹⁰ National Service personnel are students who graduate from accredited tertiary institutions and are required under law to serve the nation for one year [www.google.com].

phone cameras and moviemaker software. The students reacted positively to film-based lessons and it was a delight to watch, to the extent that they quickly disseminated the message at home and convinced their parents to allow them to bring their laptops and take pictures with phone cameras to bring to school to support their teachers.

Teachers mentioned that they have never done technology integration in any form and that it was a new experience. They have also never taught with a film. The students also admitted no one had ever taught them with a film. I was content with this feeling because I felt I was sharing something new with public basic school social science teachers and it was going to bring innovation into their pedagogical practices. As one of them put it, they will stop teaching in the abstract completely. It was going to shift their teaching from the behaviourist approaches to constructivist approaches, which this study relied on as its methodology. One funny, but quite serious thing, which happened when I projected the moviemaker interface on the screen, was that one participant shouted in panic that I should have taken them through the basics first before showing them the interface. I was concerned that this would slow down the workshop activities, but came to the realisation that I had taken teacher participation for granted. My assumption was that they had basic computing skills, because of the assurances from the headteacher. As things turned out, it seemed as if the Headteacher also relied on the Assistant Headteacher, who is also the school's ICT teacher, to make the selection. In addition, I got the impression that the Headteacher based his choice on teachers he deemed hardworking and felt they could equally be having basic computing skills. These teachers turned out to be hardworking, though and so I gained from the collaboration after all. I also calmed down the participant who panicked with words of encouragement and motivation.

Literature points out that action research benefits both the researcher and the researched. Participants learn and improve on their professional practice (Carr and Kemmis, 1986). Likewise, the researchers improve their professional practice (Dick, 2002).

In this study, the participants reported that they could self-assess their TPACK development using their lesson plans as artefacts against the TPACK framework. They could develop TPACK-compliant lesson plans, take lesson-related pictures with their mobile phones to produce lesson-related films and use them as TLRs to improve their teaching. They could work as a team with a common goal in focus.

From my own end, I benefited from the collaboration with the participants because it helped me to learn from them, collect primary data verbatim through the FGD, the SWOT analysis, reflective journal entries and individual face-to-face interviews. I have increased my knowledge and skills in research. I have upgraded my training experience in technology integration into pedagogy. I have learned how to conduct an action research and how to develop tools for FGDs, just to mention a few. Even though it was a very tedious energy-sapping and time-consuming journey, I have developed deep insights into the process of carrying out action research and how teachers can be supported to produce lessons that reflect the vision of creating a 21st Century classroom.

5.3 Policy Implications for Practice

The study has direct implications for stakeholders in education, especially the MOE, which is the policy formulating body.

From the international point of view, the Ghana government needs to look at its international ICT initiatives more critically. This is to ensure that international donors are not funding only deployment of infrastructure (Mangesi, 2007) but helping to make it relevant to local content and the needs of teachers and students. Besides, the study sends a clear message that international funded researches on technology integration in education should not be limited to collection of secondary data but be extended to include continuing professional development (CPD) in technology integration into teaching and learning. This study, thus forms a unique example of how this can be achieved using the

mobile phone camera and the Movie Maker as tools for producing Teaching-Learning Resources.

From a national perspective, it is important that governments and decision makers, review ICT policies to stress a comprehensive and continuing professional development component, that goes beyond deployment of infrastructure, including laptop computers and training only in basic computing skills. They need to focus equally on the characteristics and mechanisms of the practitioner and the subjects, which propel such processes (Pawson and Tilley, 2004).

Furthermore, the study has direct implications for researchers and educators. This is because, it provides the prerequisite information to consider in technology integration into curricula for schools, content development, lesson planning, TLR development and continuing professional development. Thus, the study's focus on integration of technologies into content and pedagogies, and other classroom activities needs critical attention. This is to ensure the development of a TPACK-compliant curriculum content for 21st Century classrooms is attained. It is the development of this content, which would further inform what and how training materials can be developed to pave the way for a comprehensive training of teachers. As a country aspiring to close the digital gap between it and the advanced societies, intensive and continuing professional development through the education sector must start with teachers at the basic education level as this research has demonstrated.

The study has also shown that the mobile phone camera, if used judiciously as a learning tool with other technologies, will result in teachers adopting constructivist pedagogies, leading to learner-centredness and co-construction of new knowledge among learners. This point has been reiterated in section 5.5, under contributions the study has made to knowledge and its policy implications. The MOE and other stakeholders in education, therefore need to reconsider the ban on mobile phone use among teachers and students.

The stakeholders rather need to put the necessary measures in place to train teachers, to repurpose the use of the mobile phone as a learning tool for students.

In addition, the study has shown that teachers at the basic level, with some assistance, can integrate technology into content and pedagogy to create student-centred lessons. The implication is that curriculum content developers and teacher trainers, need to stress the importance of teachers using technologies that are familiar to them and their learners to improve the quality of their lessons and produce 21st century skills. The additional benefit is that it will make lessons and learning more interesting and fun to the learners (Baytak, Tarman, & Ayas, 2011).

From the institutional and school levels, there is the need to consider using appropriate technologies and their applications to support teaching of subjects to the learner's level of understanding. Engaging in continuing professional and technical development, sourcing for financial and technical support to keep initiatives running should be the focus. Coupled with this, is the need for educational managers to be committed to the promotion, maintenance and general sustainability of such initiatives and programmes. It is also evident from the study that teachers can organise their students to be part of their own lesson preparation, through participation in the development of their TLRs. This can make students active co-constructors of knowledge with their teachers.

5.4 Limitations of the study

One limitation of the study is its non-randomised sampling feature which has implications for the wider application of the findings. However, both the single case study design and the action research element required a purposeful sampling technique to produce in-depth understanding in a specific context. Also, if the researched school had allowed teachers from both streams of classes to take part in the study, this would have produced a more comprehensive vetting and peer reviews of each teacher's lesson plans and the films they had produced. In effect, this would have produced lesson plans and films from

inputs scrutinised by at least two teachers per class. Coupled with this constraint was the issue of outdated computers and intermittent power outages. These notwithstanding, I still appreciated the small size of research participants I worked with, to produce rich context-specific data that illuminated my understanding of how teachers can use technology to improve teaching and learning. This would not have been possible with the involvement of a large sample.

Another limitation was the five days the school could afford to spare me for the 'Learn and Share' workshop. This was inadequate for all the activities, which included assessing teachers' TPACK, preparing materials (films) to support teaching and integrating it (TK) as a TLR into the lesson plan and testing it in practice. If I have had more days for the workshop, teachers, in my view, would have had more time to produce better films. In the ideal situation, teachers should have had at least one additional full day to learn about taking good quality pictures that could create good impression on the learner who is watching the film produced from such pictures. Even when I sent the teachers' individual comments on their films to enable them edit to improve them, they could not make the time because of the demands on them to complete their regular class duties. The material preparation in itself was time-consuming as the teachers had to find time to go around to research into the school and community environments to take lesson/context-related pictures to prepare the films but the workshop provided very limited time for that. Watkins and Mortimore, (1999) point out that the issue of lack of time to devote to other issues outside the curriculum is the main complaint teachers make most frequently. In the circumstance the teachers were in, we relied on the pictures they brought, provided they were lesson/context-related, as well as relevant and appropriate to the class level.

5.5 Contributions of the Study to Knowledge

There are some important contributions to education, particularly at the basic level, which had resulted from this small but in-depth study of teachers engaging in technology integration in their classroom practices. In the first place, evidence gathered from our

National curricula for the various subjects at the pre-tertiary level of education, reveal that the Ministry of Education has not yet integrated the TPACK, into the curricula content for schools. This action research study has demonstrated that it is possible for basic school teachers to integrate technology into content and pedagogy using the TPACK as the process, to support teaching and learning in schools.

Besides, no study or action research involving professional development (PD) for pre-tertiary or even tertiary education teachers in Ghana, to my knowledge has been conducted where teachers particularly, public basic school social science teachers, have been able to review and revise their teaching artefacts (lesson plans), using the TPACK as a process to develop TPACK-compliant lesson plans for implementation.

Furthermore, no study in Ghana to my knowledge has yet been conducted, where teachers, especially basic school social science teachers under supervision, succeeded in producing context/lesson-related films with their mobile phone cameras in conjunction with windows live moviemaker and integrating the films (as technology) into their lesson content to support their traditional teaching and learning activities. This, in my view is a new development and a novel contribution to knowledge, especially in the ability of teachers in a developing country context to use technology to significantly improve the quality of instructional practice and learning.

