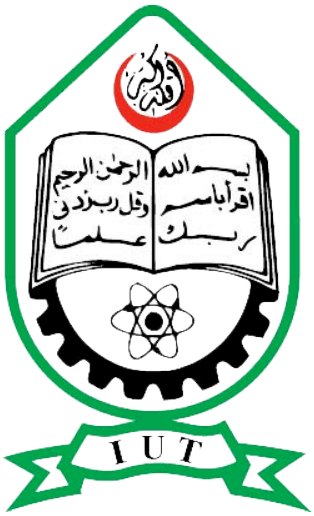

Teachers' perceptions of ICT integration into the teaching methods of University of The Gambia

A thesis submitted for the partial fulfillment of the degree of MScTE in Technical Education at the Islamic University of Technology in 2020

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Submitted to:

Department of Technical and Vocational Education (TVE)

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It is recommended that this thesis prepared by Ash Malick Jeng, entitled "Teachers' perceptions of ICT integration into the teaching methods of University of The Gambia" has been accepted as fulfilling the part of the requirement for the degree of Master of Science in Technical Education (M.Sc. T.E.) with specialization in Computer Science and Engineering (CSE).

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Dedication

I dedicated my work to The Almighty Allah without his support, strength and mercy I would be nowhere and to my beloved family have made it possible because of their countless prayers, love, support, guidance, motivation, cooperation and wisdom that held me firm and strong through my program. May Allah S.W.T render their countless support, keep them safe and away from fitnah.

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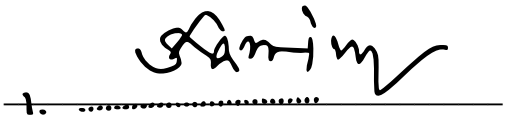
Declaration of the Author

This is to certify that the work presented in this thesis is my original work**.** This thesis has neither been submitted nor previously been accepted for the award of any other degree in this university or elsewhere. I also declare that the sources used in this thesis were explicitly acknowledged with proper citation and references.



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Acronyms

ABBREVIATION	ACRONYM
ICT	Information and Communication Technology
TPACK	Technology Pedagogy and Content Knowledge
TK	Technology Knowledge
PK	Pedagogy Knowledge
CK	Content Knowledge
PCK	Pedagogy Content Knowledge
TPK	Technology Pedagogy Knowledge
TCK	Technology Content Knowledge
TVE	Technical and Vocational Education
UNDP	United Nations Development Programme
SDG	Sustainable Development Goals
IIA	Internet Initiative for Africa
UN	United Nation
SPSS	Statistical Package for the Social Sciences
IBM	International Business Machines

Abstract

The purpose of this study was to investigate University teachers' perception on information and communication technology (ICT) integration into their teaching method at the university of The Gambia. The main objective of the study was to determine how teachers at the University of the Gambia perceived the effects of Technology, Pedagogy, and Content based on TPACK model. This study used questionnaire, adapted from the technological, pedagogical and content knowledge (TPACK) framework, which was administered at 88 faculty and staff of the University of the Gambia to collect data on their level of awareness of on ICT integration. A frequency analysis was first run to check the scores of all components of TPACK, then a correlational analysis was carried out to measure the relationship between the TPACK constructs. The data collected from these analyses are used to construct a structural equation model that showed the relationship of TPACK constructs as perceived by the faculty and staff of the University of the Gambia. The results of this study showed that the individual construct (i.e., technology, pedagogy, and content) and the paired constructs (i.e. Technology and Pedagogy, Technology and Content, Pedagogy and Content knowledge) of TPACK are positively correlated with teachers' perceived TPACK at the University of The Gambia.

Keywords: Teachers, perception, ICT integration, TPACK, The Gambia.

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Chapter 1 Introduction

1.1 Background of the problem

In the field of education, information and communication technologies (ICT) related advancement is viewed as an important apparatus for change and development in training, thus making ICT interesting to incorporate in activities of teaching, learning and management (Hismanoglu 2012). ICT has been employed in different settings of a classroom to improve teaching and learning including the utilization of the web as a device for acquiring data, venture composing, correspondence among a gathering of understudies through email or an online chat-room (Aksal and Gazi 2015). Recently, United Nation Development Program (UNDP) has engaged in funding projects aimed at assisting the Gambia in fulfilling the sustainable development goals (SDGs). Among these projects are The Internet Initiative for Africa (IIA) aimed at developing the ICT culture, the satellite project under the Gambia's Telecommunication Media (GAMTEL) to improve internet connectivity (Jiang, Li et al. 2019). In a similar vein, different internet service providers (ISPS) have join the market to provide internet connectivity utilizing the gateways provided by these projects. All the above initiatives are geared towards integrating ICT in The Gambian society to improve their way of living. One of the ways to bring into existence a knowledge society is by incorporating ICT in education, science, technology and innovation (Ivongbe, Ojeifo et al. 2010).

Currently, there have been efforts to address ICT infrastructures, regulations, and include ICT in local government, health, trade and commerce, agriculture, gender, media and education (Bassi, e-schools et al. 2011). Firstly, to concretize the integration of ICT in education, computer labs with high internet connectivity have been set. Secondly, a deliberate action has been placed by the government of the Gambia to train all the teachers regarding computer labs (Mangesi 2007). In addition, education management and education system with the aim of managing educational resources has also been created (Ang'ondi 2013). In order to ensure continuity, 'The Gambia train the trainer' program has been created to improve ICT education in the Gambia. Although the government has formulated policy framework, implemented ICT plans, advocated for ICT leadership, created infrastructure

and trained its human resources to enable the sustainability of ICT, there is almost no scholarly evidence about teachers' perception about ICT integration in the teaching methods especially at higher education level (Tchinda Josue 2007). This study, therefore, aims to bridge the gap related to teachers' perception in the integration of ICT in the teaching methods at the University of the Gambia through the examination of technological, pedagogical, content, and knowledge gaps. Technological, Pedagogical, Content and Knowledge (TPACK) is a framework designed to test teachers level of ICT integration (Mishra and Koehler 2006). The framework has seven constructs that embrace a hypothetical reason for understanding the level of teachers' ICT assimilation (Koh, Chai et al. 2013). This study shall adopt TPACK as a framework to understand the connection between technological, pedagogical, and content knowledge and the perception of teachers' ICT integration.

1.2 Problem statement

The inclusion in schools of computers, social networks, mobile phones, among others does not automatically require introduction of technology in education. The biggest issue for schools and curriculum planners is whether such tools can best be used to improve learning. Bayler and Ritchie (2002) noted that some schools have opted to bring computers into laboratories, while others have been using classroom techniques (Niess 2011). There are also teachers who concentrate on digital literacy, while some concentrate on text learning. Such discrepancies in the way growing educational stakeholder views and uses technology hamper the positive impacts technology can have on the learning of students. Despite such technical gaps between teachers and schools, the problem is, "what is the integration of education technology of these schools and teachers" may be questioned (Graham 2011).

Although emphasis is currently being emphasized on the integration of technology, pedagogy, and content in the educational environment, there is no evidence that teachers can correctly incorporate these components into their teaching (Harris, Mishra et al. 2009). This study would also provide a framework for the growth of technology integration skills and an overview of the process of TPACK and its importance in university teaching. This research would also make recommendation for the integration required to develop TPACK's teaching

skills in universities (Wetzel and Marshall 2011). This helps to identify the role of tertiary institutions in improving ICT skills for current and potential university teachers.

Not understanding teachers' perception in ICT integration creates a problem in the process of teaching and learning at the University of The Gambia. There is no research suggesting solutions to prevent the absence of ICT use. The specific problem is that the majority of research focus on examining the perception of ICT integration with special emphasis on students.

1.3 Research Questions

The purpose of this thesis is to understand teachers' perception of ICT integration in university teaching and learning and then answer the following research questions:

1. What are the teachers perceived pathways to TPACK at the University of The Gambia?
2. What are the perceptions of University of The Gambia teachers in relation to ICT integration in the learning and teaching process?

