INSTRUCTORS' PATTERNS OF ICT USE AND THE ASSOCIATED FACTORS AT A PUBLIC UNIVERSITY IN ETHIOPIA

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This is to certify that the thesis prepared by Genene Abebe entitled: Instructors' patterns of ICT use and the associated factors at a public University in Ethiopia

and submitted in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Curriculum Design and Development** complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

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Dedication

I dedicate this study to my beloved family who gave me strong support and encouragement while I was engaged in this endeavor. My dear family, words can never express the gratitude I have for each of you. Without your love, encouragement and support, I would not have had the inspiration to complete this project. My beloved children, I did this to motivate you for something better, for I know that you would do much better than me.

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Acronyms and Abbreviations

AAICT	-Availability of and Access to ICT
AICTE	-Attitude towards ICT use in Education
alwaysICT	-course always requires use of ICT
CICT	-Competence in ICT use
CN	-Course Nature
completelygrad	-teaches completely at graduate level
completelyunder	-teaches completely at undergraduate level
EICT	-Experience in ICT use
equallyunder	-teaches equally at graduate and undergraduate level
GAICT	-General Attitude towards ICT use
HESC	- Higher Education Strategy Center
ICT	-Information Communication Technology
ICTDDO	- ICT Development Director Office
ICTU	-Pattern of ICT use
JU	-Jimma University
MoE	-Ministry of Education
mostlygrad	-teaches mostly at graduate level
mostlyunder	-teaches mostly at undergraduate level
noICT	-course does not require use of ICT
PB	-Pedagogical Belief
PIICT	-Personal Innovativeness in the domain of ICT
rarelyICT	-course rarely requires use of ICT
RS	-Instructor-Perceived Readiness of Student to use ICT in their learning
sometimesICT	-course sometimes requires use of ICT
TAM	-Technology acceptance model
TE	-Teaching Experience
TL	-Teaching Level
TPB	-Theory of Planned Action
TRA	-Theory of Reasoned Action
usuallyICT	-course usually requires use of ICT

Abstract

The purpose of this study was to explore instructors' patterns of ICT use in the teaching-learning process and to examine what factors influence such patterns of ICT use. The study was conducted at one public higher education institution in Ethiopia. The study site was selected based on its relatively earlier adoption of ICT in the teaching-learning process. The theoretical framework that was used in this study was a composite of three theories: Rogers' diffusion of innovations theory, the model of teacher thought and action by Clark and Peterson, and the theory of reasoned action. Empirical evidences from previous studies were also used to guide this study. Exploratory research question, mixed methods research question, and confirmatory research question, which require the application of a mixed methods research approach, were addressed in this study. Semi-structured interview and observation were used to collect qualitative data. The Academic Vice President, Representative of the ICT Directorate Office and 14 instructors participated were interviewed. Questionnaire was used to collect quantitative data. It was distributed to 300 randomly selected instructors. Out of these, responses from 230 instructors were used for analysis. Thematic analysis was used to analyze the qualitative data. Descriptive and multiple regression analyses were used to analyze the quantitative data. Five categories of instructors' patterns of ICT use in the teaching-learning process emerged from this study: ICT as a course preparation tool, ICT as a presentation tool, ICT as an information-exchange tool, ICT as a collaboration tool, and ICT as a cognitive tool. The study also identified variables that influence instructors' patterns of ICT use in the teaching-learning process. Six variables were found to have significant contribution to explain variance in instructors' patterns of ICT use. These variables included instructors' competence in ICT use, instructors' age, instructors' personal innovativeness in the domain of ICT, instructors' pedagogical belief, instructor-perceived nature of course, and instructor-perceived readiness of students to use ICT in their learning. Two major conclusions were drawn from this study: (1) Instructors' patterns of ICT use in the teaching-learning process fall in a continuum between use of ICT as a course preparation tool and use of ICT as a cognitive tool; (2) Instructors' patterns of ICT use can be predicted by their age, competence in ICT use, pedagogical belief, level of innovativeness in the domain of ICT, perception about nature of the course they teach in relation to ICT use, and perception about readiness of students to use ICT in their learning. This study has made three major contributions. One of the contributions of the study is the development of a model that helps to illustrate instructors' patterns of ICT use in the teaching-learning process. The second is the development of a regression model that can be used for predicting instructor's patterns of ICT use. The third contribution is the development of a model that explains variance in instructors' patterns of ICT use.

Key words: *ICT, Pattern of ICT use, ICT as a cognitive tool, personal innovativeness in the domain of ICT, Pedagogical belief.*

CHAPTER ONE

INTRODUCTION

1.1. Background to the Study

The intent of this study was to explore instructors' patterns of ICT use in the teaching-learning process and to examine what factors influence such patterns of ICT use. The study was conducted at one public higher education institution in Ethiopia. Higher education institutions around the world are increasingly integrating ICT in the teaching-learning process with the conviction that it helps to improve the quality of education (Usluel, As_kar & Bas, 2008, Kumpulainen, 2007).

Unwin (2007) noted that higher education instructors generally work in an ICT rich environment. The reason for this, as depicted by Unwin (2007), is the expectation that integrating ICT in the teaching-learning process is beneficial for instructors, their students, and the overall learning environment. In their research, Wong, Li, Choi, and Lee (2008) found out that ICT has made a positive impact on changing the modes of teaching and learning in classroom practices from a teacher-centered approach to one that is student-centered.

Other research findings (Combs, 2000 & Taylor, 2000) also showed that ICT motivates teachers and students in the teaching-learning process. Similarly, some other research findings indicated that ICT has the capacity to afford opportunities for powerful teaching and learning environment (Hermans, Tondeur, van Braak, & Valcke, 2008) and can impact students' learning, motivation, critical thinking, and autonomy ((Lim, Teo, Wong, Khine, Chai, & Divaharan, 2003; Claudia, Steil, & Todesco, 2004; Cancannon, Flynn, & Campbell, 2005; Mahdizadeh, Biemans, & Mulder, 2008).

The conviction that ICT can play an important role in enhancing quality of education has led to a widespread intention of using ICT to advance educational goals (Cheng & Townsend, 2000). As a result, the integration of ICT in the curricula has become in the forefront of education reforms globally (Wong et al, 2008). To this end, these ICT-supported learning environments have come into the Ethiopian higher education system, particularly the public

universities in the country. The Ministry of education of the Federal Democratic Republic of Ethiopia is providing huge fund to public universities to expand their ICT infrastructure and to establish SMART classrooms (Technology Enhanced Classrooms) with the belief that ICT can help to improve the quality of education in these universities (MoE, 2012).

In addition to such general benefit of ICT in education, there is a curricular requirement for the use of ICT in education (Granger, Morbey, Lotherington, Owston, & Wideman, 2002). Concomitantly, the Ethiopian public universities have changed their old structure of content-based curriculum to give way to a new competency-based curriculum, which requires a shift from traditional teaching approach to constructivist learning approach (HESC's guideline for modularization, 2012). According to Oliver (2002), contemporary ICTs are able to provide strong support for this requirement of a competence-based curriculum. Other studies also contend that ICT has the potential to successfully facilitate constructivist-oriented teaching and student learning (Jonassen, 2000; Kim & Reeves, 2007). Therefore, one may expect that ICT can also enhance the implementation of competence-based curricula.

However, studies show that there is a huge gap between the promises of ICT in education and its real impact in education. Teachers have not fully utilized the potential benefits of ICT (Lee, 2006). Salinas (2006) questioned the underutilization of technology in higher education classrooms and maintained that acceptance of this technology is not shared evenly among instructors (Warwick, Mercer, Kershner, & Staarman, 2010). Spodark (2003) also noted that even after funds have been poured into computer labs, SMART classrooms, and technical support, some institutions find these resources underutilized. Other studies in Africa and Asia also confirm the underutilization of ICT in educational institutions (Chitiyo, 2006; Tinio, 2002). A survey conducted by Bass (2011) shows that ICT in Ethiopian higher education institutions are underutilized and that learning outcomes are not significantly enhanced by ICT use. The underutilization of such expensive resources is obviously a concern for both governments and researchers.

