A STUDY OF TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK) COMPONENTS AND TECHNOLOGY INTEGRATION SELF EFFICACY (TISE) AMONG PRIMARY MATHEMATICS TEACHERS AND THE RELATIONSHIP BETWEEN THEM

DESSY NOOR ARIANI

THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF EDUCATION
(MASTER BY MIXED MODE)

FACULTY OF EDUCATION AND HUMAN DEVELOPMENT
SULTAN IDRIS EDUCATION UNIVERSITY
2015

ABSTRACT

The main purpose of this study is to identify the relationships among different components of technological pedagogical content knowledge (TPACK) and technology integration self efficacy (TISE) among mathematics teachers in primary schools**.** A descriptive quantitative research design was implemented in this study to achieve this purpose. The instruments used in this study are TPACK survey instrument (Pamuk et al., 2013) to measure teacher's technological pedagogical content knowledge and Computer Technology Integration Survey (CTIS (Wang et al., 2004) to measure participants' technology integration self efficacy in teaching.The participants for this study comprised of 173 mathematics teachers from 24 primary schools of five areas in Banjarmasin. The results of this study were analyzed using descriptive analysis and inferential statistics. The descriptive analysis involved the mean, percentage, frequency, and standard deviation. The finding from the descriptive analysis was that the majority of the respondents had moderate level of technology knowledge (*M* =3.4241, *SD* = .65369); content knowledge (*M* =3.9016, *SD* = .47232); pedagogical knowledge, (*M* =3.9937, *SD* = .41847); pedagogical content knowledge (*M* =3.7835, *SD* = .43183); technological pedagogical knowledge (*M* =3.9351, *SD* = .53921); technological content knowledge (*M* =3.9385, *SD* = .47165); technological pedagogical content knowledge (*M* = 3.9167 *SD*=.43293); and technology integration self efficacy (*M* =3.8085, *SD* = .44973). The inferential statistics of this study involved the normality data, structural model and hypothesis. The normality data test result shows that C.R multivariate is 1.852 <c.r<2.58. The structural model test results show that the value of chi square is 4.843;P-value is 0.184; CMIN/DF is 1.614; RMSEA is 0.063; GFI is 0.993; AGFI is 0.911; TLI is 0.989; and CFI is 0.999. Structural equation modeling (SEM) was used to test all hypotheses. The finding of hyphothesis test shows that there are significant relationships between TPACK and TISE; significant relationships between technological knowledge and TISE; significant relationships between technological content knowledge and TISE; and no significant relationships between technological pedagogical knowledge and TISE among mathematics teachers. The findings also show that technological knowledge, pedagogical knowledge, content knowledge, pedagogical content knowledge, technological content knowledge and technogical pedagogical knowledge have positive correlations toward technological pedagogical content knowledge. The implication of this study is to increase primary schools mathematics teachers' ability of technological pedagogical content knowledge and their self-efficacy technology integration.

KAJIAN TENTANG KOMPONEN PENGETAHUAN KANDUNGAN PEDAGOGI TEKNOLOGI (TPACK) DAN INTEGRASI TEKNOLOGI KEBERKESANAN DIRI (TISE) DALAM KALANGAN GURU MATEMATIK DI SEKOLAH RENDAH DAN HUBUNGAN ANTARA MEREKA