In Ghana, the few researches conducted on mobile phone use in educational institutions, as revealed in literature were at the University level. In those instances, the researchers either did an enquiry into the level of mobile phone use by students for learning or for researching for information on the Internet to support their learning. Such researches did not also extend to cover software application in conjunction with mobile phone camera use to develop films as TLRs that supported teachers' lesson delivery. It is important to stress that even though several studies have been conducted to investigate technology integration into teaching and learning in developed countries, such as those carried out by Harris, Hofer and Grandgenett, (2010), Harris and Hofer, (2009); Mishra and Koehler,

(2006) and Heafner, (2004), no similar research to my knowledge has been conducted in Ghana. Thus, this research contributes to knowledge about the capacity of teachers in the global south to use technology effectively to improve the quality of teaching and learning.

The study reveals that participating teachers are also able to operate in a collaborative working environment in the roles of teachers and researchers, when looking out for relevant and appropriate pictures or organising video clips to turn into films to develop TPACK. The participating teachers' experiences also show how teachers in a global south context, teaching different topics within a discipline at different levels still have the potential to collaborate and share resources, knowledge and deduce creative solutions while developing TPACK. The study has also brought to the fore the notion that a connection can grow between a community of practice, that includes parents, teachers and student learning in a school setting, to the extent that parents become eager to help their children to supply teachers with pictures to produce films to teach their wards.

The study also revealed that using teacher-made lesson/context-related films and other technology enhancing instructional methods, teachers are able to make positive impact on their teaching in that their pedagogies transformed to create constructivist classrooms. Teaching in such classrooms became less teacher-centred and more learner-centred (Richardson, 2003). These pedagogies also enhanced learners' engagement and understanding of the lessons taught them. In addition, learners participated actively to co-construct knowledge, both during film (TLR) preparation and in class lessons. Their co-constructed knowledge contributed in class formed notes, which they wrote back into their notebooks with the teacher's guidance rather than the usual copying of teacher-made notes.

It can be deduced from the foregoing contributions to knowledge generated by this study that teachers, students, parents and school administrators can work collaboratively to improve the quality of teaching and learning through the medium of technology. To make

interventions and reforms meaningful, these stakeholders need to be part of the inception and planning process of professional development (Samoff, Sebatane & Dembélé, 2003; Weva, 2003).

The professional development itself needs to be continuing and its focus should be directed at lesson planning and material development to afford the teachers the opportunity to integrate technology that will transform pedagogy. This study has demonstrated that by adopting the TPACK framework – a framework that has gained attention in recent times (Angeli, and Valanides, 2005), it is possible to provide new strategies for teacher educators to solve problems related to integrating computing into classroom teaching and learning (Hewitt, 2008) and for planning teacher technology integration courses.

That is not all. The transformation of classroom pedagogy experienced by the participating teachers and their students, especially with the introduction of lesson/context-related films (technology) into their lesson content, provides the evidence that debunks policy which suggest that the use of mobile phones in schools and classrooms can have no benefit to the educational experience. As mentioned earlier, policy measures need to be put in place to allow teachers and students and other stakeholders in education, to see the use of the mobile phones first and foremost as a learning tool.

5.6 Conclusions

This exploratory enquiry study, which adopted a single cycle action research and a single case study design, investigated how teachers can explore the use of technology as tools in instruction to improve their practices in their classroom contexts. The enquiry set out to identify already taught lesson plans (teaching artefacts), which teachers in their opinion believed could have been better taught to enhance student understanding, if they had used films to support their teaching and learning activities. In addition, teachers

reviewed and revised those lesson plans using the TPACK as the process. Within the process, a positive professional development was gained through first, learning how to make a film, using a handy and commonly used technology tool like the mobile phone camera in conjunction with windows moviemaker. Second, new knowledge was constructed on teachers' experiences of successfully integrating their teacher-made lesson/context-related films into instruction to reinforce their traditional teaching-learning activities. They however, needed much support to achieve this. Their students also found the use of the film-supported lessons particularly useful in developing deep understanding of their subject and co-constructing knowledge for deep learning. It is worth noting that the ability of the teachers to identify and accept the interdependence of technology, content and pedagogy was due to the initial self-assessment of TPACK development exercise they went through using their teaching artefacts (Roblyer & Doering, 2010). They were also exposed to an exemplar of a technology-integrated (TPACK-compliant) lesson plan, that I developed from LearnThings Ltd, Africa, (2006) lesson plan template (Appendix Q²).

Basically, this study adopted the leanings of the Interpretivist tradition and assumed the constructivist methodological stance (Guba and Lincoln, 1985) as opposed to the positivist paradigm of objectivity and knowing (Auguste Comte, 1798 –1857). By this, I was able to open up to my research participants and collaborated with them to carry out the research and to accept their interpretations of situations. Consistent with the interpretivist paradigm, I used research methods such as the FGDs, reflective journal entries, participant and non-participant observations and individual face-to-face interviews to collect data. These methods enabled my case study teachers to express their thoughts about their professional practice and bring out information that they would otherwise have kept to themselves.

It is also important to note that there are several such studies that have investigated technology use in teacher education as did Mishra & Koehler, (2006); Harris and Hofer,

(2009); Harris, Hofer and Grandgenett (2011); Koh and Chai (2011) and Chai, Koh, Hwee, Tsai, and Tan, (2011). Some of the studies sort to measure the quality of technology (Harris, Hofer and Grandgenett (2011); others sort to analyse the relative impact of age, gender, and TPACK constructs on the TPACK perceptions of pre-service teachers (Koh and Chai, 2011); and others sort to examine the effects of Technology Integration Education on the Attitudes of Teachers and Students, (Christensen, 2002). Several of these studies, just as this exploratory enquiry study were interventions directed at teachers' professional development. While some may be on large scale, this study, being a case study was designed as an in-depth study to enquire into how teachers in a global south context interpret their experiences and reflections on using self-made lesson/context-related films (technology) within their lesson content and pedagogy.

I am of the belief that integrating technology into lesson plans, using the TPACK framework as the process will be relevant to all teachers at any educational level in Ghana, except that the technology used in this study may not necessarily be applicable to teaching every topic. Not all social science topics need be taught with a film. This study has however, provided the indication of how five social science teachers, when supported to work together, can successfully develop TPACK and subsequently integrate technology in their lesson plans and teaching and learning. It is important to note that even though all the five teachers received the training at the workshop on how to prepare a TPACK-compliant lesson plans and develop context/lesson-related films to use as TLRs, they were all able to infuse their creative potential in their films to make it unique. Despite the challenges they faced, they all admitted their expectations were met.

5.7 Recommendations

Granted that students' performance is at the heart of the Ministry of Education (MOE) and other stakeholders, teachers' professional development at the foundation level of education in particular, is very critical, especially when it comes to using technology as

tools to support traditional teaching and learning. In my view, the importance of the TPACK framework as prerequisite for the development of knowledge for technology integration, offer a platform for professional development of teachers. The MOE, through the GES, should review its policy on the use of technology in schools so that it extends beyond simply exposure to the technology, but to active use to improve the quality of teaching and learning. This research has demonstrated that with the right support teachers are capable of using technology in the service of teaching and learning to great effect.

In Ghana, Ohio University, USA, had trained some 23 (20 males and 3 females) professional teachers as pioneer instructional technologists between 2007 and 2009 at the master's degree level for Primary and JHS classrooms. The MOE, through the GES can resource this group of professionals as national trainers to offer professional training in technology integration into content and pedagogy, to benefit teachers at the basic school level, not only in social studies, but in other subjects.

Other recommendations emanating from the study for integrating films into teaching and learning activities include the following:

- To maximise the benefits of professional development in the use of technology to improve teaching and learning, a workshop format with ample time, for example ten days, would be necessary to achieve deep learning.
- A platform could be created where teachers can share their films so that these become resources which reach a wider network of teachers.
- Establishing a team of experts, who will regularly assess developed materials before they are shared with schools.
- Computer labs need to be well furnished with computers that are constantly updated and upgraded to make them more accessible to users. The school can also source for benevolent donors to provide the school with constant power supply and connectivity.
- Schools need to entrust their labs into the hands of a technical person who is a hardware and software person and not necessarily an IT teacher of the school.
- Schools with computer labs should make conscious efforts to regularly train and retrain the teaching staff in at least basic computing skills. If this happens, then

the school can train all the staff in integrative skills across subjects. This will benefit the primary school teachers, especially the public ones, who are in most cases not subject teachers but teach all primary school the subjects.