1.4 Research Objectives

The main objective of the study is to use the TPACK model to measure teachers' perception of ICT integration in the teaching and learning at the University of the Gambia.

To achieve the above objective, the following specific objectives are formed to:

i. Establish the individual effect of Technology, Pedagogy, and Content knowledge on overall ICT integration on teachers' perceived TPACK.
ii. Determine the individual impact of Technology, Pedagogy, and Content knowledge on paired Technology and Pedagogy, Technology and Content, Pedagogy and Content knowledge on teachers' perceived TPACK model.
iii. Evaluate the general impact of paired Technology and Pedagogy, Technology and Content, Pedagogy and Content knowledge on overall ICT integration on teachers' perceived TPACK.

1.5 Significance of the study

Integration of technology into education is not a recent phenomenon; it started in the 1990s when computers were first used in education (Niess 2011). Therefore, any review or research on technology integration in education should first examine what was done in the 1990s, what is being done and the potential prospects for technology integration in education. In this regard, this literature review is undertaken to create a theoretical framework of what has been done to integrate technology into education, what is currently being achieved, and what are the future opportunities for the integration of technology into education (Koehler, Mishra et al. 2013).

A new paradigm for teachers' integration with technology has been developed in recent years. To shape the awareness of technological pedagogical content (TPACK) this model includes the expertise of teachers in technology pedagogy and content(Voogt, Fisser et al. 2016). In order to gain an understanding of the opportunities and challenges present in TPACK for the training of pre-service teachers, it is useful to understand what other researchers have managed to achieve so far, what barriers they have encountered and what measures can be taken and how to make use of them. Furthermore, this literature review was considered important in gaining an understanding of the ideas, concepts, benefits and challenges underlying the growth of the competency of teachers in TPACK (Jang and Tsai 2013).

1.6 Definition of terms

The following words would have the following meaning in this study:

Technology can mean the know-how and innovative methods that will help people use tools, resources, and mechanisms to solve problems and gain control of the natural and generated atmosphere in an attempt to improve learning for students (Archambault and Crippen 2009).

Educational technology deals with the study and ethical approach of promoting learning to improve performance through the development, use and management of acceptable technological tools and techniques (Graham, Borup et al. 2012).

Technological Pedagogical Content Knowledge (TPACK) is the basic knowledge qualities needed by teachers for the integration of technology into their teaching, thus acknowledging the dynamic, multifaceted and situated nature of teacher education. The dynamic interplay of three key sources of information is at the core of the TPACK framework: content

knowledge (CK), pedagogy knowledge (PK), and technology knowledge (TK) (Swallow and Olofson 2017).

Teacher education may apply to policies and procedures designed to provide educators with the knowledge, attitudes, behaviors and skills needed to successfully perform their duties in the classroom, school and broader community. The teacher education is divided into two groups in relation to this study:

- Teachers relating to students who are learning the required coursework in the fields of pedagogy, specialization content and technology and who have not joined the course.

- The teacher denotes the instructor / trainer either compensated or not institution / organization.

Teacher Education is the training and education offered to student teachers before any teaching is practiced.

Competency means the ability to do something according to a specified defined standard, usually calculated by performing a measurable procedure or creating a finished output. Competency would be assessed by knowledge, expertise and the ability to perform a specific task (Kereluik, Mishra et al. 2011).

Chapter 2 Literature Review

2.1 Introduction

There is substantial research on teachers' perception and Information and communication technologies (ICT) integration, in large part due to various projects that the U.N. system and other world institutions, continue to fund, including projects aimed at assisting developing countries in fulfilling the sustainable development goals (SDGs) and alleviating barriers to progress (Byrne 2016).

The majority of published works include a focus toward the teaching, learning and management of ICT and/or why ICT should be integrated in the curricula. While these previous studies offer valuable insight in correcting learning methods, they provide only partial solutions for the ICT integration and teachers perceptions. A limited body of knowledge exists regarding Teachers' perception of integrating ICT in the teaching methods at the University level through the examination of technological, pedagogical, content, and knowledge gaps (Harris and Hofer 2011).

2.2 Review of Literature

The goal of the literature is to summarize literature of teacher perception on ICT integration both international and the Gambia and provide background as to the importance of TPACK.

2.2.1 Search Approach

The search approach for this study started with the establishment of a literature review components outline, which guided the keywords used in search databases. Keywords included, but were not limited to ICT integration, TPACK, implementing of technology, information technology, Distance learning, teacher perception(Santos, Castro et al. 2012). I focus on literature published with the last 10 years. Sources of information included journal articles, books, government statistics, theses, and dissertations. Older references have been included to give the reader a sense of the theme's durability and past(Phillips, Koehler et al. 2016). A subset of the retrieved sources, as mentioned in this dissertation's references section, has been defined as the most important sources for this study, and provides the basis for the literature review.

2.3 ICT integration

ICTs still have a great influence on the teaching-learning process, their impact was even at the beginning of the century in the past, when Richards (2005) wrote that many educators find that interesting and well-planned tasks, projects, and tools are crucial to harnessing the educational potential of digital resources, internet communications, and interactive multimedia to engage young learners' interest, engagement, and knowledge building. There is an increasing demand for educational institutions to use ICT to teach students the skills and expertise need for the 21st century. Today's educational institutions try to restructure their educational curricula and classroom facilities to bridge the current technology gap in teaching and learning to understand the effects of ICTs on the workplace and daily life.

A national study conducted in the USA found that increased hours of training in computer skills did not help teachers better integrate ICT (Bassi, e-schools et al. 2011). This study inspired many US schools of education to examine how ICT integration practice could be strengthened into their curriculum through techniques such as faculty modeling, ICT lesson plan development initiatives, and field-based ICT practice (Bassi, e-schools et al. 2011, Baert 2014, Aksal and Gazi 2015). Although these techniques have been identified to increase the relative confidence of teachers for ICT integration, the types of ICT integration knowledge and skill sets gained by teachers have not been clearly articulated. The field also lacked detailed theoretical models at this time to describe this phenomenon. This theoretical definition was discussed in the conception of TPACK by Mishra and Koehler (2006). Void in terms of ICT integration by identifying the various types of information teachers need to learn. The TPACK method has been widely adopted since its inception as a theoretical framework for the restructuring of ICT teacher education (Niess 2011).

2.4 Teachers perception on ICT

ICTs are important for the teaching process, so teachers should play a key role in the adoption and integration of ICTs in the teaching-learning process. There are several variables that influence this process. From the previous century to date, these influences are changing. The integration of ICTs into teaching-learning by teachers is often affected by organizational variables, attitudes towards technology and other variables (Chen, 2008;

Tondeur, Van Braak and Valcke, 2008; Lim and Chai, 2008; Clausen, 2007). Personal characteristics such as level of education, age, gender, educational background, computer experience for educational purposes and computer attitude may affect the adoption of a technology (Schiler, 2003). For instance, Tondeur, Valcke, and Van Braak (2008) pointed out that male teachers have more positive attitudes toward ICTs, and compared to female teachers, their use of ICTs in the education process is more frequent. The attitudes and values of teachers towards technology are among the variables influencing the effective integration of ICTs into teaching (Hew and Brush, 2007; Keengwe and Onchwari, 2008). If the attitudes of teachers towards the use of educational technology are optimistic, they can easily provide valuable insight into the application and integration of ICTs into the process of teaching and learning. Research has shown that the attitudes of teachers towards technology affect their acceptance of the usefulness of technology and its integration into teaching and learning (Huang and Liaw 2005). The computer knowledge of teachers applies favorably to their computer attitudes. The more teachers have computer expertise, the more likely they are to demonstrate positive attitudes towards technology (Rozell and Gardner 1999). It is anticipated that optimistic computer attitudes would encourage computer integration in the classroom (VanBraak, Tondeur and Valcke, 2004). According to Woodrow (1992), in order to effectively change educational practice, users need to build positive attitudes towards innovation.