The underutilization of ICT can be seen in two ways: first, in terms of the amount of time ICT is actually used in the teaching-learning process and second, in terms of how it is used. Tondeur, van Keer, van Braak, and Valcke (2008) noted that computer use has been measured

by many researchers by reporting the time teachers and pupils spend using computers or the amount of technology used in the classroom (e.g., O'Dwyer, Russell, & Bebell, 2004; Mathews & Guarino, 2000). However, the central argument here is that mere presence of ICT tools and infrastructure in educational institutions does not positively influence students' learning. Fulton, Glenn, and Valdez (2004) point out that technology can provide powerful tools for student learning, but their value depends upon how effectively teachers integrate them in the teaching-learning process to support instruction. Amy, Baylor, and Ritchie (2002) argue that the way ICT is integrated in the teaching-learning process is a critical measure of its success. They state that it is becoming increasingly clear that ICT, in and of itself, does not directly change teaching or learning. Rather, the critical element is how it is incorporated into instruction.

Understanding *how teachers integrate ICT in the teaching-learning process* further inspires another question: *Why do teachers integrate ICT the way they are doing it*? This leads to the investigation of factors that influence instructors' patterns of ICT use in the teaching-learning process. Limited studies in the past have identified potential factors that may influence how teachers integrate ICT in the teaching-learning process (their patterns of ICT use). These studies have identified two types of factors that influence teachers' patterns of ICT use. These are teacher-related factors and external (contextual) factors (Ertmer, 1999).

External factors that were identified to have influence on instructors' pattern of ICT use include administrative support, technical support, access to technology such as Internet, bandwidth, technology-related training, and also availability of time for lesson preparation and teaching (Angeli & Valanides, 2005; Galanouli, Murphy, & Gardner, 2004; Demetriadis, Barbas, Molohides, Palaigeorgiou, Psillos, Vlahavas, Tsoukalas, & Pombortsis, 2003; Earle, 2002; Becker & Ravitz, 2001; Honey, 2001; Pelgrum, 2001; Dexter, Anderson, & Becker, 1999; Ertmer, 1999; Byrom, 1998; Sheingold & Hadley, 1990). According to Rogers (2000), external factors include the availability and accessibility of necessary hardware and software, presence of technical personnel, institutional support and staff development programs that include opportunities for skills acquisition and maintenance.

With respect to internal factors, some limited studies have produced an overview of teacher-related factors (Tondeur et al. 2008a; Mumtaz 2000; Ely 1999). Those identified teacher-related factors include teacher's ICT-related knowledge and skills or experience, teacher's attitude towards ICT, and teacher's pedagogical beliefs (Sang, Valcke, Braak, Tondeur, & Zhu, 2011; Afshari, Abu Bakar, Su Luan, Abu Samah, & Say Fooi, 2009). While a number of empirical studies revealed the impact of personal innovativeness (PI) on the use of ICT for different purposes other than education (Agarwal & Karahanna, 2000; Lewis, Agarwal, R., & Sambamurthy, 2003; Hung & Chang, 2005; Lassar, Manolis, C., & Lassar, 2005; Yi, Jackson, Park, & Probst, 2006; Thompson, Compeau, & Higgins, 2006; Lian & Lin, 2008), relatively few studies have been carried out regarding the potential effects of personal innovativeness on the use of ICT in education (van Braak, 2001).

1.2. Context of the study

This study was conducted as an attempt to expand the frontiers of knowledge gained through the efforts invested by other researchers in the area of ICT in education. It has been founded on previous studies in the area of ICT in education that focused on issues like uses of ICT in education, availability and uptake of ICT in education, and factors that hinder or enable the use of ICT in the teaching-learning process. The details of these previous studies are revisited in the literature review part of the current research. This study is thought to contribute to the understanding of how instructors use ICT in the teaching-learning process and what factors influence such patterns of ICT use.

1.3. Statement of the Problem

This study intended to explore instructors' patterns of ICT use and to examine factors that influence such patterns of ICT use in the teaching-learning process. Though the Association for African Universities called the universities in Africa to study their ICT status and levels of integrating technology into their curricula (Association of African Universities 2000), no adequate research has so far been conducted in Ethiopian public universities in relation to their statuses in ICT expansion and level of integrating it in the teaching-learning process (Amare, 2010). Obiri-Yeboah, Fosu, and Kyere-Djan (2013) contend that, with the exception of South African, Mauritian, and most of North African universities, other African universities are

seriously affected by lack of ICT infrastructure and deficiency of access to Internet hampering their ICT use in the teaching-learning process. However, very little is known about the status of ICT resources, access to these resources, and how these resources are being utilized in the context of Higher education institutions in Ethiopia in general and Jimma University in particular.

Studies show that the mere presence of ICT in any education system, be it in a school or university, does not bring the expected advancement in students' learning. Unwin (2007) noted that what is usually given less attention is the recognition that it is not the availability of ICT which is important, but *how* it is used. Mishra and Koehler (2006) also contended, "Part of the problem, we argue, has been a tendency to only look at the technology and not how it is used. Merely introducing technology to the educational process is not enough." (p. 3). Bransford, Brown, and Cocking (2000) argue that the positive impact of technology depends on *how* teachers use ICT in their classes.

Studies in the area also show that the way instructors use ICT, that is, their pattern of ICT use is not the same. Some instructors use ICT to reinforce traditional teaching methods (as conveyors of information) while others use ICT as a cognitive tool (a tool intended to engage students in knowledge construction) (Ertmer, 2005; Wang, 2002; Ertmer, Ross, & Gopalakrishnan, 2001; Jonassen, Carr, & Yueh, 1998; Jonassen, 1996). It is documented in the literature that the majority of instructors are not using ICT to involve students in constructivist learning activities (Barak, 2007; Judson, 2006; Hennessy, Harrison, & Wamakote, 2005). Even those instructors who identified themselves as constructivists were found to fail to exhibit this idea in their use of ICT in the teaching-learning process (Judson, 2006). Barak (2007) reported that although instructors perceived ICT learning environments to play a significant role in education, they resisted change and opted to retain old and familiar teaching methods.

These evidences show that there is inconsistency between the widely accepted promises of ICT to improve the teaching-learning process and the actual practices in educational institutions. Concerning the inconsistencies between the promises of ICT to improve the teaching-learning process and what is seen in the field, Ivan Webb (2007) in his PhD thesis

noted, “Many classrooms are adequately equipped with ICT, and many teachers have participated in substantial professional development activity around the use of ICT, yet the question remained largely unanswered” (P.1).

This makes it a serious concern for developing countries like Ethiopia that invest large amount of money on ICT with the expectation that it provides positive impact in education for development. Nevertheless, no adequate study was carried out to examine how the available ICT resources in public universities in Ethiopia have been utilized in the teaching-learning process.

The study of variables that influence instructors’ patterns of ICT use is believed to be important because it can lead to improved use of ICT to facilitate students’ learning. Increased understanding of the determinants can also assist instructors in overcoming the barriers to technology use in the teaching-learning process. Consequently, research studies on factors that are related to ICT use by teachers in different countries have started to appear (e.g. Inan & Lowther, 2010; Zamani, 2010; Hermans et al., 2008; Paraskeva, Bouta, & Papagianni, 2008; Kim, Jung, & Lee, 2008; Hew & Brush, 2007; Robinson, 2003; Baylor & Ritchie, 2002; Granger, Morbey, Lotherington, Owston, & Wideman, 2002).

However, studies about the influence of some variables on instructors’ patterns of ICT use show inconsistent results. For example, Tondeur, et al. (2008) conducted a research to study the correlation between teachers’ pedagogical belief and their ICT use in classroom. The results of their study indicate that the use of ICT is mediated by teachers’ beliefs about teaching and learning. According to their study, teachers with relatively stronger constructivist beliefs report a higher frequency of computer use. They found that there are significant differences between teachers with different pedagogical beliefs in their patterns of ICT use. On the other hand, Judson (2006) conducted a survey study and found in his study that although most teachers identified themselves with constructivist convictions, they failed to exhibit it in their classroom use of ICT.

According to Ertmer (2005), other researchers also described inconsistencies between teachers' beliefs and their classroom practices (Kane, Sandetto, & Heath, 2002; Ertmer, Gopalakrishnan, & Ross, 2001; Calderhead, 1996; Fang, 1996). A study conducted by Bate

and Maor (2008) revealed that instructors' ICT competences and stated pedagogical beliefs do not necessarily translate into classroom practices.