- The Ministry of Education, through NaCCA, and in collaboration with the Kofi Annan ICT Centre and other donor agencies can form a team to revise the curricula for schools.
- All IT teachers must constantly be upgrading and updating themselves with new programs, which can enhance teaching and learning.

Finally, teachers and heads of schools can be part of an awareness drive within the school community to educate the community on the need to incorporate technology into teachers' professional practice. This is most likely to work because even from a very small size research of this nature, awareness spread like wild fire among parents and guardians in the community. To my surprise, they defied all odds to participate in using a banned equipment like the mobile phone to help gather pictures for their wards to bring to school for the teachers to make lesson/context-related films to teach them.



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Appendix A - Some ICT Initiatives and Projects in Ghana

<p>Project: GeSCI – to expand the deployment of ICTs in schools in Ghana and to the effective use of these ICTs to achieve Ghana’s educational and community development objectives.</p> <ul style="list-style-type: none"> • <i>Organisation(s):</i> Ministry of Education, Youth and Sports • <i>Funding sources:</i> UNICT Task Force • <i>Contact:</i> www.gesci.org/gesci/publisher/index.jsp?aID=229&nID=111&pID=107
<ul style="list-style-type: none"> • Project: NEPAD E-Schools – supporting six schools in six regions with ICT infrastructure • <i>Organisation(s):</i> Ministry of Education • <i>Funding sources:</i> HP, Microsoft, Oracle, and Cisco • <i>Contact:</i> www.hp.com/hpinfo/newsroom/press_kits/2005/wsis/ov_nepad.pdf
<ul style="list-style-type: none"> • Project: Intel-E-learning Centre (Accra girls) – pilot project to establish Africa’s first WiMAX connected school • <i>Organisation(s):</i> Accra Girls’ Secondary School • <i>Funding sources:</i> Intel • <i>Contact:</i> www.intel.com/pressroom/kits/worldahead/wa_backgrounder.pdf
<ul style="list-style-type: none"> • Project: Presidential Special Initiative on Distance Learning – TV show on Mathematics, Science and English broadcast nationwide and sold on CDs • <i>Organisation(s):</i> Ministry of Education • <i>Funding sources:</i> Government of Ghana • <i>Contact:</i> www.iicd.org/photos/iconnect/Articles/iconnectarticles.2005-05-09.7326350124
<p>Project: HP Digital Community Centre (KNUST) – high-speed ICT infrastructure at KNUST and for community learning and technology centers (CLTCs)</p> <ul style="list-style-type: none"> • <i>Organisation(s):</i> KNUST • <i>Funding sources:</i> HP • <i>Contact:</i> http://h41111.www4.hp.com/globalcitizenship/uk/en/e_inclusion/project/project_kumasi.html

Project: Research and Educational Network (REN) – to facilitate the interactions and collaboration between researchers in institutions and the world

- *Organisation(s):* University of Ghana
- *Funding sources:* World Bank/InfoDev

• *Contact:* www.ejds.org/meeting2003/ictp/papers/Intsiful.pdf

Project: GIMPA Distance Learning Centre – connecting policy and decision makers, managers, academics, politicians, professionals, development partners and donors, etc. to a global knowledge exchange

- *Organisation(s):* GIMPA
- *Funding sources:* World Bank

• *Contact:* www.gimpa.edu.gh/home/gimpa/index.php?option=com_content&task=view&id=35&Itemid

Project: APSnet) – has twinned with many schools abroad, including Denmark, Great Britain, Mexico, and the US, facilitating exchanges among teachers and students

- *Organisation(s):* UNESCO
- *Funding sources:* UNESCO

• *Contact:* http://portal.unesco.org/ci/en/ev.php-URL_ID=20753&URL_DO=DO_TOPIC&URL_SECTION=201.html

Source: Mangesi, (2007: 6)

Appendix B: Implementation of ICT Initiatives by the Ministry of Education (MOE) – Information Researcher gathered in 2012 from an Interview with Rev. Dadebo, former National ICT Coordinator, MOE.

	Organisation/Institution	Liaising with other Organisations	Description of Initiative
A	i. Government's own initiatives through the MOE	Global e-Schools and Community Initiatives (GeSCI)	Involvement of District Assemblies, which factor program into their annual budget to support programme. Provision of air conditions, furnishing of labs, facilitating of training of teachers. Collaboration with subject association
B	ii. Government in Partnership with other government agencies (partnerships)	i. Min. of Education with Ministry of Environment, Science and Technology ii. Basic School, Computerisation Programme	Better Ghana ICT project – distribution of laptops to basic schools plus training of teachers in basic computer skills – 2011 to date
		ii. Ministry of Education & Ministry of Finance	1:1 Initiative – One laptop per child (OLPC) 2008; Two (2) weeks training in ICT Integration for Basic School teachers (Banini, 2012).
		iii. Ministry of Education & Min. of Communications	* ICT deployment – Supply of computer and Internet connectivity to all 38 Teacher Colleges of Education and all 37 Technical Institutes. * Networking promoted by the Ghana Investment Fund for Electronic Communications . (GIFEC) * Many JHS and SHS received connectivity.

	Organisation/Institution	Liaising with other Organisations	Description of Initiative
C	Government versus Private Organisations	<ul style="list-style-type: none"> * NIIT; * Intercom Programming & Manufacturing Company (IPMC), * The Accra Institute of Technology and the Kofi Annan ICT Training Centre <p>They serve as centres of excellence in ICT training that attract students from other West African countries.</p>	<ul style="list-style-type: none"> * In the area of teaching; * sale of computers to teachers on hire purchase terms for procurement of infrastructure
D	Government and Intergovernmental Organisations/NGOs	<ul style="list-style-type: none"> * NEPAD e-schools Initiative (15 countries) by the e-Africa Commission; Six schools in Ghana benefit. * The Global Learning and Observations to Benefit the Environment (<i>GLOBE</i>) Programme in 112 countries 	<p>NEPAD e-schools Initiative (15 countries) by the e-Africa Commission; Six schools in Ghana benefit. Aims at ensuring that the youth participated effectively in the global information society.</p> <p><i>(GLOBE) Program</i> works to promote the teaching and learning of science, enhance environmental literacy and stewardship, and promote scientific discovery.</p>
E	Govt. and International Private Organisation	Microsoft, Intel©Teach and Oracle	Teaching and ICT integration – 3000 teachers trained nationwide in 2012.
F	Government Agency - MOE	MOE/GES/GeSCI/USAID & Vodafone	ICT integration at the SHS level for teachers in Math, English and Science.
G	Intergovernmental Organisation	British Council Badiliko Programme	Setting up ICT hubs in Communities – Provision of Computers Connectivity and Technical support at Enzema East Districts (Axim); Duayakwanta; and Setwi Wiaso.

Information compiled by researcher

APPENDIX C: Conditions that Facilitate the Implementation of Educational Technology Innovations

SN	Conditions for technological change	Description
1	Dissatisfaction with the status quo	Wanting to have a change
2	Knowledge and skills exist	Having the precise knowledge and skills or competence to implement the change
3	Resources are available	Items needed like hard and software – e.g. computers and other equipment, technical and financial support.
4	Time is available	Implementers must make time to learn
5	Rewards or Incentives exist for participants	Reward participants in ways that they deserve.
6	Participation is expected and encouraged	Encouraging co-operation
7	Commitment by those who are involved	Obligation to sustain the change
8	Leadership is evident	Leadership that cares
Source: Ely (1999: 302) Journal of Research on Computing in Education, https://doi.org/10.1080/08886504.1990.10781963		

APPENDIX D: Ten Semi-structured Interview Guide for School Selection.

1. Do you have a computer laboratory?
2. How many computers (PCs) are there in your school and how many are functioning?
3. Do you have connectivity in your computer lab?
4. Do your PC's have Windows 7 or above?
5. Do your teachers have accessibility to the lab?
6. How many teachers teach either Social studies or Citizenship Education?
7. How many of them are computer literate?
8. Do you think the teachers can have time for 5 days training workshop and how about one-month practice at school?
9. Will you be able to provide the needed number of teachers (4 or 5) for the training?
10. Reception and leadership support from school head and assistant (This is to be

- [illegible]

Appendix F: Guiding Questions for Reflective Journal entries

Questions 1 - 8 were given to participants to guide them to write the daily journal entries over 5 days, during the training period. Questions were adapted from Ron Klug (2002: 54): In Smith, Mark (1999, 2006) and modified by researcher to suit the Ghanaian context.