It is important to note that the attitude of teachers plays an important role in affecting the quality of ICT education from a number of perspectives (Kusano et al., 2013). Voogt (2010) found that teachers who in their lessons use technology extensively appear to have a high degree of trust in pedagogical technology skills and concentrate on a learner-centered approach. They are more interested in professional development and collaborative programs with peers than teachers who do not use technology so much. Other research indicates that the pedagogical values of teachers (e.g., teaching and learning philosophies) are linked to their integration of technology. Schools need to build good leadership in order to shift the views of students. School principals should also be not only an official boss, but also a personal consultant to support individual teachers and employees (Kim, Kim, Lee, Spector and DeMeester, 2013).

2.5 TPACK

Teachers utilize technology in the classroom in several respects. In addition to traditional homework products, various posts, among them 10 science apps, ten geography apps and creative learning relative to conventional homework items, were recently used in the classroom (Finger, Jamieson-Proctor et al. 2010). When teachers are motivated by the latest trends that allow technology to be integrated into classrooms (Wetzel and Marshall 2011). The TPACK model gives us a new framework in which technology can be integrated into education and how modern classrooms can be structured and students have the best educational experience while technology integrates(Kelly, Lesh et al. 2014).

2.5.1 What is the TPACK Framework?

TPACK stands for Technological Pedagogical Content Knowledge. This idea was created so that teachers would illustrate the skills they need to educate, teach and use technology to their students (Kopcha, Ottenbreit-Leftwich et al. 2014). Below is the history of how this started.

2.5.2 The Concept of TPACK

Mishra and Koehler (2006) wrote the seminal piece on the TPACK model. They clarify that their hypothesis comes with design tests after five years of researching teachers at all different grade levels to see how their classes worked. They developed their original concept on the 1986 work of Shulman “Those Who Understand: Knowledge Growth in Teaching.” (Mishra 2019)

In 2006, Mishra and Koehler published the seminal article on the TPACK model in “Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge”. They clarified that after five years of researching teachers in all class, they discovered how the classrooms functioned through design experiments (Anderson, Barham et al. 2013). They established their original concept on Shulman's "Those Who Understand: Knowledge Growth in Teaching"(Mishra 2019).

First, Shulman addresses the general concept of teaching awareness that teachers have variety of expertise about the topics they are teaching and a number of pedagogical

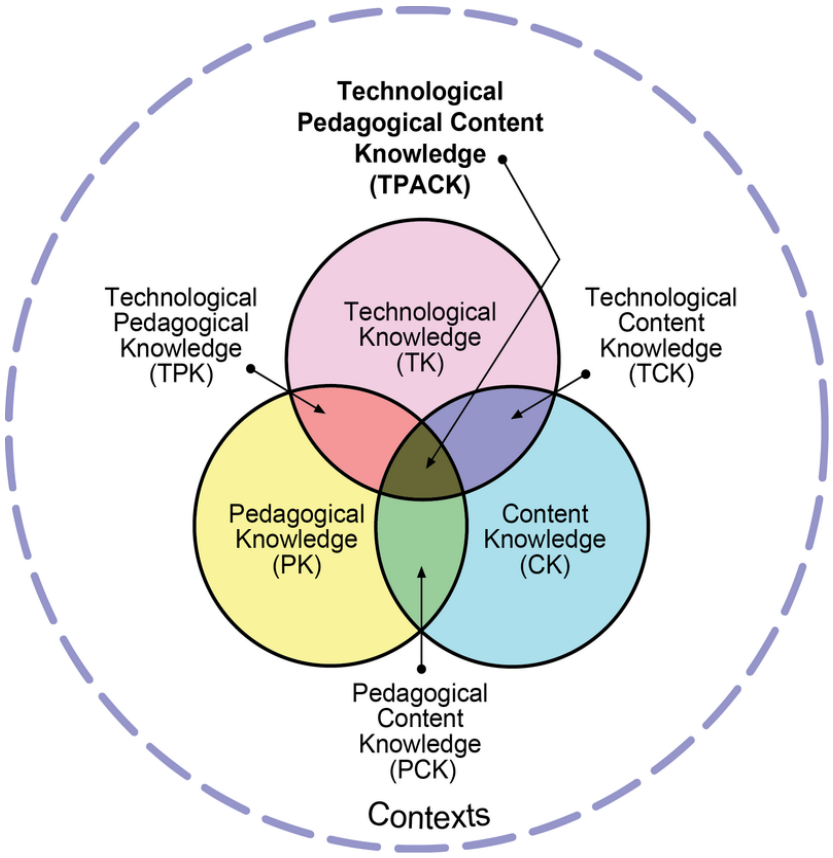
information – on how they should educate, including unique teaching activities (Shin, Koehler et al. 2009).

Shulman says good teachers combine these two ways of learning how to teach their subje cts effectively. He names this pedagogical content knowledge or PCK (De Rossi and Trevisan 2018).

Twenty years later, Mishra and Koehler realized that technology in the classroom has been the greatest transformation in education (Sheffield, Dobozy et al. 2015). They noticed that technical information was regarded as an information unrelated to the PCK (Herring, Koehler et al. 2016). After five years of study, Mishra and Koehler developed a new paradigm TPACK that applied technology to pedagogical knowledge of content and highlighted the connections, interactions and constraints under which teachers function in all three of these fields of knowledge (Drummond and Sweeney 2017).

2.5.3 The Composition of the TPACK Model

TPACK offers us three fields of knowledge: technology, pedagogy and content. The arrangement in a Venn diagram of these three groups allows us to see the four areas generated by Mishra and Koehler (Mishra and Koehler 2008).



TPACK Venn Diagram Framework (Mishra & Koehler, 2008) p.3

Technology Knowledge (TK): All educational materials from blackboard to advanced technology are included in this knowledge (Koehler and Mishra 2009). In general, this extends to a number of technologies used in classroom setting (Mertler and Vannatta 2002).

Content Knowledge (CK): "what will be taught?" (Mertler and Vannatta 2002). Teachers must have knowledge about content or subjects. Which including theories, facts and concepts related to specific content areas. People who do not understand this may have misunderstandings or misleading facts about the area (Koehler and Mishra 2009).

Pedagogy Knowledge (PK): Teachers also need knowledge about teaching, including teaching strategies for addressing individuals' learning needs and methods of presenting the subject matter (Kanuka 2006). This knowledge consists of implementation of strategies, planning lesson, and learners' assessment.

The first Shulman's overlap: Pedagogical Content Knowledge. This overlap tells us that teachers plan lessons that are the most successful way for students to understand different lessons (Warr, Mishra et al. 2019). Another scholar, Rick Marks, said in 1990 that PCK "represents a class of expertise that is central to the teachers' job (Gholami and Husu 2010) and that is usually not possessed by non-teacher experts or teachers who know nothing about the topic (Koehler, Shin et al. 2012).

Technological Content Knowledge is the second overlap. The TCK refers to the impact technology has on teaching content. For example, instructors have been teaching their students cursive and penmanship (Kereluik, Casperson et al. 2010). But several school systems have withdrawn from the program cursive handwriting (Angeli and Valanides 2008). It is evident that technology, without going into the discussion about the validity of cursive, has changed the understanding of subject we teach students (Hu and Fyfe 2010).

The Technological Pedagogical Knowledge portrayed in the Venn diagram is the third overlap. TPK emphasizes the field of shared interaction of technology and pedagogy (Niess 2005). The incorporation of technology into the classroom also affects the teaching of the curriculum. A basic illustration would be when an instructor utilizes an educational video clip to illustrate a subject on the wall (Koehler, Mishra et al. 2011).