Moreover, a cross-cultural study was conducted by Straub, Keil, and Brenner (1997) to examine the validity of Davis' (1989) technology acceptance model (TAM) and the findings showed that the TAM had worked to predict ICT use for the participants from the US and Switzerland, but had not worked for the Japanese. Similarly, in another cross-cultural study, Pelgrum (2001) reported that there was a substantial variation between countries of the most significant barriers to ICT as perceived by teachers. These findings indicated that variables that predict ICT use in one country or culture may not predict ICT use in another culture. This makes it important to identify the specific contextual factors that affect instructors' patterns of ICT use on a specific culture. There is no empirical evidence about *how* instructors in Ethiopian public universities use ICT in the teaching-learning process and *why* they use ICT the way they use it.

In addition to what has been mentioned so far, other studies on the integration of ICT in education focus on factors that influence the use of ICT in education in general. Yet, studies on factors that influence how instructors use ICT in the teaching-learning process are rare (e.g., Becker, 2000; Pelgrum, 2001; Drent & Meelissen, 2007). While majority of the studies to date focused on whether or not teachers use technology in their teaching practices (Teo, Hung, & Lee, 2008), this study has focused on examining *how* instructors use ICT and what factors influence the way they use ICT in the teaching-learning process. Moreover, while there is a great deal of knowledge about how ICT is being adopted and used in higher education institutions in developed countries, there is no much information on how ICT is being adopted and used in similar institutions of developing countries like Ethiopia.

This study, therefore, attempted to fill the gap in the existing body of knowledge on how instructors use ICT in Ethiopian public universities and what factors influence their patterns of ICT use in the teaching-learning process, by incorporating new variables and by extending the research to a new culture, a new population, a new research setting, a university in a developing country, where no similar research has been conducted before.

1.4. Objectives of the Study

1.4.1. General objective

The major objective of this sequential exploratory study was to explore instructors' patterns of ICT use and to examine what factors influence such patterns of ICT use in the teaching-learning process.

1.4.2. Specific objectives

The specific objectives of the study were to:

i. establish categories for patterns of ICT use in the teaching-learning process
ii. develop a model that describes instructors' pattern of ICT use
iii. identify barriers and enabling factors that affect instructors' patterns of ICT use
iv. identify variables that have significant correlation with instructors' patterns of ICT use
v. identify predictor variables that make a significant contribution to explain variance in instructors' patterns of ICT use in the teaching-learning process
vi. build a model that best explains variation in instructors' patterns of ICT use
vii. forward suggestions for effective use of ICT in the teaching-learning process

1.5. Research Questions

As has been mentioned earlier, a mixed methods research was used in the current study. Creswell and Clark (2011) noted the need to have qualitative, quantitative, and mixed methods questions in a mixed methods research. According to these authors, the style of writing these research questions into a mixed methods research might assume several forms, one of which is writing separate quantitative questions and qualitative questions. These could be written at the beginning of a study or when they appear in the project, if the study unfolds into two separate phases.

Accordingly, three types of research questions guided this study. The first research question was exploratory qualitative research question which required the use of qualitative method.

The second research question was a mixed methods question which required the use of both qualitative and quantitative methods. The third research question was confirmatory quantitative research question which required the use of quantitative method. The nature of these three types of research questions dictated the use of a mixed methods research approach. The research design used here was exploratory sequential design, where first a qualitative study is conducted which was followed by a quantitative study. Due to this fact, the exploratory qualitative research question was presented first, which was followed by the mixed method research question and the confirmatory quantitative research question. Thus, the following three overarching research questions were set to guide the study, namely:

1. *How do instructors use ICT in the teaching-learning process?*
2. *Why do instructors use ICT the way they use it?*
3. *Which of the anticipated explanatory variables have the strongest significant contribution in explaining variance in instructors' patterns of ICT use in the teaching-learning process?*

The third research question is a confirmatory quantitative research question. Inherent to the third research question are the following sub-questions:

a. *What is the degree of association of the anticipated explanatory variables with instructors' patterns of ICT use (ICTU)?*
b. *How much of the variance in patterns of ICT use can be explained by the independent variables in this study?*
c. *What are the most significant explanatory variables to instructors' Patterns of ICT use?*
d. *What model can be suggested to explain variation in instructors' patterns of ICT use?*

The third confirmatory research question and its four sub-questions were addressed by the quantitative study part of this research project.

1.6. Theoretical Framework

1.6.1. Introduction

Research scholars agree that theories are used to identify variables that help to establish research hypotheses which, in turn, help to test a theory (Zikmund, 2003). A theoretical framework was used in this study to explain variables that may influence patterns of ICT use in the teaching-learning process. The theoretical framework that was used in this study is a composite of three theories: Rogers' diffusion of innovations theory, the model of teacher thought and action by Clark and Peterson, and the theory of reasoned action. Empirical evidences from previous studies were also used to guide this study as part of the theoretical framework.

1.6.2. Rogers' Diffusion of Innovations Theory

This study viewed the use of ICT as innovation adoption. One common theory through which researchers study the adoption of innovation is Rogers' diffusion of innovations theory (2003). Rogers' diffusion of innovations theory is the most appropriate theory for investigating the adoption of technology in higher education (Medlin, 2001; Parisot, 1995). The diffusion of innovations theory proposed by Rogers (1995) states that people respond differently in their approaches to a new idea, practice, or object due to their individual differences. This particular individual difference in response to new idea, practice or object is referred to as personal (individual) innovativeness.

Rogers (2003) defines individual innovativeness as a degree to which an individual is relatively earlier in adopting an innovation than other members of the society. According to Midgley and Dowling (1978), individual innovativeness refers to the individual's openness to new ideas and decision-making to adopt an innovation free from the influence of other's experience. Similarly, Hurt, Joseph, and Cook (1977) defined it as a generalized willingness to change. Van Braak (2001) described innovativeness as "a relatively-stable, socially-constructed, innovation-dependent characteristic that indicates an individual's willingness to change his or her familiar practices" (p. 144). In the context of information technology applications, Agarwal and Prasad (1998) introduced the term personal innovativeness in the

domain of information technology (PIIT) and defined it as “the willingness of an individual to try out a new information technology” (p.206).

According to Rogers’ diffusion of innovations theory, individuals possess different degrees of willingness to adopt innovations. Rogers noted that in a given population, the portion of that population adopting an innovation is approximately normally distributed over time (Rogers 1995). Breaking this normal distribution into segments leads to the segregation of individuals into five categories of individual innovativeness (from earliest to latest adopters): innovators, early adopters, early majority, late majority, laggards (Rogers, 1995).

As applied to this study, Roger’s diffusion of innovations theory holds that one would expect personal innovativeness in the domain of ICT (PIICT) to influence instructors’ ICT use in classroom. Hence, in this study it is hypothesized that personal innovativeness in the domain of ICT (PIICT) positively correlates with patterns of ICT use.

1.6.3. The Model of Teacher Thought and Action by Clark and Peterson

According to Clark and Peterson (1986), the process of teaching involves teachers’ thought processes (teachers’ cognition such as teachers’ thinking and beliefs) and their actions and observable effects. These scholars stated that teachers’ thinking and beliefs occur inside their mind and they are unobservable. Clark and Peterson (1986) noted that the shift from studies on teachers’ behavior to a study of teachers’ thought processes (cognition) enhanced our understanding of how and why the process of teaching looks and works the way it does.

The model of Teacher Thought and Action by Clark and Peterson (1986) depicts two domains, each represented by a large circle, that are involved in the process of teaching: teachers’ thought processes (teachers’ theories and beliefs, for example) and teachers’ actions and observable effects. In their model, Clark and Peterson (1986) classified teachers thought processes into three categories: teachers’ planning, teachers’ interactive thoughts and decisions, and teachers’ theories and beliefs.

This model helps to explain the relationship between teachers’ thought processes such as their theories and beliefs and their actions in the teaching-learning process. Clark and Peterson

(1986) argue that teachers' theories and beliefs make up an important part of teachers' general knowledge through which teachers perceive, process and act upon information in the classroom. They contend that teachers' theories and beliefs serve as a guide to their thoughts and actions. Clark and Peterson also showed in their model that teachers' actual behavior affects their thoughts.