- Q1) When you look back on the day's activities, what were the most significant events?
- Q2) In what way is this day exceptional and useful to you as a teacher?
- Q3) How did you feel today as the activities were going on?
- Q4) Did you find anything worrying today?
- Q5) What did you accomplish and you are happy about?
- Q6) Did you fail at anything? Which areas of your learning today need improvement?
- Q7) What have you learned today from the workshop that will support your profession as a teacher?
- Q8) Any other comments?

Appendix G: Summary of Reflective Journal Responses.

Participants	Feelings at the Start	New things/Significant & Exceptional Events	Workshop Accomplishments	Usefulness of what learnt to pro final practice	Challenges encountered	Solutions & Recommendations
(1)						
Sir Jalien (JHS)	<p>- I need more constant practice in my ICT lessons.</p> <p>- I came to the realization that I had never used or integrated into any part of my lesson plan.</p> <p>- I was excited to be learning new things</p> <p>- I feel my knowledge has been upgraded</p>	<p>Importing picture onto storyboard and adding effects, voice or music.</p> <p>Reviewing my lesson plans to identify CK, PK and to integrate TK.</p> <p>Presentation done on TPACK</p>	<p>I was able to use still picture to produce a film.</p> <p>I was able to change the font colours & background colours of the slides.</p> <p>I was able to demonstrate how I can teach my developed TPACK compliant lesson</p>	<p>Films will assist me in my lesson delivery and make it more participatory and lively for both students and I.</p> <p>Films will help me have more real TLMs for my lessons and make them more interesting</p>	<p>Interrupted power supply. Where exactly in my lesson. Plan to introduce the films</p> <p>The moviemaker software was unable to install on my computer.</p> <p>I am not very much conversant with using my computer</p>	<p>School needs power generator</p> <p>I need to have constant practice in my ICT lessons.</p>

Appendix G1: Summary of Sir Jalien's (JHS) Reflective

Participants	Feelings at the Start	New things/Significant & Exceptional Events	Workshop Accomplishments	Usefulness of what learnt to pro final practice	Challenges encountered	Solutions & Recommendations
(2)						
Sir Benjamin (JHS ICT Teacher)	<p>- I was very happy with all the activities because even as an ICT teacher, I was learning new things.</p> <p>- I felt very eager and enthusiastic to learn more as the activities were going on.</p> <p>- The day was enjoyable and exceptional to me because the facilitator made each of practise each step after each demonstration</p>	<p>- Using the TPACK framework to review my lesson note.</p> <p>- Making a film with still picture I have taken myself.</p>	<p>- I was able to review my lesson plan and been able to integrate TK into CK and PK to made the lesson TPACK-compliant.</p> <p>- I can add motion to still pictures.</p> <p>- I can now take pictures, using my own mobile phone and developing a film out of them for my children to support my teaching</p>	<p>- Films will support my lessons</p> <p>- I do not have to always draw images and diagrams on the board to use as TLMs.</p>	<p>- I forgot the steps to follow to save a movie for editing and to save a movie permanently.</p> <p>- Need to improve on how to integrate TK into my lesson.</p> <p>- Practice is the key.</p> <p>- Using films to teach should be spread across the country – every teacher needs it.</p>	

Appendix G2: Summary of Sir Benjamin's (JHS) Reflective Journal

Participants	Feelings at the Start	New things/Significant & Exceptional Events	Workshop Accomplishments	Usefulness of what learnt to pro final practice	Challenges encountered	Solutions & Recommendations
(3)						
Aseda (P4 Teacher)	<ul style="list-style-type: none"> - I have built my confidence a bit on the use of ICT. - Felt glad that I can also use mobile phone to help in my lesson - Happy to discover I have use so many teaching methods, during the lesson plan review. 	<ul style="list-style-type: none"> - Lesson plan review leading to TPACK self-assessment Also SWOT analysis - Learned to collaborate with my students - How to use the moviemaker to make a movie and to use it to teach. - Presentation of a TPACK-compliant lesson, using a film at intervals 	<ul style="list-style-type: none"> - I have been able to add text and animation to pictures as well as voice narration and credit - I am able to prepare a new lesson plan which integrates technology - I was able to use a moviemaker to prepare movie for a lesson. 	<ul style="list-style-type: none"> - I felt absolutely relieved because I will do no more drawing. - I think my TPACK-compliant lesson plan is more orderly. Now my teaching will be more child-centred. - Making a movie is not as difficult as I thought using films to teach will support my profession because even if I am not present in class, the pupils can watch the film ahead of the main lesson. 	<ul style="list-style-type: none"> - Power failure - My confidence Level in using the computer was low. - How to save an editable movie and a final project 	<ul style="list-style-type: none"> - I realised I needed to improve on my basic ICT skill to be able to effectively use the training. I can do this through constant practice

Appendix G3: Summary of Aseda's (Primary 4) Reflective Journal

Participants	Feelings at the Start	New things/Significant & Exceptional Events	Workshop Accomplishments	Usefulness of what learnt to pro final practice	Challenges encountered	Solutions & Recommendations
(4)						
Sir Damien (P6 Teacher)	<p>My confidence has also improved</p> <p>I was excited because the presentation skills used by the facilitator was simple and participatory, making it easy for me to understand the issues.</p> <p>I was anxious to have the windows live movie maker installed on my laptop but it never happened. The problem was with my laptop.</p>	<p>- Importance of the TPA CK framework in the teaching and learning process</p> <p>- Learned about the importance of technology in enhancing teaching</p> <p>- How to import pictures onto moviemaker's story board, add animations and effects to the movie.</p> <p>- I have learnt to use pictures I captured on my mobile phone to produce films.</p> <p>- The new strategy of teaching with films will elicit the rest of pupils in learning</p>	<p>- I was able to assemble pictures to produce a film that I can use to teach.</p> <p>- I was able to review my lesson plans with support of a sample TPA CK-compliant lesson plan.</p> <p>Through that I was able to know that I had never used TK in any lesson plan.</p>	<p>Films can help me elicit my pupils' interest in the classroom.</p> <p>I came to the realization that a simple and concise way to make the lessons in my class interesting is using a film to teach.</p> <p>It will enhance pupils' understanding of the lesson.</p>	<p>Intermittent electricity supply</p> <p>I could not install the moviemaker software on my machine but some of my colleagues could. My laptop had a problem.</p> <p>What we need are laptops to produce the films. Making the film itself is very very easy.</p> <p>The idea of integration is excellent and must be embraced</p>	

Appendix G4: Summary of Sir Damien's (Primary 6) Reflective Journal

Participants	Feelings at the Start	New things/Significant & Exceptional Events	Workshop Accomplishments	Usefulness of what learnt to pro final practice	Challenges encountered	Solutions & Recommendations
(5)						
Sir Jonas (P5 Teacher)	<p>- I was a little bit jittery because these were new things I was learning.</p> <p>- I felt a bit nervous while the activities were going on because many of the things were new to me.</p> <p>- As the days went by, I was very very comfortable and relaxed, enjoying every aspect when the credit slide was being added tour films as the</p>	<p>- Examination and review of lesson plans to identify CK, PK and TK in them. This contributed to knowledge I did not have before.</p> <p>- How to take pictures with the mobile phone to prepare the slides.</p> <p>- Preparing a movie to back my lesson</p>	<p>- I was able to review my lesson plans to identify portions where I used CK and PK and where I could have used TK</p> <p>- I can now use my laptop and mobile phone to prepare a movie to use as TLM for teaching and learning activities</p> <p>- I am now able to develop a TPACK-compliant lesson plan to support my teaching and learning activities</p>	<p>- I learnt how to use pictures suitable as TLMs for pupils.</p> <p>- TLMs have the tendency of drawing my pupils' minds to the lesson for a long time.</p> <p>- I can now use my laptop and mobile phone to prepare a movie to use as TLM for teaching-learning activities.</p> <p>- Films are likely to invoke the C21st skills in pupils and capture their attention for learning.</p>	<p>- I have a challenge with my smart phone, which is needed for picture taking in this project.</p> <p>- I realised that I was not up to the level of basic computing skills necessary for making a film.</p> <p>- The presenter was up to the task and must keep it up.</p> <p>- This is a very impressive workshop and is helpful in today's teaching and learning.</p> <p>- Technology-integrated lessons, should be encouraged because it will capture Pupils' attention in class.</p>	