Finally, Technological Pedagogical Content Knowledge is at the center the Venn diagram. This part recognizes that all three knowledge sets have effect on each other and they are each relevant and an understanding of all three is necessary to provide an effective learning environment (Graham 2011). TPACK is a form of expertise that is fundamental to educator's work on technology, as Mishra and Koehler paraphrased Marks' remarks on the implementation of TPACK (Gawrisch, Richards et al. 2020). Such information will not usually be found in the area of education or technicians who know nothing about the topic or pedagogy, or teachers who have no awareness of the topic or education (Lin, Tsai et al. 2013). Mishra and Koehler found that in relation to these modern information overlaps, knowledge exists in different contexts. The instructor is part of the context, and students and the community are also part of the context (Mishra and Koehler 2009). The meaning varies subtly in each case, and the awareness shifts to build a learning atmo sphere (Graham, Burgoyne et al. 2009)

2.5.4 How does TPACK impact technology in teaching and learning?

Technology is generally viewed as if it were distinct from learning and teaching. We have Professional Development sessions where we are advised to use some specific program or device, and there is no debate of how to incorporate it into our classroom (Jordan 2011). This is what Mishra and Koehler refer to as an actual negative effect. They say that TPACK's lack of awareness holds the technology separate and leads to four problems in classroom use of technology (Hu and Fyfe 2010). First, technology changes are so fast that it's incredibly difficult to keep up with all the latest advances and features (Tournaki and Lyublinskaya 2014). The second issue is that software is designed for business, not education. This also means students are learning how to use the software and not learning the class material (Hofer, Grandgenett et al. 2011). The third problem with holding the technology isolated is the learning conceptual nature (Mishra, Koehler et al. 2011). A teacher can change a lesson to ensure it meets the needs of the individual student group, but the instructional video cannot (Martinovic and Zhang 2012). Every time it is played it is the same video (Herring, Koehler et al. 2016). Lastly, Mishra and Koehler say that keeping technology separate puts emphasis on "what" not "how." From the viewpoint of the instructor, the lesson is about what technology we are going to use today, what it means, what skills it takes, rather than how I can teach my students (Chai, Koh et al. 2010).

2.5.5 Applications of TPACK

Having technology as a separate collection of information creates challenges, but when we grasp the TPACK structure we can incorporate technology into our classroom content and pedagogy. The integration will help our students understand better. Mishra and Koehler propose TPACK will direct the development of the curriculum and teacher education. Judith B. Harris and Mark J. Hofer collaborated with colleagues from universities across the USA to develop Activity Forms to bring TPACK to our classrooms now (Polly, Mims et al. 2010). Their work, Grounded Integration in Technology, Instructional planning Using Form Taxonomies for Curriculum Learning, outlines how TPACK will improve the way we prepare our daily lessons (Shin, Koehler et al. 2009). They identify a strategic planning

in which we first pick the learning outcomes that we will be focusing on that day or during the class. The teaching methods are the output (Koehler, Mishra et al. 2013). The second step they suggest is to select a type of operation. The method of teaching is pedagogy, or how the students should understand the content (Baert 2014). Finally, we select technologies that endorse the type of activity and help the learners. Harris, Hofer and their colleagues give some examples of how our teaching strategies can encompass and part of the TPACK framework and enable us to construct and develop overlapping knowledge to make our students the best learning environment (Hofer and Harris 2012). TPACK 's simplest concept is that a person who is a world-renowned expert in a topic may not be a great instructor because they lack the experience of pedagogy to make the subject matter great. simple and comprehensible (Mishra and Koehler 2007). To be a good teacher, our knowledge of the subject must be balanced with our knowledge of how to teach. We will need to learn how to integrate technology with our content and pedagogy to create an efficient learning atmosphere, with the growing emphasis on technology (Hofer and Grandgenett 2012).

Chapter 3 Methodology

3.1 Research Design/ Conceptual Framework

The research was designed based on the seven constructs of Technology knowledge, Pedagogy knowledge, Content knowledge, and the intersection constructs derived from Technology and Pedagogy knowledge, Technology and Content knowledge, Pedagogy and Content knowledge and, technology, pedagogical, and content. This examined the TPACK of teachers to improve five dimensions of effective learning as stated by (Jonassen et al., 2008), to include active learning, cooperative learning, constructive learning, intentional learning and authentic learning.

3.2 Population and Sampling Technique

A purposive sampling technique was used to select 100 teachers at the University of The Gambia. The participants' selection process and their participation in this study required the approval of the university. The questionnaires were completed by teachers of all the genders, age, category, faculty and specialization during their free time. The information obtained from the respondents was treated confidential for purposes of this study and remained anonymous.

3.3 The Instrument/ the Questionnaire Design

This research is a quantitative type of study and a descriptive method of data collection was being used to evaluate the expertise necessary by university instructors to integrate ICT into their teaching methods and measure teachers' perceived perception with admire to the extent to which they agreed or disagreed with questions related to the seven TPACK factors. The five point Likert scale will be used to rate the question where 1-strongly disagree, 2-disagree, 3-neutral, 4-agree, 5-strongly agree. The questionnaire were closed-ended questions which was divided into two different sections; the first section concerned demographic data that was background of the respondents and the second section contained their perception with respect to the seven TPACK construct : Technology Knowledge (TK) - 6 items, Pedagogy Knowledge (PK) - 5 items, Content Knowledge (CK) - 3 items, Pedagogy Content Knowledge (PCK) - 3 items, Technology Content Knowledge (TCK) -

3 items, Technology Pedagogy Knowledge(TPK) - 4 items, and Technology Pedagogy Content Knowledge (TPCK) - 4 items, making it a total of 28 items that measured teachers perception.

3.3.1 Data Collection Procedure

The questions were developed using Google forms an online survey administration tool. I shared a link to the respondents on the google form via emails and other social media platforms. Being an online form, the respondents received all responses in real time upon completion of the survey. Online questionnaires had been used by many studies to collect data that yielded positive results (Lakhal, Khechine et al. 2013, Habibi, Springer et al. 2015).

A total number of 100 questionnaires were distributed via email and other social media platform among the respondents and a total of 88 were returned, filled using an online survey administration tool (Google form).

Chapter 4 Data Analysis and Results

The collected data from the questionnaire was analyzed using version 23 of IBM Statistical Software for the Social Sciences (SPSS). Separate tables and charts for the various sections of the questionnaire were prepared and each table and chart had been described separately as seen below.