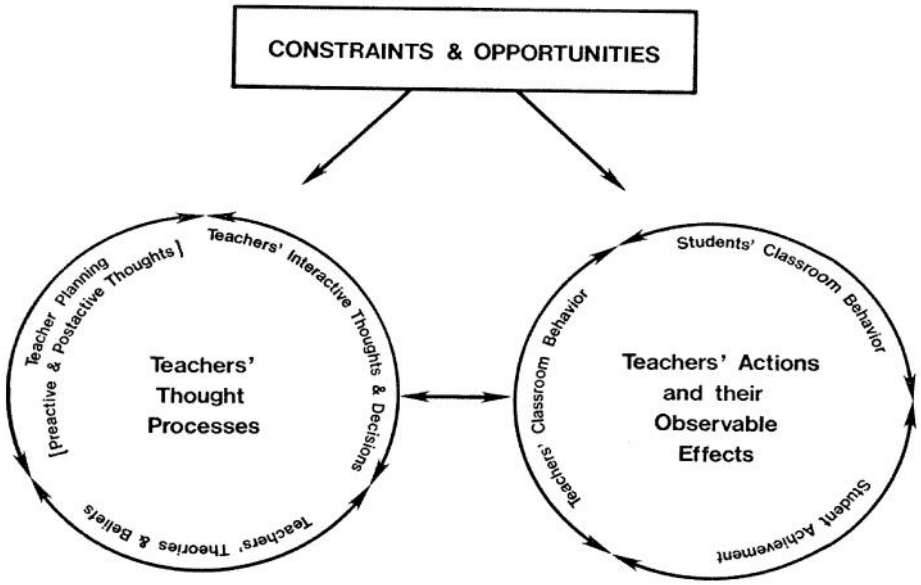

Figure 1: A Model of Teacher Thought and Action (by Clark and Peterson, 1986)

Generally, it can be depicted from the model of Teacher Thought and Action by Clark and Peterson that teachers' thoughts and beliefs affect their action in the teaching learning process. This is in line with the assumption that instructors' pedagogical belief determines their pattern of ICT use. When applied to this study, the model of teacher thought and action holds that instructors' pedagogical belief is related to their practice with ICT in the teaching–learning process.

1.6.4. Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) was proposed by Fishbein and Ajzen (1975). TRA is based upon people's behavior being strongly related to their attitudes and the social pressure they encounter (subjective norm) towards that behavior. It asserts that, beliefs lead to attitudes which, in turn, lead to intentions and then generate behavior (Ma and Liu 2004). TRA postulates

that both attitude and subjective norms are predictor of intention where intention is an approximate predictor for actual behaviors (Ajzen & Fishbein, 1980).

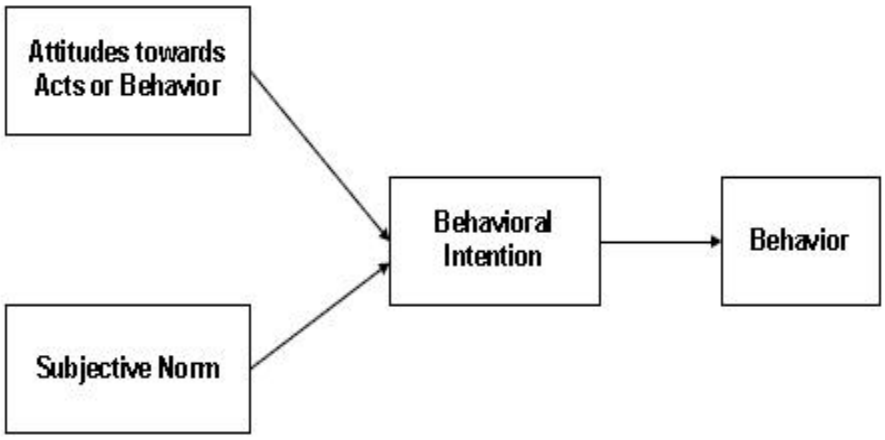

Figure 2: A Model of the Theory of Reasoned Action (as proposed by Fishbein and Ajzen, 1975)

According to Ajzen (1988), attitudes are composed of cognitive, affective, and behavioral elements. Cognitive refers to the perceptions of the attitude object; affective refers to feelings towards the attitude object; and behavior refers to the response to the attitude object. Albirini (2006) developed instrument to measure teachers' attitudes toward ICT taking into account these three components, which are assumed to correlate with the use of ICT in the teaching-learning process. TRA also depicts that social pressure influence the intention to perform a behavior. When applied to this study, the TRA model holds that subjective norm (pressure from colleagues and others) and instructors' attitude are related to their practice with ICT in the teaching–learning process.

1.6.5. Evidences from Empirical Studies

In addition to the theories that have been discussed, a rich body of empirical research has specifically focused on factors that affect ICT adoption. For instance, P. Rogers (2000) interviewed 28 college and university teachers and found ten barriers to technology integration in the teaching-learning process: 1) availability and quality of hardware/software, 2) faculty role models, 3) funding, 4) institutional support, 5) models for using technology in instruction, 6) staff development, 7) student learning, 8) teacher attitudes, 9) technical support, and 10)

time to learn to use the technology. Cox, Preston, and Cox (1999) conducted a study examining factors that influence the use of ICT in teaching. The results revealed that those teachers who are already regular users of ICT have confidence in using ICT, perceive it to be useful for their personal work and for their teaching and plan to extend their use further in the future. The findings of their study also show that access to technology as well as administrative and professional support also play major role in using ICT in the teaching-learning process.

To sum up, the theories and evidences mentioned above helped to identify variables that are expected to explain why instructors differ in their patterns of ICT use in the teaching-learning process. Based on the above theories and evidences from literature, it can be anticipated that instructors' personal innovativeness, their pedagogical beliefs, their ICT competencies, their experience, nature of the subject they teach, and other context-related factors such as support and access to ICT have influence on the use of ICT in the teaching-learning process.

Furthermore, the theories explained above served as bases for the conceptualization of the ideas that are investigated here and to develop a conceptual model that shows the anticipated relationship among variables in this study.

1.7. Conceptual Framework

1.7.1. Introduction

In the previous section, the value of the selected theoretical framework to examine factors that affect the adoption of ICT in the teaching-learning process was justified. This section presents the conceptual framework of the study.

Conceptualization is the process of taking vague ideas and notions or concepts, and coming to agreement about their meanings. The concepts used here can be defined differently by different persons. Thus, these concepts were defined in a way that reflects a common understanding. Conceptual model, nominal definitions and operational definitions were used for conceptualizing the basic ideas used in this study.

1.7.2. Conceptual Model of the Current Study

There are several theoretical models that can be used to investigate factors that affect user acceptance of ICT and how they use ICT (Venkatesh, Morris, Davis, & Davis, 2003). The theoretical models employed to study user acceptance and behavior include the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and the theory of planned behavior (TPB) (Ajzen, 1991; Mathieson, 1991), as well as the technology acceptance model (TAM) and its variations (Yi et al., 2006; Venkatesh et al., 2003; Venkatesh & Davis, 2000; Davis, 1989; Davis, Bagozzi, & Warshaw, 1989).

A new conceptual model, labeled ICTU conceptual model, was proposed for the current study because most past acceptance and behavior models were not developed to support ICT use in teaching-learning environments and, consequently, these models seem to be inappropriate, even after modification. The use of ICT in the teaching-learning process is distinct from its use in other contexts. This is so because the use of ICT in the teaching-learning process is linked with instructor-related as well as contextual factors (Ertmer, 1999). That is why a different model that takes into account these two categories of factors for predicting instructors' patterns of ICT use in the teaching-learning process was proposed for this study.

The ICTU conceptual model suggests that instructor-related variables (instructors' attitudinal, demographic and perceptual factors) and contextual factors have association with instructors' patterns of ICT use in the teaching-learning process.

According to the model, the independent variables are 13 and the dependent variable is one. The independent variables include age, teaching experience (TE), experience in ICT use (EICT), teaching level (TL), personal innovativeness in the domain of ICT (PIICT), pedagogical belief (PB), competence in ICT use (CICT), general attitude towards ICT (GAICT), attitude towards ICT in education (AICTE), instructor-perceived nature of the course (CN), instructor-perceived readiness of students to use ICT in their learning (RS), access and availability of ICT resources (AAIT), and Support. Teaching-level (TL) and instructor-perceived readiness of students to use ICT in their learning (RS) were included in the list of independent variables based on evidence obtained from the qualitative study phase of this research project. The dependent variable is pattern of ICT use (ICTU).