Appendix G5: Summary of Sir Jonas's (Primary 5) Reflective Journal

APPENDIX H: TPACK-based technology integration assessment instrument

CRITERIA	4	3	2	1
Curriculum Goals & Technologies (Curriculum-based technology use)	Technologies selected for use in the instructional plan are strongly aligned with one or more curriculum goals.	Technologies selected for use in the instructional plan are aligned with one or more curriculum goals.	Technologies selected for use in the instructional plan are partially aligned with one or more curriculum goals.	Technologies selected for use in the instructional plan are not aligned with any curriculum goals.
Instructional Strategies & Technologies (Using technology in teaching/ learning)	Technology use optimally supports instructional strategies.	Technology use supports instructional strategies.	Technology use minimally supports instructional strategies.	Technology use does not support instructional strategies.
Technology Selection(s) (Compatibility with curriculum goals & instructional strategies)	Technology selection(s) are exemplary, given curriculum goal(s) and instructional strategies.	Technology selection(s) are appropriate, but not exemplary, given curriculum goal(s) and instructional strategies.	Technology selection(s) are marginally appropriate, given curriculum goal(s) and instructional strategies.	Technology selection(s) are inappropriate, given curriculum goal(s) and instructional strategies.
“Fit” (Content, pedagogy and technology together)	Content, instructional strategies and technology fit together strongly within the instructional plan.	Content, instructional strategies and technology fit together within the instructional plan.	Content, instructional strategies and technology fit together somewhat within the instructional plan.	Content, instructional strategies and technology do not fit together within the

1. Harris, J., Grandgenett, N., & Hofer, M. (2010). Testing a TPACK-based technology integration assessment instrument. In C. D. Maddux, D. Gibson, & B. Dodge (Eds.). *Research highlights in technology and teacher education 2010* (pp. 323-331). Chesapeake, VA: Society for Information Technology and Teacher Education (SITE).

2 Adapted from: Britten, J. S., & Cassidy, J. C. (2005). The Technology Integration Assessment Instrument: Understanding planned use of technology by classroom teachers. *Computers in the Schools*, 22(3), 49-61.

3 “Technology Integration Assessment Rubric” by Judi Harris, Neal Grandgenett & Mark Hofer is licensed under a [Creative Commons Attribution-Noncommercial-No Derivative Works 3.0 United States License](http://creativecommons.org/licenses/by-nc-nd/3.0/us/). (<http://creativecommons.org/licenses/by-nc-nd/3.0/us/>)



APPENDIX I: Application to proceed for fieldwork

THE UNIVERSITY OF SUSSEX

RF006

Application for Permission to Proceed on Fieldwork or to Study Away from the University of Sussex

Before Completing The Application Form Overleaf, Please Read The Notes Below Carefully

NOTES:

1. The Director of Doctoral Studies of the relevant School may permit a student to carry out fieldwork elsewhere as part of the programme, provided that any such fieldwork elsewhere is in the interests of a student's academic work and that a student shall have spent at least half the minimum prescribed period of registration as a research student at the University.
2. The minimum prescribed period of registration for a research student studying for the MPhil Degree is three terms for a full-time student and six terms for a part-time student; and for a research student studying for the PhD Degree it is six terms and nine terms respectively. These periods do not include any period of coursework.
3. You may not proceed to fieldwork unless:
 - (i) your thesis title and research outline/research topic have been submitted and approved; and
 - (ii) you have received notification in writing from the Research Student Administration Office confirming that permission has been granted for you to proceed to go on fieldwork.
4. When this form has been fully completed and the proposal has been approved by the Director of Doctoral Studies, the Research Student Administration Office will send a letter to you confirming that permission for departure has been given together with details of fees payable. The Research Student Administration Office will send a copy to the supervisor(s), the Research Convenor, if applicable, and the Director of Doctoral Studies.

The general expectation is that 100% of the relevant fees will normally be paid. With respect to periods away on fieldwork, however, a discount of 35% (i.e. 65% of the full fee) may be agreed, subject to the approval of the Director of Doctoral Studies. Such a discount will only be approved in exceptional circumstances, and only where a clear case can be made on the basis of restriction of access to Sussex facilities (other than supervision) – i.e. that you will not have access to the standard facilities, infrastructure and support network that would normally be available to you.

Please note that fees are adjusted as above in termly units only, or where the majority of the number of weeks in a term are spent on fieldwork. All fees are calculated in termly units and therefore periods spent on fieldwork during vacation periods are not counted in the fee adjustment calculation.

5. You are required to inform the Research Student Administration Office, Sussex House, of an address for correspondence during your absence, and any subsequent change of address.
6. Work Space - You must contact the Graduate School Co-ordinator to make arrangements with regard to work space.
7. You are required to maintain regular contact with your supervisor(s) on your progress, in accordance with School policy and in the light of discussion of arrangements with your supervisor.
8. You are required to notify the Research Student Administration Office, Sussex House, when you return from your period of fieldwork and also of your new term-time address.
9. If you have any queries concerning approval for fieldwork, please contact the Research Student Administration Office, Sussex House. Tel: 01273 873850.

Name of Student: Dzigbodi Ama Banini	Reg. No: 21113075
Research Programme: International Professional Doctorate Degree in Education (EdD)	School: School of Education & Social Work
Date of First Registration as a Research Student: 4 th July, 2011	Current Reg. Status: 1 st September, 2015
Current Correspondence Address: Ghana Education Service, (HQ) P.O. Box M45, Accra, Ghana - W/A	


I wish to be away from the University on fieldwork/distant study as detailed below:

Date of Departure: **12 October 2015;** Date of Return: **21st December, 2015; extended to 12th March, 2016**

Purpose and location of fieldwork or study away from the University: **To conduct a Teacher Professional Development ('Sharing and Learning' Training) Workshop, to be followed by three months' data collection.**

Fieldwork/distant study address (see Note 5 overleaf):

**St Sylvanus R.C. Basic School
Pokuase, Ga-West District,
Ghana – W/A.**

Signature : 
Student

Date: 27 / 08 / 2015

I confirm that the above student's research topic/outline has been approved and that I recommend approval of this application for fieldwork.

Signature: Date:

Main supervisor

I endorse the above recommendation.

Signature:Date:

Research Convenor (where applicable)

I approve the recommendation above and confirm the fee to be charged as (please tick box)

☐

Full fee or

☐

65% of full fee

Signature:Date:

Director of Doctoral Studies

On approval, please forward this form to the Research Student Ad

APPENDIX J: Sussex Certificate of Approval to go to the field



Certificate of Approval	
Reference Number	ER/DB290/3
Title of Project	INTEGRATING TECHNOLOGY INTO PEDAGOGY AT THE BASIC LEVEL OF EDUCATION IN GHANA (COPY)
Principal Investigator (PI):	Dzigbodi Ama Banini
Student	Dzigbodi Ama Banini
Collaborators	Ghana Education Service
Duration of Approval	n/a
Expected Start Date	01-Oct-2015
Date of Approval	30-Sep-2015
Approval Expiry Date	30-Sep-2016
Approved By	Jayne Paulin
Name of Authorised Signatory	Janet Boddy
Date	01-Oct-2015

*NB. If the actual project start date is delayed beyond 12 months of the expected start date, this Certificate of Approval will lapse and the project will need to be reviewed again to take account of changed circumstances such as legislation, sponsor requirements and University procedures.

Please note and follow the requirements for approved submissions:

Amendments to protocol
 * Any changes or amendments to approved protocols must be submitted to the C-REC for authorisation prior to implementation.

Feedback regarding the status and conduct of approved projects
 * Any incidents with ethical implications that occur during the implementation of the project must be reported immediately to the Chair of the C-REC.

Feedback regarding any adverse and unexpected events
 * Any adverse (undesirable and unintended) and unexpected events that occur during the implementation of the project must be reported to the Chair of the Social Sciences C-REC. In the event of a serious adverse event, research must be stopped immediately and the Chair alerted within 24 hours of the occurrence.

APPENDIX K: Gatekeepers' Permission Letter

GHANA EDUCATION SERVICE

*In case of reply
the number and date of this
letter must be quoted.*



HEADQUARTERS
Ministry Branch Post Office
Accra

14th December 2015

My Ref №: GES/HQ/CC/VOL ... /

Republic of Ghana

Your Ref №.

The District Director,
Ga West District,
Amasaman – Greater Accra Region.

A REQUEST FOR DZIGBODI AMA BANINI TO CARRY OUT A RESEARCH AT (NAME OF SCHOOL) BASIC SCHOOL, POKUASE, GA WEST

Ms Dzigbodi Ama Banini works with the Curriculum, Research and Development Division (CRDD) of the Ghana Education Service (HQ) and a distant doctoral research student of the University of Sussex, Brighton, UK.