4.1 Demographic Data

Demography by Gender

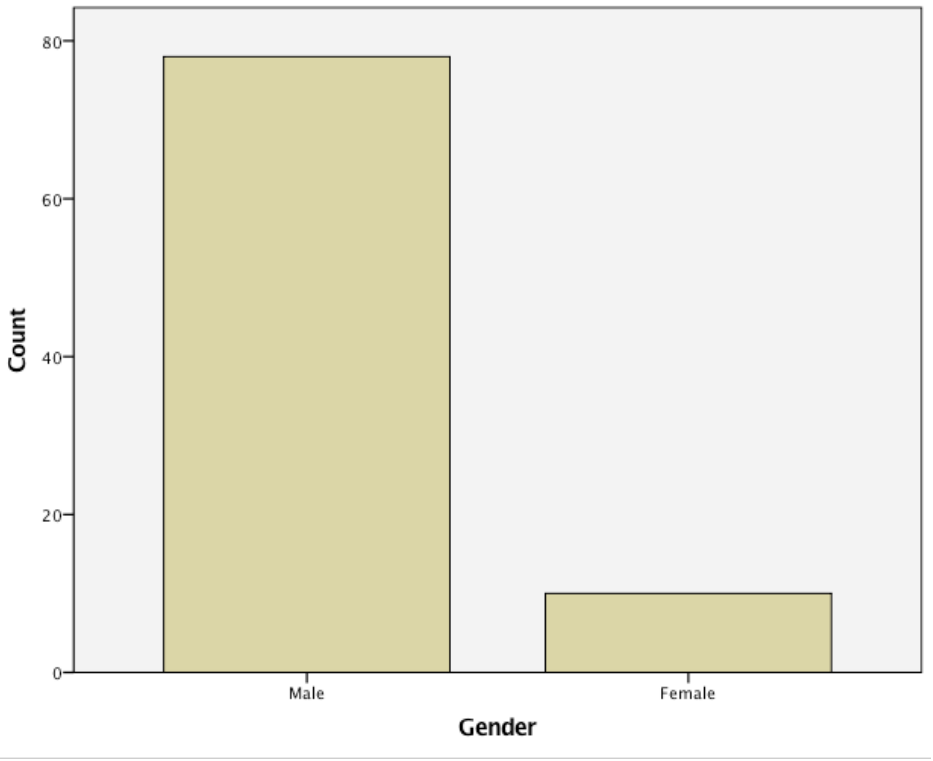


Figure 1 Gender demography

The chart figure 1 above was a graphical representation of the gender for participants in the study which included the teaching staff in the university of The Gambia. A total number of 88 respondents participated in the study of whom, 10 (11.4%) were Females and 78 (88.6%) were Males.

Demography by Age

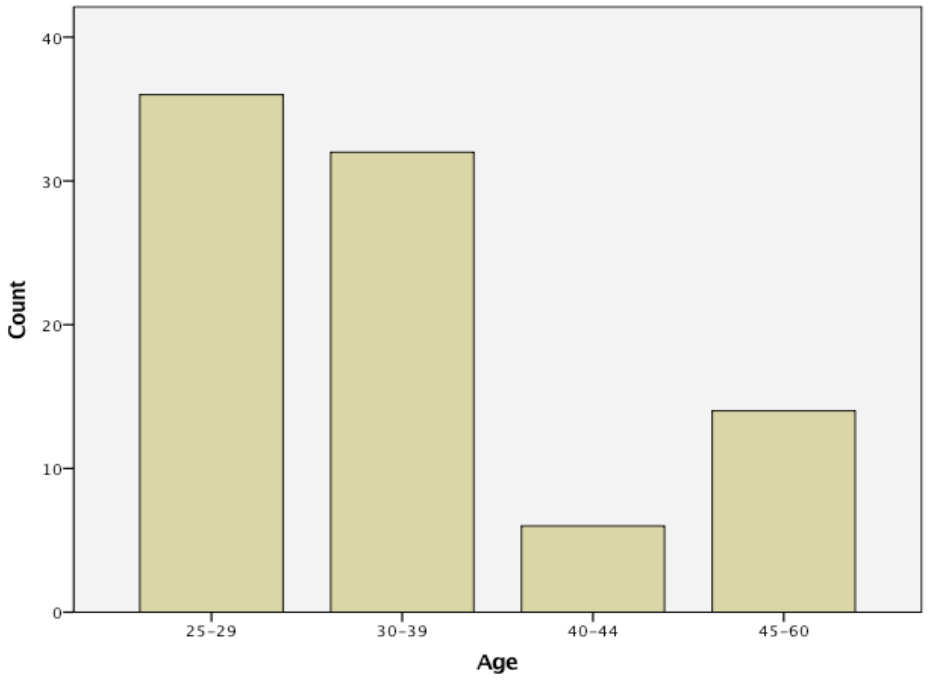


Figure 2 Age Demography

The chart figure 2 above showed that 40.9% of the total number of respondents were in the age range of 25-29, 36.4% of the total number of respondents were in the age range of 30-39, 6.8% of the total number of respondents were in the age range of 40-44 and 15.9% of the total number of respondents were in the age range of 45-60.

Demography by Category

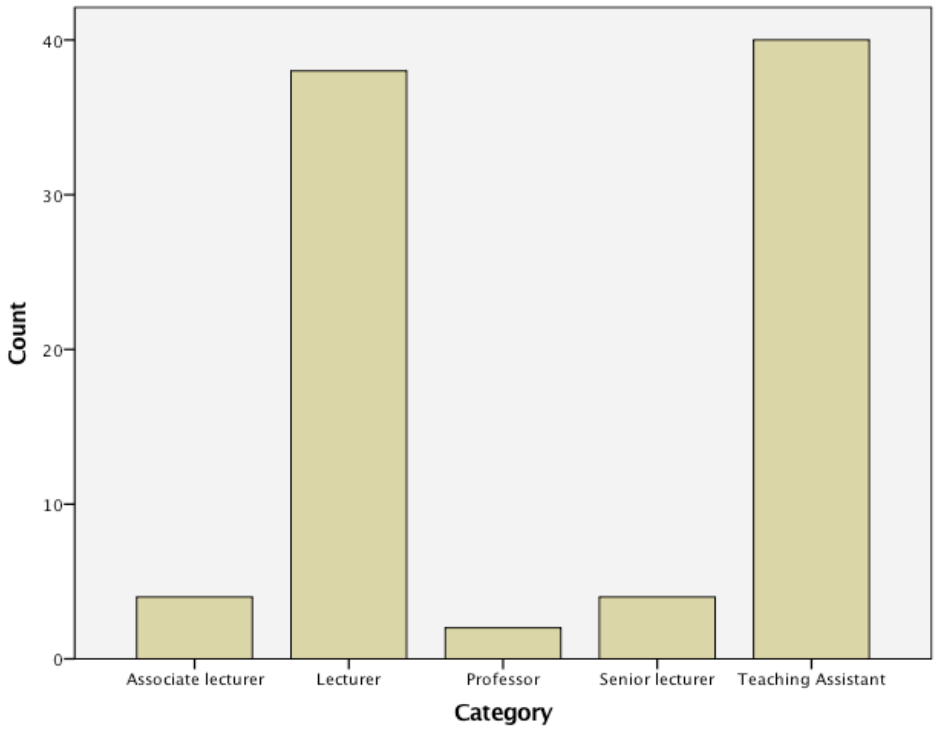


Figure 3 Category Demography

The chart figure 3 above showed the majority of the respondents 40(45.5%) are Teaching Assistants, followed by Lecturers, accounting 38(43.2%) of the total number of respondents, followed by Associate lecturers and Senior lecturers, accounting for 4(4.5%) respectively, and the remaining 2(2.3%) were Professors.