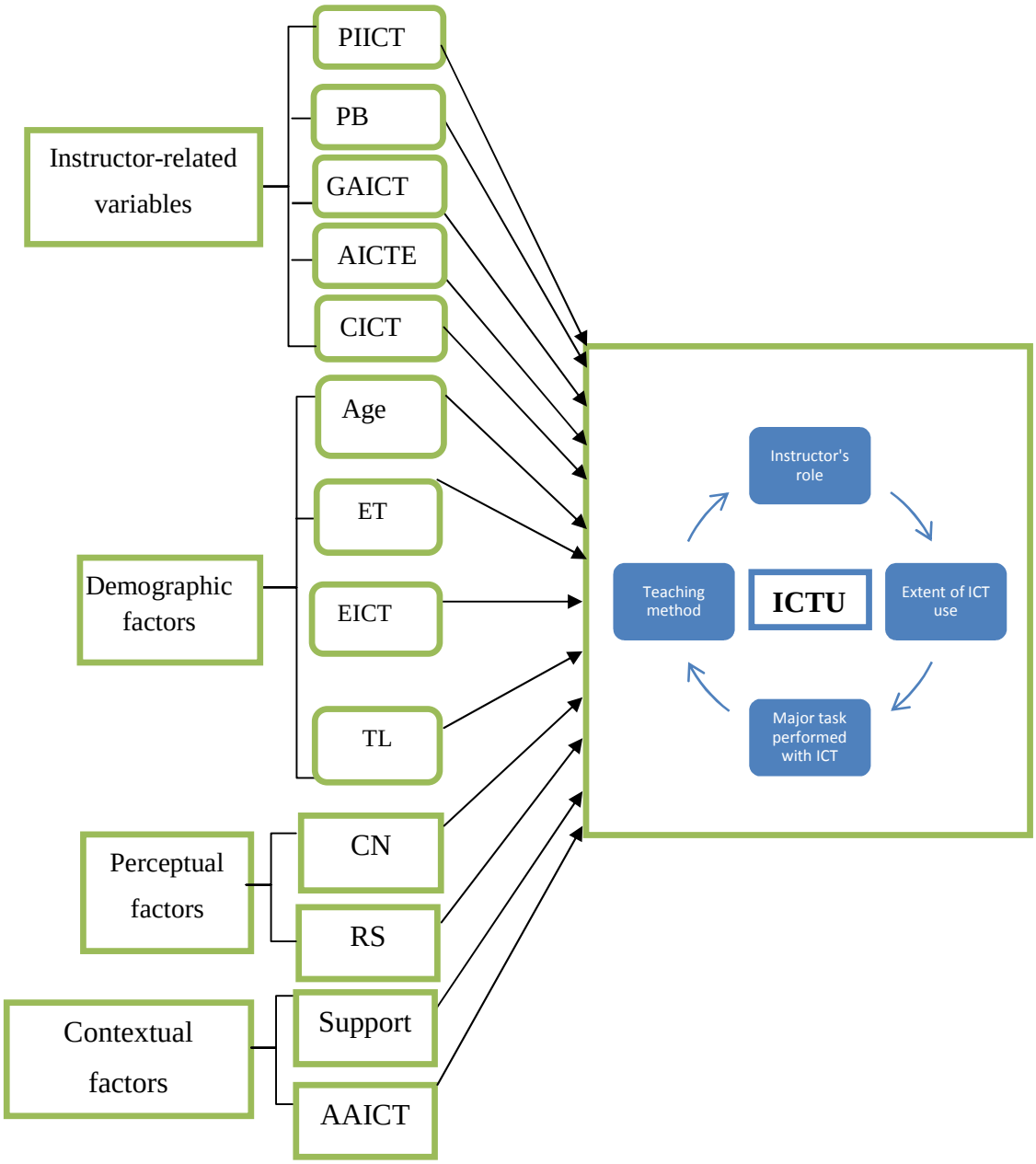

Figure 3: The ICTU Conceptual Model

Based on the ICTU conceptual model, it was anticipated that the independent variables indicated in the model might predict instructors' pattern of ICT use in the teaching-learning process.

1.7.2. Nominal Definitions of the Main Concepts in the Current Study

Some concepts used in this study might have different meanings based on their contexts. The following nominal definitions were used to clarify the concepts in the context of this study.

***ICT (Information Communication Technology)*:** refers here to computer including its hard ware and software components; computer peripherals like printer, fax machine, digital camera, and LCD projector; the Internet, broadcasting technologies (radio and television), mobile phone, fixed telephone line, and other electronic media that are used to share, distribute, gather, create, disseminate, store and manage information in the teaching-learning process.

***Pattern of ICT use*:** refers here to the way ICT is used in the teaching-learning process.

***ICT integration, ICT use, or ICT adoption*:** used interchangeably, refers here to the infusion of ICT into the teaching-learning process in or outside the classroom which is mainly intended to facilitate and enhance students' learning.

Attitude towards ICT: refers here to the general liking or disliking of ICT; the positive or negative inclination to use ICT.

***Attitudes towards ICT in education*:** refers here to the degree of favor or disfavor with which teachers evaluate the presence and use of ICT in education.

***Personal innovativeness*:** refers here to the willingness of an individual to try out new things.

***Pedagogical belief*:** refers here to teachers' belief about teaching or their preferred ways of teaching.

***ICT Competence*:** refers here to the level of knowledge, skills, and abilities a teacher has about ICT in order to use it in the teaching-learning process effectively and efficiently.

***Instructor or teacher*:** used interchangeably, here refers to an academic staff in a higher learning institution who is involved in the instructional process.

***Student-Centered method of teaching*:** refers here to a constructivist approach to teaching in which teachers try to take advantage of students' prior knowledge and interests to encourage active engagement in intellectual exploration, problem solving, construction, and synthesis of new knowledge (International Society for Technology in Education, 2000).

***Higher education*:** refers here to education provided mainly at university level.

***Constructivist learning environment*:** refers here to the educational milieu that supports students to be engaged in group or to work independently in such a way that they construct their own knowledge.

1.7.3. Operational Definitions of the Variables

As stated earlier, the dependent variable in this research is instructor's pattern of ICT use (ICTU), and the other variables indicated in the conceptual model are all independent variables. The operational definitions of these variables help to show how they can be measured.

PIICT- the average score (level) that an instructor gets from the PIICT scale. It is a multi-indicator measured with 4 items (indicators) which focus on tendency to use new ICT, tendency to try out new ICT, rate of adoption of new ICT as compared to peers, and hesitation to use ICT.

PB-the average score that an instructor gets from the PB scale. It is a multi-indicator measured with 10 items (indicators) which focus on instructor's belief on the value of shaping course based on students' idea, belief on value of students' independent work, group work and self-assessment, and belief on value of sticking to schedules and modules.

GAICT-the average score that an instructor gets from the GAICT scale. It is a multi-indicator measured with 5 items (indicators) which focus on instructor's positive or negative experience in using ICT, extent of ICT use on daily basis, confidence in using ICT properly, and perception on whether ICT saves time or not on routine tasks.

AICTE-the average score that an instructor gets from the AICTE scale. It is a multi-indicator measured with 5 items (indicators) which focus on effect of ICT on students' performance, creativity and motivation to learn, effect on efficiency of the learning process, and also instructor's perception on whether modern education demands ICT use or not.

CICT- the average score that an instructor gets from the CICT scale. It is a multi-indicator measured with 10 items (indicators) which focus on instructor's competency in using application software like MS-Word, in using LCD projector, in installing software, in fixing minor computer problems, in using Internet to communicate with others and to download course materials, and in creating and organizing files and folders on computer.

AAICT-the average score that an instructor gives for the AAICT items (items 8 to 10 in the CF scale). It is a multi-indicator measured with 3 items which focus on the availability of ICT resources and access to these resources.

Support-the average score that an instructor gives for the support items (item 1 to 7 in the CF scale). It is a multi-indicator measured with 7 items which focus on administrative as well as technical support provided to instructors while using ICT in the teaching-learning process.