She has applied to conduct her field research on the topic, "Integrating Technology into Pedagogy at the Basic Level Education in Ghana", at *Name of school*, one of the schools under your jurisdiction. Her research will involve the Citizenship Education and Social Studies teachers, who also have basic computing skills and are willing and committed to participate in the research. The research involves partly a training workshop situation. This workshop, which will form part of the teachers' professional development, will be held at the school, starting from Wednesday, 15th December 2015.

The training workshop which she refers to as a 'Learning through Sharing' Workshop, aims at exploring the possibility of your teachers using technology (in this case, the Mobile phone camera and Windows Live Moviemaker) to produce lesson-related films that can be used as (TLRs) to support their teaching-learning activities.

Furthermore, she also requests that your teachers, after the training, explore the possibility of putting the knowledge acquired and shared at the workshop into their classroom practices for about one school term. During the field practice, the teachers will share their reflections, experiences, including their challenges with the researcher, through password-protected e-mails, though the information will remain the intellectual property of the teachers. At the end the field practice, she will come back to the school to interview the participants on the project.

It will be very much appreciated, if you can give her the needed assistance to undertake the research project.

Thank you.

**Stephen Adu (Dr), Ag Deputy Director-General & Dir., Basic Education Division,
Ghana Education Service (HQ), ACCRA.**

APPENDIX L: INFORMATION SHEET SAMPLE



UNIVERSITY OF SUSSEX

INFORMATION SHEET FOR TEACHER PARTICIPANTS

Participant Information Sheet for the study of Integration of Technology into Pedagogy at Basic School Level of Education in Ghana.

Researcher: Dzigbodi Ama Banini: School of Education and Social Work, Sussex University, Falmer Brighton, BN1 9QQ, United Kingdom.

I am a doctoral student at the University of Sussex. As part of my thesis, I am undertaking a research on 'Integrating Technology into teaching and learning at the Basic Level of Education in Ghana.' This research is a case study with an element of action research, which involves the training of teachers on how to use technology as a tool to support teaching and learning.

The purpose of the study is to:

- Explore the use of technology (in this case, the Mobile phone camera and Windows Moviemaker as tools to enhance the teaching and learning of a social science subject, such as Citizenship Education, at the basic school level of education.
- Share and learn with classroom teachers about how to incorporate technology as a tool into curriculum content to support lesson preparation and instruction.
- Analyse the effects of technology use documented in the various reflective journals,
- Identify any challenges faced in the implementation of the training and practice
- Document other ways suggested about going round the challenges identified

The University requires that ethical approval be obtained for the research involving research participants.

I am inviting you in your capacity as a Basic school level, social science teacher, to participate in this study, which will involve sharing with you for five (5) days how to use technology as a tool to enhance your teaching-learning processes. The technology will include your Mobile phone camera in conjunction with Window Live moviemaker to produce lesson-related films to support your teaching-learning activities.

The workshop will start with a reconnaissance session in the form of a Focus Group Discussion (FGD) for about one hour with eight of you, to probe into the status of technology use in your teaching and learning.

At the main workshop, which I term, a 'Learning and Sharing' workshop, you will be asked to document all your experiences and reflections on the training during the five (5) days and other experiences in the field of practice in reflective journals. This will remain as your intellectual property.

I will request that you put what you have learned at the training into practice during the next 4 weeks of the term's teaching in your school. You may also involve your students by going out with them during their afternoon study or extra curricula activity time, to collaborate with you to take lesson-related pictures from within the school environment or the community near your school, as a recreational activity. These pictures will usually be about everyday activities, such as people sweeping, washing, collecting rubbish, names of trees / flowers, festivals, depending on the lesson topic. I will sit in your class as a non-participant observer to observe your lessons. You will be provided with guiding questions to enable you document your experiences. I will request you to submit your daily reflections at the close of each day of the training. The essence is to share your reflections / experiences with other colleagues participating in the research and with the researcher. By these functions, you will invariably be performing two roles of – i) a research participant and ii) a researcher.

Two weeks after the training, I will visit you for class observation to see how you used your films to support your teaching. Then I will come again, after the next two weeks to do another class observation after which I will conduct an individual face-to-face interview with you for about one hour on your four weeks' field practice.

One critical issue for participating in the research will be your pledge to be very willing and committed to the research from start to finish.

However, you have the right to refuse to answer any particular question during the interview session, or to withdraw from the study at any time without question; or ask any further questions about the study that occurs to you during your participation. You also have the right to be given access to a summary of the findings from the study, when it is concluded. If you feel the need to withdraw from the exercise at any time, just let me know in good time.

Responses collected will form the basis of my thesis, which will be written as a report on an anonymous basis. It will not be possible for you to be identified personally; and in this regard, pseudonyms will be adopted for your person. I will audiotape your voice during the interview but it will link to you. I will keep any information I collect from you strictly confidential. No other person besides me, my supervisors, Professor Brian Hudson and Professor Kwame Akyeampong, both of the School of Education and Social Work of Sussex University, and the University will be privy to it. I will submit the report to the School of Education and Social Work of Sussex University for marking.

If you contribute to the study it could, for instance, inform government policy leading to decisions to improve existing infrastructure and capacity building towards the use of more innovative ways of integrating technology into your teaching and learning practices to support your work. Additionally, taking part in the research will inculcate in you some new research knowledge and skills such as writing a Reflective Journal, collecting data and producing films to use as teaching learning resources and improving your learner-centred approaches to teaching and learning. I hope that it will also enhance your Curriculum Vitae.

If you decide to take part as a research participant, you will be required to read and sign the informed Consent Form that I will provide you.

- Be interviewed by the researcher
- Allow the interview to be video-taped / audio taped
- Provide samples of blood / urine / muscle / tissue / saliva / faeces at nn times per day / week / month
- Make myself available for a further interview should that be required
- Take a trial medication nn times a day for nn weeks
- Use a computer to:
- Allow the researchers to have access to my medical / academic records
- I understand that any information I provide is confidential, and that no information that I disclose will lead to the identification of any individual in the reports on the project, either by the researcher or by any other party.
- **OR**
- I understand that (*outline steps to be taken*) will be done to prevent my identity from being made public.
- **AND / OR**
- I understand that I will be given a transcript of data concerning me for my approval before being included in the write up of the research
- **OR**
- I understand that I have given my approval for my name and/or the name of my town/community, and / or the name of my workplace to be used in the final report of the project, and in further publications

- **OR**
I understand that confidentiality cannot be guaranteed for information, which I might disclose in the focus group/s/ group interviews.
- **OR**
I consent to the videotapes being shown to other researchers and interested professional parties.
- **OR**
I consent to the use of sections of the videotapes in publications

The following clauses should be included in all consent forms:

I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any stage of the project without being penalised or disadvantaged in any way.

I consent to the processing of my personal information for the purposes of this research study. I understand that such information will be treated as strictly confidential and handled in accordance with relevant data protection legislation.

NB In some fields of research, it could be helpful to re-use the data for future research and analysis. If it is likely that your data is of this kind and you want to have the option to use the data for other purposes, or for it to be available to other researchers, you must obtain explicit permission and describe what you want the participant to agree to in the Explanatory Statement. A statement should be included for the participant/s to agree that the information provided can be used in further research projects which have research governance approval as long as their name and contact information is removed before it is passed on. State exactly what permission is to be sought.

Name: _____
Signature _____
Date: _____

Independent witness to participant's voluntary and informed consent (if this is necessary for your project for example, where there is a relationship between the participant and the researcher, which might be deemed to unduly influence the participant's voluntary consent).

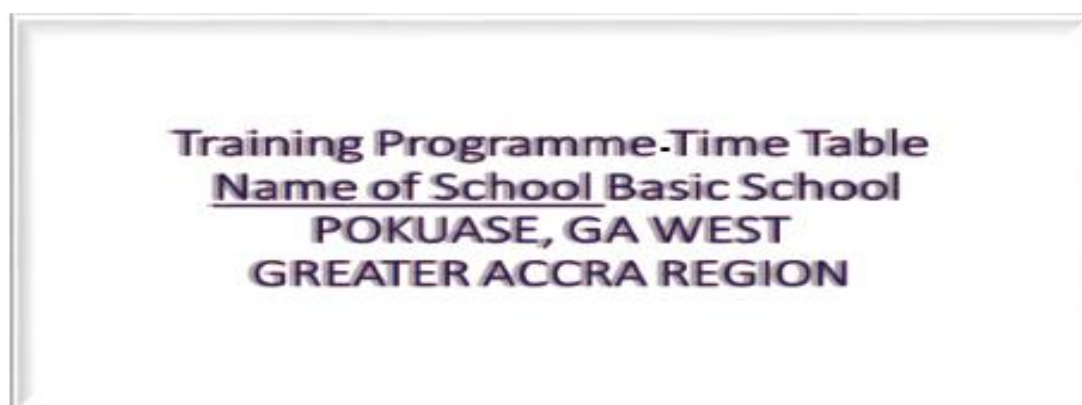
I believe that _____ (name) understands the above project and gives his/her consent voluntarily.