ABSTRAK

Tujuan utama kajian ini adalah untuk mengenal pasti hubungan antara komponen pengetahuan kandungan pedagogi teknologi (TPACK) dan integrasi teknologi keberkesanan diri (TISE) dalam kalangan guru matematik di sekolah rendah. Satu reka bentuk penyelidikan kuantitatif deskriptif telah digunakan dalam kajian ini untuk mencapai tujuan ini. Instrumen yang digunakan dalam kajian ini ialah TPACK survey (Pamuk et al., 2013) untuk mengukur pengetahuan kandungan pedagogi teknologi dan instrument Computer Technology Integration Survey (CTIS) (Wang et al., 2004) untuk mengukur integrasi teknologi keberkesanan diri (TISE) peserta dalam pengajaran pembelajaran. Peserta kajian terdiri daripada 173 orang guru dari 24 buah sekolah rendah dari lima kawasan di Banjarmasin. Analisis deskriptif melibatkan min, peratusan, kekerapan, dan sisihan piawai. Keputusan kajian ini menggunakan analisis deskriptif dan statistik inferensi. Dapatan analisis deskriptif bahawa majoriti daripada responden melaporkan tahap sederhana pada pengetahuan teknologi (M = 3.4241, SD = 0.65369); pengetahuan kandungan (M = 3.9016, SD = 0.47232); pengetahuan pedagogi, (M = 3.9937, SD = 0.41847); pengetahuan kandungan pedagogi (M = 3.7835, SD = 0.43183); teknologi pengetahuan pedagogi (M = 3.9351, SD = 0.53921); pengetahuan kandungan teknologi (M = 3.9385, SD = 0.47165); teknologi pengetahuan kandungan pedagogi (M = 3.9167 SD = 0.43293); dan integrasi teknologi keberkesanan diri integrasi (*M* =3.8085, *SD* = .44973). Statistik inferensi kajian ini melibatkan data normal, model struktur dan hipotesis. Keputusan ujian data normal menunjukkan bahawa CR multivariate adalah 1.852 <cr<2.58. Keputusan ujian model struktur menunjukkan bahawa nilai khi kuasa dua adalah 4,843; P-nilai adalah 0.184; CMIN / DF adalah 1.614; RMSEA ialah 0.063; GFI adalah 0.993; AGFI adalah 0.911; TLI adalah 0.989; dan CFI adalah 0.999. Struktur pemodelan persamaan (SEM) digunakan untuk menguji semua hipotesis. Dapatan ujian hipotesis menunjukkan terdapat hubungan yang signifikan antara TPACK dan TISE; pengetahuan teknologi dan TISE; pengetahuan kandungan dan teknologi TISE; dan tidak ada hubungan yang signifikan antara pengetahuan teknologi pedagogi dan TISE kalangan guru matematik. Dapatan kajian juga menunjukkan bahawa pengetahuan teknologi, pengetahuan pedagogi, pengetahuan kandungan, pengetahuan kandungan pedagogi, pengetahuan kandungan teknologi dan pengetahuan pedagogi teknogikal mempunyai korelasi positif terhadap teknologi pengetahuan kandungan pedagogi. Implikasi kajian ini adalah untuk meningkatkan keupayaan matematik guru sekolah rendah tentang pengetahuan kandungan pedagogi dan integrasi teknologi keberkesanan diri mereka.

TABLE OF CONTENTS

LIST OF TABLES

Table **Page**

LIST OF FIGURE

Figure **Page**

LIST OF ABBREVIATION

AMOS	Analisis of Moment Structures
c.r	critical ratio
CK	Content Knowledge
N	Population size
N	Sample size
p	Probability
PCK	Pedagogical Content Knowledge
PK	Pedagogical Knowledge
SD	Standard deviation
SEM	Structural Equation Modeling
Sig.	Significant
SPSS	Statistical Package for Social Science
TCK	Technological Content Knowledge
TISE	Technology Integration Self Efficacy
TK	Technological Knowledge
TPACK	Technological Pedagogical Content Knowledge
TPK	Technological Pedagogical Knowledge

LIST OF SYMBOLS

%	Percentage
$<$	Less than
$>$	More than
$\leq$	Equal less than
α	Cronbach's index of internal consistency
μ	Mean
σ	Standard Deviation

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter deals with the background of study, statement of problems, research objectives, research questions, significance of study, limitations of study, terms of definition, conceptual framework, and hypotheses. The summary of this chapter is presented at the end of each chapter.

1.2 Background of Study

The primary school years are the time when pupils learn to like or dislike mathematics, where feeling of despondency and failure first surface and where misconceptions of mathematics are often formed. The learning of mathematics is a complicated and dynamic process linking to the interaction between previously acquired levels of understanding to the conceptualization and incorporating of new materials. Most modern views of mathematics education acknowledge that children do not simply take in mathematical knowledge that is transmitted to them, no matter how well it is organized and structured (Bobis, 2004).

Children frequently construct and develop their own ways of doing mathematics – often in a manner quite different from the way it was introduced or intended to be processed (Bobis, 2004). In the mathematics learning process, it should have mathematical power in students, such as attitudes or mindsets which expected to get after the learning of mathematics. The attitudes are content, problem solving, reasoning and proof, communication, connection and representation (NCTM, 2000).

In the past, mathematics had been thought of in terms of content only – a body of facts and procedures that needed to be memorized. It is now more aptly described as a way of thinking, and the learning of it is characterized not only by its products but also by a growth in understanding of mathematical concepts and processes. The development of such concepts and processes is based on finding mathematical patterns and relationships. The effective use of the patterns and relationships provides opportunities for students to choose and apply mathematical understandings to a range of problem solving situations. Because mathematical thinking is concerned primarily with the processes, such as investigating and conjecturing, it is inherently linked to problem solving – a process in itself (Bobis, 2004).

Although mathematics is an important subject but many of the students cannot solve the problems of mathematics well. Several reasons why this happened are matters related to teachers, students, the availability of facilities, teaching methods and the other factors that influence student in mathematics learning (Budiman, 2011; Shadiq&Ini 2004; Nur, 2001). Some of teachers teach mathematics in the way they were used to be and they are stuck in old way. As a result, effective teaching cannot be entirely content-driven, student-centered and or teacher-centered.