Demography by Faculty

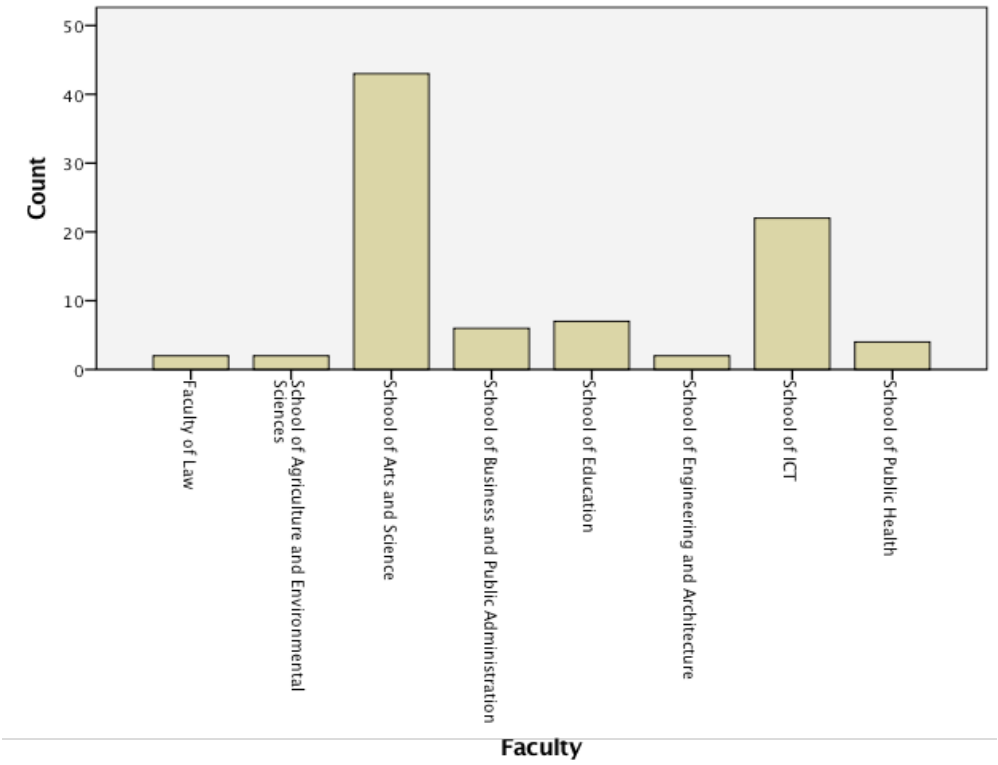


Figure 4 Faculty Demography

The figure 4 above indicated most of the respondents came from the School of Arts and Science 43(48.9%), followed by the School of ICT accounting for 22(25.0%), followed by the School of Education representing 7(8.0%), then the School of Business and Public Administration consisted of 6(6.8%), the School of Public Health comprised 4(4.5%), the Faculty of Law, the School of Agriculture and Environmental Sciences, and the School of Engineering and Architecture each accounting for 2(2.3%).

Demography by Specialization

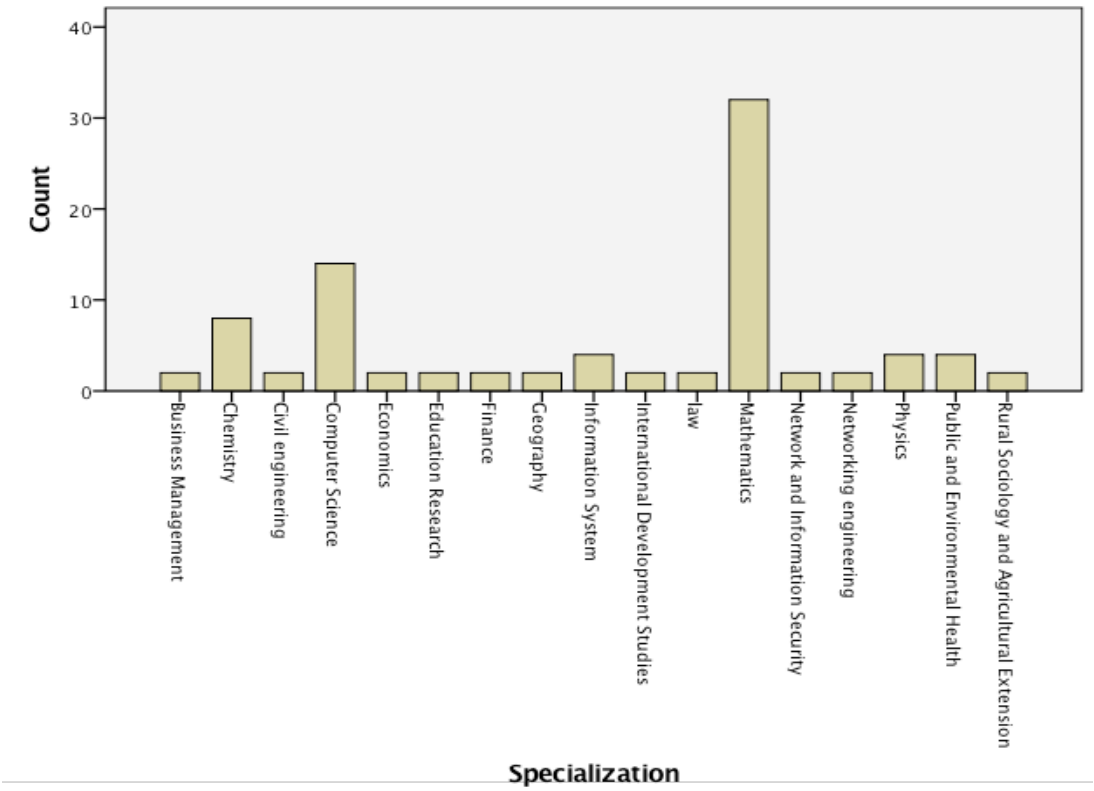


Figure 5 Specialization Demography

The figure 5 above indicated that most of the respondents surveyed were trained in Mathematics 32(36.4%), followed by Computer Scientists 14(15.9%), and Chemistry specialists 8(9.1%). In addition, the other respondents who are skilled in Information System, Physics, and Public and Environmental Health lecturers represented 4(4.5%) each, and the remaining respondents specialized in Business Management, Civil engineering, Economics, Education Research, Finance, Geography, International Development Studies, Law, Network and Information Security, Networking Engineering, and Rural Sociology and Agricultural Extension each represented 2(2.3%) of the total number of respondents.

4.2 Reliability Analysis

TPACK Construct	Cronbach alpha
Technology Knowledge (TK)	.894
Content Knowledge (CK)	.749
Pedagogy Knowledge (PK)	.903
Pedagogical Content Knowledge (PCK)	.805
Technological Pedagogical Knowledge (TPK)	.839
Technological Content Knowledge (TCK)	.853
Technological Pedagogical Content Knowledge (TPACK)	.912

Table 1 Reliability Measurement

The reliability of the seven constructs was first established using Cronbach's alpha for all constructs to analyze the reliability of the questionnaires. The reliability of each for the seven constructs is: TK (0.894), CK (0.749), PK (0.903), PCK (0.805), TPK (0.839), TCK (0.853), and TPACK (0.912). the degree of reliability from .7 to .95 (Lance, Butts et al. 2006) is fully supported because all the above value fall in the range.

4.3 Descriptive Statistics

Constructs	*items*	*Mean*	*Std Dev*
TK	I can connect teaching tools e.g. Projectors, Printers without support	4.3636	1.15651
	I can learn MS word, MS PowerPoint and other related teaching software with ease	4.6591	0.80067
	I follow the technology trends especially that which involves teaching	4.2045	1.01889
	I use smart devices very well to assist me in teaching	3.6364	1.39112
	I can use a number of technologies needed in teaching	4.0455	1.11323

	I have sufficient technical skills to use technology in teaching	4.2500	0.93772
PK	I know how to assess student performance in my courses	4.4773	0.75775
	I can adapt my teaching style to different learners	4.4091	0.75256
	I can assess student learning in multiple ways.	4.2955	0.89903
	I can use a wide range of teaching methods in a lecture room setting.	4.2500	0.71519
	I know how to organize and maintain classroom management.	4.3409	0.80067
CK	I have sufficient knowledge about the courses I teach	4.5682	0.65733
	I can use my course way of thinking	4.3636	0.83297
	I have various ways and strategies of developing my understanding of the courses that I teach	4.5909	0.65454
PCK	I can select effective teaching methods to guide student thinking and learning in my courses	4.3864	0.7181
	Teaching tactics may be used to guide students learning capability in teaching- learning process	4.4545	0.7257
	Different teaching methods have different impact of learning in terms of classroom situation	4.4545	0.78651
TCK	I know about technologies that I can use to simplify and elaborate the courses that I teach	4.0682	1.05912
	I know about technologies that allow me to represent concepts that would otherwise be difficult to understand	3.8409	1.26751
	I know about technologies that allow me to record data about my student and their performance	4.0227	1.06109
TPK	I can choose technologies that enhance the teaching methods for a lesson.	4.0455	0.98154
	I can choose technologies that enhance students' learning for a lesson.	4.0000	0.98261