Name:	
Signature	
Address:	
Date:	

APPENDIX N: List of handout materials used for the training workshop

1. Time table – Training programme
2. Day 1 to 5 Evaluation Sheets
3. TPACK-compliant sample lesson for Social studies/Geography designed on LearnThings Lesson plan outline
4. Music and Video files
5. Picture of Mt. Afadza
6. Picture of Akwapim
7. Picture of Mt Amedzofe
8. Daily reflection question guide
9. Literature / Notes on Reflective journals

} Hyperlinked to portions of the sample lesson presentation

APPENDIX O: Workshop Programme/Timetable

Day 1 – Monday, 25th January, 2016; 8:30 a.m. – 2:10 p.m

S/N	Activity	Start Time	Duration
1	Focus Group Discussion (FGD) + Discussion of Daily Reflective journal	8:30 a.m.	1 hr
2	SWOT Analysis – to support the FGD	9:30	30 Mins
3	Gallery Walk and discussions on SWOT	10:00	20 Mins
4	Technology Integration presentation + Films	10:20	1 ½ hrs
5	BREAK	11:50	30 Mins
6	Explanation of TPACK supported by 2 films	12:20	30 Mins
7	Presentation of sample TPACK-compliant lesson	12:50	20 Mins
8	Review of Lesson Plans at Class Level for comments	1:10	30 Mins
9	Evaluation / reflective journal entries for Day 1	1:40	30 Mins
10	Closure	2:10	-

Day 2 - Tuesday, 26th January, 2016 - 8:30 a.m. – 1:30 p. m.

S/N	Activity	Start Time	Duration
1	Plenary	8:30 a.m.	20 Mins
2	Participants watch 2 sample films produced on Moviemaker	9:50	20 Mins.
3	Introduction to Windows Moviemaker interface	10:10	20 Mins.
4	Step by step demonstration session and participants are called in turn to come and practice one step at a time in making the film with facilitator's guide(All participants are made to practice each step).	10:30	1:30 Mins.
5			
6	BREAK	12:00	30 Mins
7	Practice continues	12:30	30 Mins
8	Evaluation / reflections and Feedback on Day 2	1:00	30 Mins
9	Closure	1:30	-

Day 3 – Wednesday 27th January, 2016 - 8³⁰ a.m. – 12³⁰ p. m.

S/N	Activity	Start Time	Duration
1	Plenary	8:30 a.m.	20 Mins
2	Participants embark on producing their own films at class level	8:50	1½ Hrs
3	BREAK	10:20	30 Mins
4	Participant continue producing their films	10:50 p.m.	40 Mins
5	Film editing, adding of titles etc.	11:30	30 Mins
6	Evaluation / reflections and Feedback on Day 3	12:00	30 Mins
7	Closure	12:30	-

Day 4 – Thursday 28th January, 2016 - 8:30 a.m. – 2:00 p. m.

S/N	Activity	Start Time	Duration
1	Plenary	8:30 a.m.	20 mins.
2	Using the sample lesson plan provided as a guide, participants develop new TPACK-compliant lesson plans by inserting (TK) at the appropriate sections of their lesson plans to represent their films which already has content (CK) and pedagogy (PK)	8:50	40 mins.
3	Participants to compare newly developed TPACK-compliant lesson plans with the original ones they had taught and to comment on what is new & different.	12:30	10 mins.
4	BREAK	12:40	30 mins.
5	Lesson plan development continues	1:10 p.m.	20 mins.
6	Evaluation / reflections and Feedback on Day 4	1:30	30 mins.
7	Closure	2:00	-

Day 5 – Friday, 29th January, 2016 - 8:30 a.m. – 1:20 p.m.

S/N	Activity	Start Time	Duration
1	Plenary	8:30 a.m.	20 Mins.
2	Participants continue with development of their TPACK compliant lesson plans.	8:50	1 hr
3	BREAK	10:20	30 Mins
4	Peer presentations and peer reviews of lessons plans with films, followed by discussions. Comments on films to be used to improve them.	10:50	1 ½ hrs
5	Discussion of other field practice protocols – e.g. Lesson observation 2 weeks into practice and recording of field experience and reflections.	12:20	30 Mins
6	Evaluation / reflections and Feedback on Day 5	12:50	30 Mins
7	Closure	1:20	-

[illegible]

Appendix P: Responses from SWOT Analysis participating teachers wrote on Small Stickers from Fig. 4.2

Q. What are the strengths, Weaknesses, Opportunities and Threats your school has as a result of the introduction of ICT in your school?

Strengths:

1. The ICT tools are being used properly because the school has an ICT teacher.
2. Pupils have serene environment to learn ICT without having to go out of the school to learn it.
3. The school is highly recognized as a resourced school.
4. There is prompt printing and photocopying of examination papers and other materials and this saves time in so many ways.
5. Students' performance in ICT at the Basic Education Certificate Examinations (BECE) has improved over the years because of ICT on the school.
6. It has projected the name of the school nationwide.

Weaknesses:

1. Many of the teachers are not computer literate.
2. The school is unable to raise money to pay our electricity bills or afford connectivity.
3. Class teachers do not have the opportunity to use the ICT tools and equipment.
4. The school has only one ICT instructor.
5. Lack of good computers makes our lessons sometimes uninteresting.

Step 1

Previous knowledge

Before the start of this lesson students know that:

- rocks are classified into three types
- sedimentary rock is one of the three rocks
- rocks are formed from materials on the earth's surface.

User's Instructions

Questions and answers

Use true and false and supply/multiple type teaching activity to recall previous knowledge.

Q1. Rocks are classified intotypes.

Q2. Rocks are formed by land and sea. True ☐ False ☐

Q3. Rocks are formed from.....on the earth's surface

Developer's Instructions

Use click buttons to bring correct answers into view, followed by a 'bravo' shout for correct answers and a 'try again' for incorrect answers. Spend just about 5 to 8 minutes on this activity.

Step 2

Lesson Objectives

User's Instructions

At the end of the lesson, students will be able to:

- **State** the meaning of sediments,
- **Describe** what sedimentary rocks are,
- **Explain** the way sedimentary rocks are formed,
- **Identify** examples of the types of sedimentary rocks and where they can be found.

Unit 3 What are Sedimentary Rocks?

Sedimentary Rock is a 'Rock formed by the hardening of material deposited in some process; (e.g. **precipitation** or sedimentation) most commonly sandstone, shale, and limestone.'

<http://www.graniteland.com/infos/home/sedimentary-rock>

It can also be defined as 'Any rock composed of sediment, i.e. solid particles and dissolved minerals. Examples include rocks that form from sand or mud in riverbeds or on the sea bottom.'

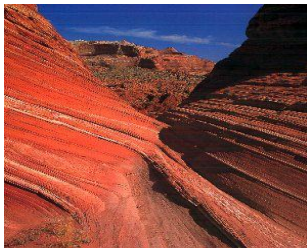
<http://www.merriam-webster.com/dictionary/sedimentary%20rock>

Developer instructions

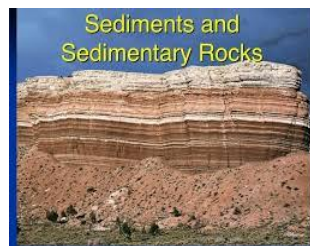
This is a rollover activity. Provide technique for clicking on Rock A, B and C to pop out each sedimentary rock for observation by user.

**** Assign each picture to a separate screen. The questions below apply to each of the three screens/plates.**

Rock A



Rock B



Rock C



User's Instructions: Click on Rocks A, B, C to pop out pictures for observation and for answering the following questions.

Discussions Q's

Q1. What colour is the sedimentary rock A, B, and C?

Q2. What significant feature do you notice on Rock A and B?

Q3. What difference is there between Rock A and Rock C?