The mathematics teachers that havegreat knowledge ofthe subjectmatter is not enough to teach mathematics well (Idris, 2006). New concepts and understandings of mathematics need to be linked to a student's existing knowledge base and personal experiences. Students need to be involved in the learning process, actively engaged in thinking and encouraged them to verbalize their though processes and reflect upon their problem solving endeavors. Therefore, the role of the mathematics primary school teachers is thus particularly important. Mathematics teacher have to know how to explain the subject matter and other factors that may be involved in teaching such as;the teachers' understanding of curriculum, course design and syllabus, understanding of student backgrounds and the PCK (Pedagogical Contents Knowledge) that enable him/her to relate and use proper pedagogical approach to the contents and the learners. On other hand, mathematics teachers should be sensitive tomaking the study of mathematics to be creative, less stressful and the learning is meaningful. Moreover, the nature of the primary classroom allows the teachers to make important links between mathematics and the other subjects' areas. To accomplish this, teachers should use better information and communication technologies to follow developments in their content areas, to use and adjust contemporary approaches, methods, techniques and proceduresthat suit the contents and the learners.

Information Communication Technology (ICT) has been developed rapidly and has been used in all areas of knowledge, including in the field of education. Realizing the importance of information technology in education, mathematic teachers should utilize the technology to assist the learners achieve their goals and to ease them in understanding and using the concepts of mathematics.ICT has been proven to be a means that develop individual intellectual skill in mathematics which is a prerequisite to not only the prosperity of each individual in this information explosion but also in shaping education policy in a country as a whole. Oldknow & Taylor (2000) noted there are at least three reasons for promoting the integration of ICT in education: i) public policy; ii) desirability and; iii) inevitability.

ICT in an educational teaching and learning tool that can be used to develop better strategies for teachers and learners in acquiring the knowledge of mathematics. ICT, once it is well-planned, can be effective instructional means to be used by students for deeper understanding of the subject matter and for teachers in facilitating learning among the students. Educational technology such as television, video and computer multimedia provide information that can be authentic and challenging as well in addition to stimulating student's sensorial apparatus through color, movement, images and sound (Pandey, 2005).

The effective use of educational technology requires that teachers have both the necessary technology skills and a certain comfort level to make full use of what technology has to offer. Fitzallen (2005) puts great emphasis on the recognition of a need for teachers to gain an understanding of how Information and Communication Technology (ICT) can be used to extend students' thinking and problem-solving skills, rather than being just a publication and research tool. Roblyer, M. D &Doering, A. H. (2006) examined that using technology in education not only motivates students by tapping into their comfort zone, but also enhancinginstructional methods, increasing productivity and allowing students to gain required information. There are four objectives that can be enhanced by ICT in education: i) expanding access to all levels of education; ii) improving the quality of education; iii) enhancing lifelong learning; and iv) facilitating nonformal education (Pandey, 2005). Therefore, one of the major challenges that many schools are facing is preparing students with essential skills necessary for success in a rapidly changing, technology-driven society (Schoen & Fusarelll, 2008).

In mathematics education, ICT have played important role in enhancing the learning of mathematics.National Council of Teacher of Mathematics (NCTM) (2000) described six principles that address crucial issues that are fundamental to mathematics program at schools: i) equity; ii) curriculum; iii) teaching; iv) learning; v) assessment; and vi) technology. Within technological principle, NCTM stresses that technology is essential in teaching and learning mathematics and it influences that mathematics that is taught and enhances students' learning (NCTM, 2000). In the mathematics classroom envisioned in the Principle and Standards, every student should have access to technology to facilitate his or her mathematics learning under the guidance of a skillful teacher (NCTM, 2000).

Many of research results from mathematics education illustrate that the integrating of ICT may change the environment of teaching and learning mathematics (Chandra & Briskey, 2012; Tay, Lim, Lim, & Koh, 2012). ICT seems to provide a focal point that encourages interaction between learners and the technology itself. This implies that ICT used in instruction will support constructivist pedagogy, where learners use technology to explore and reach an understanding of mathematical concepts (Sang, Valcke, Braak, Tondeur, & Zhu, 2011; Crisan, 2004). British Educational Communications and Technology Agency (BECTA)(2003) describe that the benefits of ICT that are used in mathematics learning will increase motivation amongst pupils, fast and accurate feedback to pupils using ICT and greater collaboration between pupils. Thus, ICT can make students more active and not solely dependent to their teacher so they can study independently. Furthermore, for ICT to be used effectively in everyday teaching, radical changes are advocated in approaches to the teaching of mathematics. For this reason, it is important to promote research and practice that are able to provide teachers the opportunities to adequately utilize and integrate the technology into mathematics classrooms.

ICT challenges current descriptions and practices of pedagogy in terms of the perceptions of time, place, authority and the purpose of teaching. Information and communications technology can expand the opportunities to extend the connections between learners, teachers and information beyond the formal school day and the agreed