ICTU-the average score that an instructor gets in terms of her/his pattern of ICT use. It is a multi-indicator measured with 4 questions (indicators) which focus on instructor's dominant teaching method, instructor's role, instructor's or students' extent of ICT use, and major task performed with ICT.

RS-the average score that an instructor gets in terms of her/his perception about instructor-perceived readiness of students to use ICT (RS) scale. It is a multi-indicator measured with 4 items (indicators) which focus on instructors' perception on whether students have time to use or not, perception of instructors on whether students have interest to use ICT or not, instructors' perception on whether students have competence to use ICT or not, and instructors' perception on whether students have access to ICT resources or not.

CN-the score that instructor get in terms of her/his perception about the nature of the course s/he teaches. It has only one indicator which focuses on instructors' perception on whether the course they teach requires ICT use or not.

Age- the number of years that have passed since the instructor was born. It is measured in number of years.

Teaching experience (TE)-the number of years that have passed since the instructor started teaching at any education level.

Experience in ICT use (EICT)-the number of years that have passed since the instructor started using ICT in teaching or in other areas of life.

Level of teaching (TL)-The level at which a teacher teaches, which is measured depending on whether the teacher teaches at undergraduate or graduate level.

1.8. Research Methodology

This part provides an overview of the research approach, the research design and the data collection and analysis methods used in this research. The detail of the methodology part is given in chapter three. A mixed methods research approach was used in this study. The philosophical foundation for this study is based on the worldviews outlined by Creswell and Clark (2011). According to their argument, the use of either quantitative or qualitative approaches may not completely address the research questions in a given research, whilst a combination of approaches does (Creswell & Clark, 2011). The current research follows the same line of argument. As a result, the philosophical approach adopted by this research was the pragmatic approach.

This study used the Exploratory Sequential Design by taking one public university as a research site, namely Jimma University. The detail of this research design is given in chapter three. The participants in this study were instructors of Jimma University, the Vice President for Academic Affairs of the University, and a Representative of the ICT Directorate Office of the University.

The method of data analysis used in the qualitative strand of this study was thematic analysis. The data analysis for the quantitative strand consisted of descriptive and multiple regression analysis. The Statistical Package for the Social Sciences (SPSS) version 20 and Microsoft excel 2007 were used in analyzing the quantitative data.

1.9. Significance of the Study

Knowledge gained from the current study was thought to be beneficial to the profession, to the university academic staff, to the University administrators, to the Ministry of Education and to the world of research in ICT in education. Overall, information from the current study might help policymakers, researchers, university officials and instructors to understand the statuses of Ethiopian higher education institutions in terms of ICT integration in the teaching-learning process and to apply appropriate intervention strategies that are needed for effective utilization of ICT in the teaching-learning process.

1.10. Delimitation of the Study

One of the delimitations of this study was that it exclusively focused on the application of ICT in education. Further, this study was delimited to the application of ICT in the context of higher education in Ethiopia. The university that was chosen as a research site was Jimma University. During the data collection period of this study, there were 30 public universities in Ethiopia. Preliminary assessment by the investigator revealed that with the exception of Jimma University, the rest universities in the country had no sufficient ICT infrastructure, which makes it difficult to conduct the current study in either of them except at Jimma University. Jimma University was the only university that transformed traditional classrooms into technology-enhanced smart classrooms.

The other delimitation of this study was that the results of the study mainly depended on instructors' perspectives. Students' views were not incorporated in this study with the assumption that with the late advent of ICT in education in the University, data obtained from students might not be matured enough to the study. The other delimitation of the study was that gender factor was not considered as a variable. This was so because previous studies showed that gender difference does not have significant effect on ICT use (Buabeng-Andoh & Totimeh, 2012; Norris, Sullivan, Poirot & Soloway, 2003).

1.11. Limitations of the Study

One of the limitations of this study is related to generalisability. The study was conducted at Jimma University and the findings of this study can be generalized to the population of instructors in the University. It is difficult to generalize the findings of this study to a different context. However, the findings in this study can be transferable to the context of other universities and may inspire researchers to conduct a similar study in a different context.

The other limitation of this study is that, the quantitative responses from respondents in this research were obtained through self-reported responses. Self-reported responses may or may not be accurate. People can lie on a test, they can fake bad or fake good, or they can purposefully try to manipulate the results (Anastasi & Urbina, 1997). However, this does not mean that all self-report data are invalid; only that they cannot be trusted in all cases (Ericsson & Simon, 1993). The investigator tried to control biased responses by using negatively worded items alongside the positively worded items during data collection.

1.12. Organization of the Study

This exploratory sequential mixed methods research was presented in nine chapters. Chapter one provides background to the study, statement of the problem, objectives of the study, theoretical and conceptual frameworks of the study, significance of the study, delimitation of the study, limitation of the study, and organization of the study. Chapter two provides a review of literature related to policy and legal issues concerning the expansion and utilization of ICT in education, patterns of ICT use in the teaching-learning process, and factors that have association with pattern of ICT use in the teaching-learning process, by taking into account developing as well as developed countries. Chapter three includes a description of the study methodology, research design, research setting, development and validation of data collection tools, and methods of data collection and analysis. Chapters four and five present the results of data analysis of the qualitative study. Chapters six and seven present the results of the quantitative study part of this research project. Chapter eight contains summary of the major findings and discussion of the results. Finally, chapter nine contains conclusions and implications for improved practice and further studies.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This review is based on reading mainly from 20 journals such as JSTOR, IJEDICT, British Journal of Educational Technology (BJET), Computers and Education (C & E), Journal of Educational Technology and Society (JETS), International Journal of Computers & Technology, Educ Inf Technol, Eurasia Journal of Mathematics, Science & Technology Education, and The Turkish Online and Journal of Educational Technology (TOJET). Moreover, other internationally recognized scholarly journals were consulted to search for relevant articles for review. One book, which contains the result of a ten year project, is also included for review.

From hundreds of articles obtained, a limited number of articles which were found to be very relevant to this study were selected for review based on their relationship to the variables that would be tested in this study. Those articles which focus only on specific type of ICT, those which focus on use of ICT outside the education system, those which focus on factors affecting students' ICT use, and those which focus on factors that exclusively apply to schools have been excluded from the list of reviewed articles. Finally, those articles that used the technology acceptance model as their theoretical model have been excluded because the model mainly focuses on behavioral intention to use ICT rather than the actual use of ICT.

The first section of this literature review focuses on the context of ICT use in education in Ethiopia, mainly in relation to regulatory and policy frameworks as well as ICT infrastructure at national level. This is done because both the frameworks and the infrastructural issues have impact on the use of ICT in the education sector. The second section of this literature review deals with ICT use in education. The third section focuses on pattern of ICT use in the teaching-learning process. Different patterns of ICT in education will be reviewed in this part. The fourth and the last section of this literature review will focus on factors that are related to pattern of ICT use in teaching and learning.

2.2. The Ethiopian Context of ICT in Education

2.2.1. The National ICT Policy and Strategy

The study of the status of ICT policy and strategy is believed to provide information about the ICT readiness at national level. Hennessy, Harrison, and Wamakote (2010) noted that national ICT policies together with supportive local policies are prerequisites for the integration of ICT in education. On this basis, the purpose of reviewing the context of ICT in education in Ethiopia is to describe the existing national policy framework in relation to the use of ICT in education.

Ethiopia has put in place regulatory and policy frameworks that help to ensure the infusion and use of ICT in different sectors of the country. One of these frameworks is the National ICT policy and strategy, whose final draft was released in 2009. The United Nations e-Government survey (2010) documented that in 2005 the Government of Ethiopia adopted a national information and communications technology (ICT) policy and in 2006 launched a five-year ICT action plan to help diversify the country's economy, promote public sector reform and improve opportunities in education, health, small business development and agricultural modernization.

The National ICT policy and strategy is mainly aimed at development, deployment and the exploitation of ICTs to facilitate the development of all key sectors of the economy (Hare, 2007). The ICT policy is an integral part of the country‘s larger development goals and objectives. Formerly, the Government of Ethiopia, under the former Ministry of Capacity Building, drafted the National ICT for Development (ICT4D) Five Years Action Plan (2006-2010) which was initiated by the United Nations Development Programme (UNDP).