Step 4 How are sedimentary rocks formed? Sedimentary rocks are classified according to their manner of origin into mechanical or chemical sedimentary rocks. Mechanical rocks, or fragmental rocks, are composed of mineral particles produced by the mechanical disintegration of other rocks and transported, without chemical deterioration, by flowing water. They are carried into larger bodies of water, where they are deposited in layers. **Shale, sandstone, and conglomerate** are common sedimentary rocks of mechanical origin. The materials making up chemical sedimentary rocks may consist of the remains of microscopic marine organisms precipitated on the ocean floor, as in the case of **limestone**.

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Discussion Activity

- Every minute of every day, rocks are being worn down by wind and rain.
- Tiny grains of dirt, sand, mud and clay are worn off and washed into streams, rivers, lakes and oceans by rain water. When these tiny bits of sand and dirt settle to the bottom of the water, they are called sediment.
- Minerals in the water and microscopic or very tiny sea animals also get mixed in with the dirt and sand to form the sediment.
- Every day more sediment piles on top of what is already there. After thousands and millions of years we end up with a really deep pile of sediment. The weight and pressure from all the stuff on top turns the sediment on the bottom into **sedimentary rock** through a process called **sedimentation**.

<http://www.ivyhall.district96.k12.il.us/4TH/KKHP/RocksandMinerals/sedimentary.html>

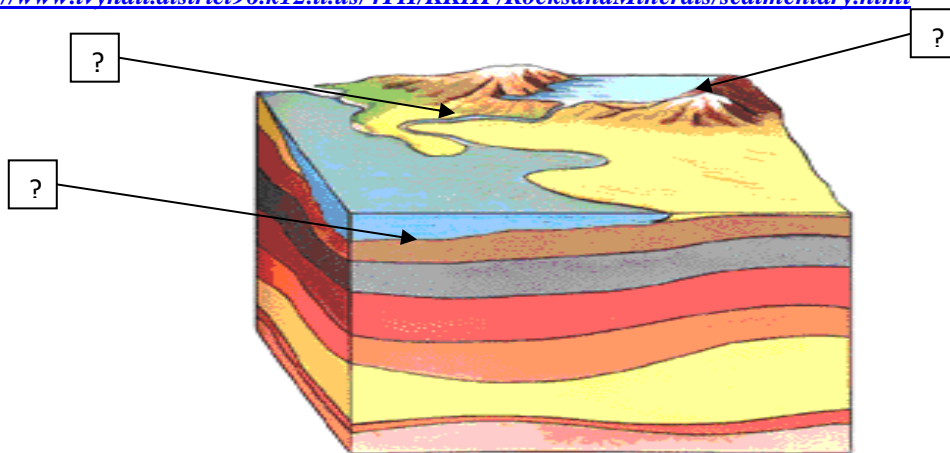


Diagram Source: <http://www.gpc.edu/~pgore/geology/geo101/sedrx.htm> - 14k

User's Instructions: Use question and answer technique and supply type item to solicit answers from students based on the formation of Sedimentary rocks.

Q.1 Which agents wear out rocks? Mention any two agents. Multiple choice type item

Q.2 Which type of materials are washed into the streams, rivers, lakes? Multiple choice type item

Q.3 Pressure and weight turn the sediment into rock after **long/short** years (Pick correct answer).

Q.4 Number arrows as 1, 2, 3 to trace the stages of sedimentary rock formation.



Developer instructions

Use animation technique to display the various stages of sedimentary rock formation.

Use Multiple Choice activity to elicit information from learners.

Also use motion animation to illustrate falling rain.

Step 5 Picture illustrations

Examples of Sedimentary rocks include common types such as: Chalk, Shale, Sandstone and Limestone.

Teacher should describe each of the rocks for learner to be capable of identifying them by sight.

E.g., Shale is fine-grained varieties of Sedimentary Rocks formed by consolidation of beds of clay and mud. The grains are so fine that the rock seems to have a homogeneous appearance. The colour could be gray; some could be red, pink, green, brown and black and the texture is soft and smooth. (Encarta, 2003) (Key: Rock 1. Shale; Rock 2. Chalk; Rock 3. Sandstone; Rock 4. Limestone).

Drag and Drop Activity

- chalk (Rocks A). 1.



- limestone (Rocks B). 2.



- sandstone (Rocks C). 3.



- shale (Rocks D). 4.



Source of information - www.google.com

User's instruction: Examine the rocks carefully, based on descriptions learnt. Click on each image and drag the handles out to enlarge them. This enables closer viewing. Drag and drop each rock name on their respective pairs of images.

Source: Locate the source (Website) of each image by placing the cursor on it.

Developer instructions

This is a drag and drop activity. Provide click buttons for dragging names of rocks to their correct images. Correct answers should be followed by a 'bravo' shout and a 'try again' for incorrect answers.

Appendix R: Copy of the Face-to-Face Interview Schedule

FACE TO FACE INTERVIEW SCHEDULE FOR PARTICIPANTS



University of Sussex

UNIVERSITY OF SUSSEX

FACE-TO-FACE TEACHER INTERVIEW INSTRUMENT (FOR END OF FIELD PRACTICE)

I am the research doctoral (distant) student at the University of Sussex who organised a training workshop for you a month ago to share with you the use of the Mobile phone camera and Windows Live Moviemaker as tools to produce lesson-related films to use as TLRs to support your teaching and learning activities.

I am here to conduct a face-to-face interview with you on your experiences, reflections, challenges and recommendations after 4 weeks of field practice on the training. Your participation in this exercise is confidential and any information you provide will be kept confidential but will be helpful in guiding me in my research work. Thank you.

Section A: Profile of Research Participant

1. Name of School: (Pseudonym to be used here)
2. Town / City: Pokuase - ACCRA
3. Sex of teacher: M - Male [] F - Female []
4. Class taught:
5. Subject(s) taught:
6. Current Rank:
7. Function: T – Teaching; A – Administrative; O – Other.....
8. Academic Qualification
9. Professional Qualification
10. Teacher's Age Group:
 - i) 20 – 25 years []
 - ii) 25 – 30 " []
 - iii) 30 – 35 " []
 - iv) 35 – 40 " []
 - v) > 40 " []
11. For how long have you been teaching?
12. How many pupils / students are in your class presently?

Section B: Knowledge of Technology Access and Use (Technology here includes the Computer, printer, cell phones, projector etc. – Researcher to mention them to the teacher).

13. What is your understanding of technology use in teaching and learning?
14. Are you aware that technology use in teaching and learning has been mentioned in the School Curricula across the various subjects? Yes [] No []
15. How long have you been using any of the technologies mentioned earlier?
- i) Less than a year []
 - ii) 1 – 3 years []
 - iii) 4 – 6 years []
 - iv) > 6 years []
 - v) Never []
16. How long have you been using technology as a tool in your teaching-learning activities?
- i) Less than a year []
 - ii) 1 – 3 years []
 - iii) 4 – 6 years []
 - iv) > 6 years []
 - v) Never []

Section C: Teachers' use and value placed on the technology.

17. How did you feel introducing this new technology (Movies) to your pupils?
18. Did these technologies lend support to you to cover the topics in the Citizenship Education How? Explain.
19. What can you say about your pupils' response to the use of the Movies to teach them?
(That is what is new?)

- Checklist:
- a) Enjoyment []
 - b) Excitement []
 - c) Boredom []
 - d) Improved understanding []
 - e) Confusion []
 - f) Increased participation []
 - g) Decreased participation []

20a. Do you think that the movies you used helped pupils / students to understand the lesson better? How did it helped them with their learning?

20b. What specific learning has the use of movies helped your pupils / students to achieve?

21. Have you learnt anything new from using movies to teach lesson topics in your class?

Section D: How the technologies are used in different contexts

23. Did you have all the technologies that you needed to do effective teaching?

24. Did you feel that you used the technologies in the way you intended? Explain.

25. What preparation did you have to do?

26. In using the technologies, what did you find easy to do? Why was it easy for you?

27. What did you find more difficult? Can you explain why it was difficult?

28. What did you enjoy doing most with the technology and why?

29. In what way did the technology help you to improve your teaching-learning activities?

30. In what ways can these technologies help teachers to improve their teaching?

31. What challenges did you encounter in using these technologies?

Section E: What support do teachers need to use these technologies? (Recommendations)

32. What new ideas has the practice with the technologies give you about teaching?

33. Did the practice with the technologies give you new ideas about any other materials to use in your teaching? In other words, what will you do differently?

34. What further support would you need to use this new technology?

35. Do you have any other comments to make?

THANK YOU FOR YOUR TIME

////////////////////////////////////