	I am thinking critically about how to use technology in my lecture room.	4.0000	0.93465
	I can adapt the use of the technologies that I am learning about to different teaching activities	3.9545	0.98154
TPACK	I can teach lessons that appropriately combine the course I teach, technologies, and teaching methods	3.9545	0.8829
	I can select technologies and teaching methods to use in my lecture room that enhance what I teach, how I teach	3.8636	0.94907
	I can use strategies that combine content, technologies, and teaching methods	3.9318	0.91971
	I can choose technologies that simplifies content for a lesson.	3.9545	0.93353

Table 2 Descriptive Statistics

TPACK Construct	Mean	Std dev
Technology Knowledge (TK)	4.1932	0.87825
Content Knowledge (CK)	4.3545	0.66832
Pedagogy Knowledge (PK)	4.5076	0.58717
Pedagogical Content Knowledge (PCK)	4.4318	0.57881
Technological Pedagogical Knowledge (TPK)	3.9773	0.99654
Technological Content Knowledge (TCK)	4.0000	0.79690
Technological Pedagogical Content Knowledge (TPACK)	3.9261	0.81927

Table 3 Summary Descriptive Statistic

The result showed that the opinions of respondents about the constructs: TK (mean = 4.1932 and standard deviation = 0.87825), CK (mean = 4.3545 and standard deviation = 0.66832), PK (mean = 4.5076 and standard deviation 0.58717), PCK (mean 4.3545 and standard deviation 0.66832) have strong opinion and the remaining TPK (mean = 3.9773 and standard deviation = 0.99654), TCK (mean = 4.0000 and standard deviation = 0.79690), TPACK (mean = 3.9261 and standard deviation = 0.81927) had neutral opinions.

4.4 Correlational Analysis

The correlational significant of the seven constructs was developed at $p < 0.01$ level, the result was used to develop a structural equation model.

Objectives	*Correlation*	*Correlational coefficient*	*significance*
To establish the individual effect of Technology, Pedagogy, and Content knowledge on overall ICT integration on teachers' perceived TPACK	TK → TPACK	.664**	.000
	PK → TPACK	.489**	.000
	CK → TPACK	.405**	.000
To determine the individual impact of Technology, Pedagogy, and Content knowledge on paired Technology and Pedagogy, Technology and Content, Pedagogy and Content knowledge on teachers' perceived TPACK model.	TK → TPK	.719**	.000
	PK → TPK	.527**	.000
	TK → TCK	.708**	.000
	CK → TCK	.522**	.000
	PK → PCK	.566**	.000
	CK → PCK	.918**	.000
To Evaluate the general impact of paired Technology and Pedagogy, Technology and Content, Pedagogy and Content knowledge on overall ICT integration on teachers' perceived TPACK	TCK → TPACK	.756**	.000
	TPK → TPACK	.821**	.000
	PCK → TPACK	.371**	.000

Table 4 correlation coefficient of Structural model

	TK	PK	CK	PCK	TCK	TPK	TPACK
TK	-						
PK	.515	-					
CK	.444	.614	-				
PCK	.467	.566	.918	-			
TCK	.708	.507	.522	.473	-		
TPK	.719	.527	.516	.449	.813	-	
TPACK	.664	.489	.405	.371	.756	.821	-

**. Correlation was significant at the 0.01 level (2-tailed).

Table 5 Pearson correlation coefficient

Pearson correlation coefficient (r) was used to determine the relation between the seven constructs (Cohen, Cohen et al. 2013), the findings showed that there was strong relationship between most construct, was statistically significant. TK&TPK (r = .719, p = .000), TK&TCK (r = .708, p = .000), CK&PCK (r = .918, p = .000), TCK&TPACK (r = .756, p = .000) and TPK&TPACK (r = .821, p = .000). While TK&TPACK (r = .664, p = .000), PK&TPK (r = .527, p = .000), CK&TCK (r = .522, p = .000), PK&PCK (r = .566, p = .000), PK&TPACK (r = .489, p = .000), CK&TPACK (r = .405, p = .000) and PCK&TPACK (r = .371, p = .000) had moderate relationship between them because they were between .30 and .70(Fraenkel, Wallen et al. 1993).

The first objective was fully supported because TK, PK and CK had significant effect on the overall teachers perceived TPACK of The University of The Gambia. The second objective was fully supported given the significant correlation between TK & PCK, PK & PCK, TK & TCK, CK & TCK, TK & TPK and PK & TPK. The last objective was fully supported because the paired TCK, TPK and PCK had significant impact on the overall teachers perceived TPACK of the university of The Gambia.

4.5 Structural equation Model

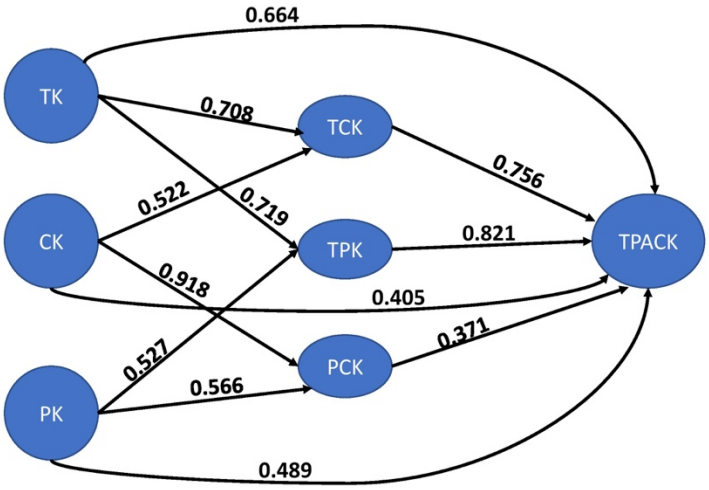


Figure 6 Structural equation model of the TPACK framework

The result showed that both the individual and paired constructs (TK, CK, PK, TCK, TPK and PCK) had a clear relationship to TPACK. The relationship between CK & PCK had the highest correlational coefficient (r) of both the individual and paired constructs. It's impact on TPACK was therefore considered to be the largest. Whereas the relationship between PCK and TPACK had the lowest correlational coefficient (r).

Chapter 5 Discussion and Conclusion

5.1 Discussion of finding

This study used both exploratory and correlation analysis to investigate the perception of TPACK in the integration of ICT into their teaching methods among 88 teaching staff at the University of The Gambia.

5.1.1 Analysis of individual TPACK construct

The results of this study (table 3) showed that respondents believed that technology knowledge was a significant predictor of ICT integration. These respondents believed that the use of teaching tools (such as printers, projectors), teaching software (such as Microsoft Package), the use of smart devices and technologies in teaching, and the necessary technical skills can improve the integration of ICT in teaching and learning. This result was consistent with previous studies (Koehler, Mishra et al. 2013) suggesting that understanding information technology and applying it productively, which showed that understanding and effective application of information technology, recognizing when information technology can assist or hinder the realization of goals, and constantly adapt to changes in information and communication technology.

Secondly, the findings of this study Table 3 showed that 60% of respondents believe that pedagogical knowledge was a positive predictor of ICT integration. The respondents believed that it was necessary for ICT integration to evaluate student performance; adjust to the teaching styles of different learners; evaluate student learning in different forms; used multiple teaching methods in the classroom; and know how to organize and sustain the classroom. This finding was consistent with earlier research (Lim and Chai 2008, Chai, Koh et al. 2010), highlighting the needed to foster teachers' PK in order to contribute to the pedagogies for facilitating effective learning.

Thirdly, the results of this current study showed that CK had a positive relationship with ICT integration. The respondents found out that knowing the courses properly, viewing the course using different techniques and strategies to broaden the knowledge of the courses will enhance effective learning and teaching. This result was consistent with previous studies (Shulman 1986, Koehler and Mishra 2009) describing content knowledge to include concepts, theories, ideas, conceptual frameworks, scientific knowledge, and established practices and approaches geared towards developing knowledge.