Apart from the National ICT policy and strategy, the government of Ethiopia has given legal and regulatory framework to the sector by establishing a new institutional setup at ministerial level by the name Ministry of Communication and Information Technology (MCIT), replacing the previous EICTDA (Ethiopian Information and Communication Technology Development Agency) and ETA (Ethiopian Telecommunication Agency) to lead the ICT sector. MCIT leads

the ICT development of the nation by way of developing policy instruments, designing various programs, mobilizing resources, and guiding and monitoring implementation.

2.2.2. Education and the National ICT Policy and Strategy

With regard to ICT in education (ICTE), the national ICT policy and strategy (2009) posits that ICT facilitates the development of education and enables both individuals and countries to meet the challenges presented by the knowledge and information age. It is also stated in the policy that ICT plays a crucial role in improving the quality of education.

One of the major goals of the policy as stated under the 'ICT for the education sector' is to "Ensure that ICT is an integral part of the educational and training system at all levels, and wherever possible, ICT shall be used to extensively deliver education" (The National ICT Policy and Strategy, 2009: p. 15). As its objectives, the policy commends to ensure that ICT is an integral part of the national education systems to expand quality ICT education and make it accessible and also to develop standards of evaluation and guidelines for the development and exploitation of ICT in schools, colleges and universities.

2.2.3. ICT Infrastructure in Ethiopia

Hare (2007) witnessed a considerable advancement in ICT infrastructure across Ethiopia in the past decade. He noted that the Ethiopian Telecommunication Corporation, in collaboration with the World Bank, the African Development Bank, and the International Monetary Fund has deployed a state-of-the-art multimedia broadband backbone infrastructure with a core nucleus of 4,000 kilometers of optical fiber. Despite all these efforts, the coverage of ICT services in Ethiopia is the lowest in Africa (Forster & Morella, 2010). According to Adam (2010), though there has been improvement in recent years, Ethiopia's ICT sector remains far behind the rest of the world. This is in line with what is stated in the final version of the national ICT policy and strategy (2009) which depicts that ICT in Ethiopia is at the early stage of development.

2.2.4. ICT in Public Universities in Ethiopia

No recent research has been conducted in Ethiopia which shows the status of ICT penetration in public universities. The latest evidence provided about ICT in public universities in Ethiopia was by Hare (2007). However, experience shows that no significant difference is expected in deployment of ICT infrastructure within these few years.

As it is described in Hare (2007), a baseline study was conducted by the Ministry of Education and the result was that most universities and higher learning institutions in Ethiopia have few computers, which are shared at a student-computer ratio of 10:1 in most cases. The study also showed that despite the presence of computers, most of the institutions lack a network infrastructure and have limited connectivity. Hare also noted that the lecturers were using the available ICT as a teaching tool, and very few students were using computers and the Internet as a learning resource.

The other evidence about the level of ICT infrastructure in higher education institutions in Ethiopia comes from Obiri-Yeboah and the associates (2013) who contend that, with the exception of South Africa, Mauritius, and most of North Africa, African universities suffer from a lack of computer stations and a lack of access to affordable high-speed Internet connectivity.

2.3. Patterns of ICT Use

2.3.1. How ICT Use is Measured

Literature shows that researchers measure ICT use in different ways. For some researchers ICT use is related to the amount of ICT used in the classroom, the type of ICT used in the teaching-learning process, or the time teachers and students spend working with ICT. Judson (2006) noted that most of the researches in the use of technology in education are related to availability of technology in the educational institutions and that there is much less research on how frequently and in what manner technology is being used in these educational institutions.

Tondeur, et al (2008) contend that many researchers have measured computer use by reporting the time teachers and pupils spend using computers or the amount of technology used in the classroom (e.g., Mathews & Guarino, 2000; O'Dwyer, Russell, & Bebell, 2004). According to Cox (2008), a large element of the current research agenda is to measure the uptake of ICT in schools by teachers, pupils, types of ICT used and so on.

Many scholars have questioned the measuring of ICT integration by simply counting the number of machines or calculating student to computer ratios (Proctor, Watson, & Finger, 2003). Murphy (2006) suggests that the question that needs to be raised is about how ICT is used to support a constructivist approach in teaching. There is ample evidence from literature that making any ICT available in educational institutions does not in itself result in changed learning and teaching methods (MCEETYA, 2005). Baylor and Ritchie (2002) argue that ICT itself will not directly change teaching and learning but the way it is incorporated into instruction will certainly be a critical element in its integration.

Bransford, et al (2000) contend that new technologies by themselves do not guarantee effective learning. They caution that the impact of ICT in students' learning mainly depends on how teachers use it in their classes. Bottino (2004) asserted that when considering the design of ICT supported learning environments, consideration has to be given not only to the ICT tools but also to the possible ways of using them effectively. Lim and Tay (2003) note that how ICT tools are used is more important than what types of tools are being used. Tubin (cited in Peeraer &Van Petegem 2012) also argues that what counts is not the ICT type but its implementation in the teaching-learning process. Bernaur (1995) added to this by contending that it is not technology by itself that results in improved student outcomes, but rather how the technology is used and integrated into instructional processes.

2.3.2. Categorizing Pattern of ICT Use

In terms of how ICT is used in the teaching-learning process, literature shows that instructors' pattern of ICT use in the teaching-learning process is not the same. Some instructors use ICT to reinforce traditional teaching methods while others use ICT to create constructive learning environment (Jonassen, 1996; Jonassen et al, 1998, Ertmer, Ross, & Gopalakrishnan, 2001;

Ertmer, 2005; Wang, 2002). Depending on how teachers use ICT in the teaching-learning process, scholars in the area categorized pattern of ICT use in different ways.

Tondeur and associates (2007) conducted a research in elementary schools to study the pattern of ICT use in classrooms. The results of their study suggest a three-factor structure, named as "basic computer skills" (to develop students' technical computer skills), ''the use of computers as an information tool" (to research and process information) and ''the use of computers as a learning tool" (to practice knowledge and skills). Ainley, Banks, and Fleming (2002) identified categories of educational computer use such as ''computers as information resource tools", ''computers as authoring tools" and ''computers as knowledge construction tools".

Referring to literature, Inan and Lowther (2010) identified three broad categories of patterns of ICT use: ICT for instructional preparation, ICT for instructional delivery, and ICT as a learning tool. Teacher's professional use of ICT involves preparation for various classroom activities; such as, preparing instructional materials and creating lesson plans. When ICT is used for instructional delivery, the teacher can present instruction by means of a projector. The third category, ICT as a learning tool, involves students' use of software applications to extend their abilities to solve problems, create products, or communicate and share their perspectives with each other.

The other categorization of ICT use in classroom was ICT as instructional media and ICT as a cognitive tool (Jonassen, 1996; Jonassen et al, 1998). Traditionally, instructional technologies (including ICT) have been used as instructional media for delivering instruction, that is, as conveyors of information and tutors of students ((Jonassen, 1996; Jonassen et al, 1998). When used in this way, information is stored in the technology and during the instructional process, learners perceive and try to understand the messages stored in the technology as they interact with it. Jonassen (1996) argues that the use of ICT (technology) as conveyors of knowledge have produced no significant differences in learning as a result of their interventions.

'Cognitive tools' (Jonassen & Reeves, 1996; Lajoie, 2000), 'cognitive technologies' (Pea, 1985), 'technologies of the mind' (Salomon et al, 1991), or 'mind tools' (Jonassen, 1996) are computer-based tools and constructive learning environments that have been adapted or

developed to function as intellectual partners with the learner in order to engage and facilitate critical thinking and higher-order learning. They are ICT tools that are intended to engage and facilitate cognitive processing-hence cognitive tools (Kommers et al, 1992). Professor David H. Jonassen, who died in December 2012, is honored for his scholarly contributions in research and development related to computers and education. Ertmer and Ottenbreit-Leftwich in T.C. Reeves et al (2013) contend that Jonassen's powerful conceptualization of computers and related technologies as "mindtools" (Jonassen, 1996) or "cognitive tools" (Jonassen & Reeves, 1996) provides a sound theoretical and practical foundation for effective technology-enabled learning in schools.