To determine the effect of the individual TK, PK and CK constructs and their effect on TPACK, a bivariate correlation was performed. The results between TK and TPACK, PK and TPACK and CK and TPACK indicated by bivariate shown in (table 4). The overall impact of individual constructed on TPACK was restrained. This means that the absence of an individual constructs the other construct do not affect the overall TPACK. for example, if the teacher had technical skills, then that ability can only be translated into the overall TPACK this also applied to both PK and CK they didn't have an influence on TPACK. In essence when using TPACK model experiences and skills were shared among its individual constructed. This was in line with earlier studies in (Koh, Chai et al. 2013) which reported that teachers perceived TK to have direct positive influence on TPACK, while they believed CK had a positive relationship with TPACK. Whereas, the studies of (Koh, Chai et al. 2013) showed no significant impact. This current study scored a slightly positive relationship. This implied that teachers perceived that individual constructs had an impact on the overall TPACK in the University of The Gambia.

5.1.2 Analysis of paired TPACK constructs

In this study, teachers believed that there was a significant correlation between PCK and ICT integration. They agreed that effective teaching techniques and strategies should be used to direct the teaching process, and that different teaching techniques had different effects on learning. This finding concurs with earlier studied (Koehler and Mishra 2009, Schmidt, Baran et al. 2009) which found that pedagogical content knowledge integrated content and pedagogy to develop better teaching practices.

Second, the survey results showed that teachers perceived that there was a significant relationship between TPK and ICT integration. The use of specific technologies may enhance the teaching method and students' learning, set up the use of technology in a lecture room and teach about in different teaching activities. This result confirms previous research (Koehler and Mishra 2009, Schmidt, Baran et al. 2009), which implied that the simultaneous integration of technology and pedagogy can improve teachers' expertise.

Third, the results of this study showed that TCK was significantly related to ICT integration. They think that technology expertise can be used to simplify and enhance the curriculum; reflect concepts that are otherwise difficult to understand; and record student and performance data. This result was consistent with earlier studies (Niess 2005, Koehler and Mishra 2009, Schmidt, Baran

et al. 2009) which suggested that teachers should know where and how to use specific technologies to enhance the teaching of specific subjects.

A bivariate correlation analysis was conducted to assess the impact of the paired TCK, PCK and TPK constructs and their overall TPACK. Bivariate had shown in Table 4 display the results between paired constructs and their overall TPACK: TCK and TPACK, PCK and TPACK and TPK and TPACK. TPK was considered to have a greater effect on TPACK than PCK and TCK. similar result was presented by (Koh, Chai et al. 2013) in the study which investigated the effect of TPACK pre-service teachers. This was consistent with the basic principle of TPACK which asserts that by simultaneously combining teaching, pedagogy, content and knowledge presents a better effect on the TPACK. This further explained the reason why an individual construct had a retained impact on the TPACK, whereas, the paired constructs provide stronger correlation and indicate a substantial impact on the perception of teachers on TPACK at the University of The Gambia.

5.2 Implication

The study used the TPACK framework as a tool to support teachers' knowledge and skills of that can be used to integrate ICT effectively into its teaching methods. ICT learning plans should follow methods to help teachers gain knowledge of both technology and its pedagogical used, which was particularly important when introducing teachers to new ICT tools. An example was found in (Koh and Divaharan 2011). Technology Knowledge was first taught through educator presentation of the ICT tool, teacher self-paced discovery of the ICT tool, and the sharing of technical features with peers while teaching about an ICT tool that was new and unknown. By criticizing subject-based examples regarding the integration of the method, which was aimed at improving their TCK and TPK, it gave teachers the basic information needed to understand their pedagogical uses. Through the design of lesson units that incorporated the instrument, TPACK was then formed, which was similar to the perceptions held by (Koehler, Mishra et al. 2011). The study resulted indicate that TPK, PCK and TCK had greater effects than TK, CK and PK on the TPACK of teachers'. Therefore, TK preparation should be pitched at a level appropriate during teacher development to promote comprehension of the ICT instrument and its affordances, while more focus should be put on strategies that improve the pedagogical reasoning of teachers with the ICT tool.

5.3 Limitation

The limitations of this research created room for more research in this field using TPACK framework. The framework showed how technology can be integrated into teaching and learning based on the content areas and how to convey the content area to learner (Davis and Thompson 2005, Schmidt, Baran et al. 2009, Voogt, Fisser et al. 2013). The findings also need to be confirmed by a broad study regarding the population targeted for this study. The study was also conducted among 88 teaching staff at one university (i.e. University of The Gambia), which might not be an enough sample size to get a confirmatory validation of this area of study in The Gambia. Future research can replicate this study in different university, colleges and schools.

5.4 Conclusion

This research uses the TPACK framework to investigate teachers' perceptions of ICT integration into their teaching methods. The conclusion of this study was that although there was a positive correlation between TPACK and its various components, this relationship was restrained. While the relationship between TPACK and its paired components showed a strong relationship, the relationship between the paired and individual components was mixed showing a stronger relationship among the ICT related components. The association between the individual and paired components of TPACK was more restrained. This showed the importance of integrating ICT into TPACK, because ICT glues pedagogy and content with knowledge. ICT can create and store the content while ICT components (such as PPT, Projectors, web location) can be used with the pedagogy to impart knowledge to students in a pedagogically accepted way. In future, this study can be expanded to explore the relationship of TPACK and gender, the integration of ICT in specialized disciplines and its relationship to experience. Further, another avenue for research would be exploring students' perception of TPACK especially in communities where ICT knowledge is low or average.

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Appendix: The TPACK ITEMS MODIFIED FROM (Chen and Jang (2014)) Survey Questionnaire

Dear Sir/ Madam,

I am a Masters' Student at Islamic University of Technology (IUT), Department of Technical and Vocational Education Specializing in Computer Science and Engineering conducting a research study in the area of Technological, Pedagogical, and Content Knowledge titled "teachers" perceptions on ICT integration into their teaching methods". Please note that your honest response will have a significant impact on this research project and will be highly appreciated.

Technology knowledge (TK)

- I can connect teaching tools e.g. Projectors, Printers without support
- I can learn MS word, MS PowerPoint and other related teaching software with ease.
- I follow the technology trends especially that which involves teaching
- I use smart devices very well to assist me in teaching
- I can use a number of technologies needed in teaching
- I have sufficient technical skills to use technology in teaching

Content knowledge (CK)

- I have sufficient knowledge about the courses I teach
- I can use my course way of thinking
- I have various ways and strategies of developing my understanding of the courses that I teach

Pedagogical knowledge (PK)

- I know how to assess student performance in my courses
- I can adapt my teaching style to different learners
- I can assess student learning in multiple ways.
- I can use a wide range of teaching methods in a lecture room setting
- I know how to organize and maintain classroom management

Pedagogical content knowledge (PCK)

- I can select effective teaching methods to guide student thinking and learning in my courses

- Teaching tactics may be used to guide students learning capability in teaching- learning process *
- Different teaching methods have different impact of learning in terms of classroom situation *

Technological content knowledge (TCK)

- I know about technologies that I can use to simplify and elaborate the courses that I teach
- I know about technologies that allow me to represent concepts that would otherwise be difficult to understand
- I know about technologies that allow me to record data about my student and their performance

Technological pedagogical knowledge (TPK)

- I can choose technologies that enhance the teaching methods for a lesson.
- I can choose technologies that enhance students' learning for a lesson.
- I am thinking critically about how to use technology in my lecture room.
- I can adapt the use of the technologies that I am learning about to different teaching activities

Technological pedagogical content knowledge (TPACK)

- I can teach lessons that appropriately combine the course I teach, technologies, and teaching methods
- I can select technologies and teaching methods to use in my lecture room that enhance what I teach, how I teach
- I can use strategies that combine content, technologies, and teaching methods
- I can choose technologies that simplifies content for a lesson.

* Deleted due to low factor loadings