Jonassen and Reeves (1996) contend that cognitive tools play a crucial role in providing the means through which many constructivist leaning activities are enacted, enabling individuals to access, manipulate and construct knowledge. The use of ICT as a cognitive tool enables students to think deeply and to perform their learning tasks effectively (Pea, 1985; Kozma, 1991; Mayes, 1992; Reeves, 1999; Jonassen, 2000). Jonassen (1996) posits that learning with cognitive tools requires learners to think harder about the subject-matter domain being studied than they would have to think without the cognitive tool. When using cognitive tools, learners engage in knowledge construction rather than knowledge reproduction (Ibid). Therefore, cognitive tools provide learners with constructive learning environment.

According to Kirschner and Wopereis (2003), cognitive tools help learners represent what they know as they transform information into knowledge and are used to engage in, and facilitate, critical thinking and higher-order learning. Jonassen (2006) contends that the use of ICT as a cognitive tool is in line with the constructivist theory of learning. Kim and Reeves (2007) also noted that the "scholarship of cognitive tools is founded on constructivist beliefs about how learning occurs and how learning environments should be designed accordingly" (p.208). Constructivist theory of learning views learning as a personal, reflective, and transformative process where ideas, experiences, and points of view are processed into something new.

Using ICT as a cognitive tool requires students to think deeply about what they do. According to Yildirim (2005), students use the ICT as cognitive tools to access, analyze, interpret, and

organize their personal knowledge. Generally, use of ICT as a cognitive tool impacts the teaching learning process as follows:

- Method of teaching becomes student-centered (Albalooshi & Alkhalifa, 2002; Jonassen, 2006).
- Students involve in independent learning or in interactive learning such as collaborative learning and dialogic learning (Chen, Tan, Looi, Zhang, & Seow, 2008; Kafai, Ching, & Marshall, 1997; Steketee, 2006).
- Teachers play the role of co-learners and facilitators (Chen et al, 2008; Yildirim, 2005; Dede, 2008).
- Students will be the major users of ICT (Yildirim, 2005, Becker & Ravitz, 1999).

When using cognitive tools, learners engage in knowledge construction rather than knowledge reproduction (Jonassen, 2000). According to Kirschner and Wopereis (2003), cognitive tools help learners represent what they know as they transform information into knowledge and are used to engage in, and facilitate, critical thinking and higher-order learning.

2.3.3. Changes in Teachers' Role with Change in Pattern of ICT Use

Evidence from literature shows that integration of ICT in the teaching-learning process requires a shift in teacher's role (Bransford et al, 2000; Murphy, 2006; Newhouse, 2002a). Jonassen and associates (1999) reported that in traditional teaching, teachers give knowledge and students receive knowledge from the teachers, but with new technology students need to explore knowledge than receive knowledge from their teachers. They also argued that teachers have to give up some of their authority in their management of learning.

In a previous study, Jonassen and associates (2008) contended that for learning to be meaningful with new ICT, students have to be engaged in knowledge construction rather than reproduction; conversation rather than reception; and collaboration rather than competition. Tapscott (1998) posits that the infusion of technology into the classroom requires a shift from the science and art of teaching to the creation of a community of learners. This notion assumes a classroom to be a place to learn and not necessarily just a place for teachers to teach. In this kind of learning environment, the teacher creates the learning experience for the learners and

the learners design the learning environment and the curricula. This approach to learning is consistent with the constructivist view of teaching and learning (Tapscott, 1998).

2.4. Factors Related to Instructors' Patterns of ICT Use

2.4.1. Classification of Factors Related to ICT Use in the Teaching-Learning process

In the technology integration literature many researchers make a distinction between first order barriers and second order barriers (Brickner, 1995; Ertmer, Addison, Lane, Ross, & Woods, 1999; Ertmer, 1999; Ertmer, Ottenbreit-Leftwich, & York, 2007; Hernandez-Ramos, 2005; Russell, Bebell, O'Dwyer, & O'Conner, 2003).

Brickner (1995) contends that teachers experience many real and perceived obstacles to technology adoption in their classrooms, and based on his findings from the research he classified obstacles that teachers experience as first and second-order barriers to change. According to him, First-order barriers to change are external to the teacher (extrinsic). These first order barriers include access to hardware, access to software, time to plan instruction, technical support, and administrative support. Second-order barriers to change are internal to the teacher (intrinsic). These barriers include beliefs about teaching, beliefs about technology, organizational context, lack of instructional models, and unwillingness to change.

Ertmer (1999) made a distinction between teacher-related factors and external (context-related) factors. Context-related factors include availability of resources, time, technical support, administrative support, and subject culture. Teacher-related factors are those factors which relate to teachers' ICT skill, teachers' pedagogical belief, and teachers' attitudes to ICT such as confidence to use ICT, tendency to change, attitudes, and perception of benefits.

Van Braak, Tondeur, and Valcke (2004) classified factors that affect ICT use as demographics, computer experience (computer training, computer experience expressed over time, intensity of computer use), and attitude measures (general computer attitudes, attitudes toward computers in education, and technological innovativeness). Balanskat, Blamire and Kefalla (2007) identified the factors as teacher-level, school-level and system-level.

2.4.2. Previous Research on Factors that Influence Instructors' Pattern of ICT Use

The analysis of literature on factors related to ICT use in the teaching-learning process is conducted here by categorizing the study into two, based on the economic level and the level of ICT penetration of the research settings. This is because the use of ICT in the teaching-learning process requires the deployment of ICT infrastructure in the education institutions which, in turn, depends partly on the economic level of the country. Countries at lower economic level would find it difficult to deploy ICT infrastructure in their education institutions. As a result factors that are related to the use of ICT in the teaching-learning process may vary from country to country depending on the level of ICT infrastructure and the economic level of each country.

I. Previous research in Sub-Saharan Africa

Generally speaking, studies conducted in sub-Saharan Africa in relation to factors that relate to instructors' use of ICT in the teaching-learning process are relatively rare. Hennessy and associates (2010) conducted a literature review on factors that relate to teachers' ICT use in the teaching learning process in Sub-Saharan Africa. They identified that access to electricity, ICT infrastructure, language of instruction, geographic factors such as country size, demographic factors such as population, pedagogical factors such as pedagogical knowledge, educational factors such as level of teacher education and access to professional development are major factors that affect teachers' use of ICT in the teaching-learning process.

Obiri-Yeboah and the associates (2013) conducted a study in tertiary institutions in Ghana about factors affecting ICT adoption. The study utilized a mixed methods approach in which questionnaires and semi-structured interviews were used as data collection instruments. They concluded from their study that perceived usefulness and ease of use were the primary factors driving ICT adoption. They also found in their study that inadequate infrastructure and inadequate skill to use ICT were barriers to integrate ICT in the teaching-learning process.

Though the researchers claim that they had used a mixed method approach, it can be clearly seen from the report that the analysis method that the researchers employed was descriptive

statistics. Mean and standard deviation were the only analysis methods used in the study. These simple statistical methods are not sufficient to describe factors that affect the adoption of ICT in a higher education institution. Nothing was said about the validity and reliability of the instruments used in the study.

Another study in Ghana by Buabeng-Andoh and Totimeh (2012) investigated secondary school teachers' use of computer technologies in classrooms. The researchers used descriptive statistics, multivariate analyzes of variances, independent samples t-tests and multiple regression for data analysis. Only self-reported questionnaire was used as a data collection instrument which exposes it to response bias and validity threat. The study revealed that there was no difference in the innovative use of ICT between female teachers and male teachers. Other studies also revealed that gender variable was not a predictor of ICT integration into teaching (Norris, Sullivan, Poirot & Soloway, 2003).

Buabeng-Andoh and Totimeh (2012) also indicated in their report that teachers with more years of teaching experience seem to use ICT more frequently to transform their teaching. The researchers contend that their result was in agreement with Russell, Bebell, O'Dwyer, and O'Connor, (2003) who had found that new teachers who were highly skilled with technology more than older teachers did not incorporate ICT in their teaching.

Buabeng-Andoh (2012) conducted similar study in the Ghanaian Second-Cycle Schools and the study revealed that there was a substantial positive correlation between teachers' ICT competences and ICT use. The data collection instrument employed by the researcher was a self-report questionnaire which is not free of self-bias unless it is supported by other data collection instruments. However, the findings are in line with other research findings (Pelgrum, 2001; Ihmeideh, 2009; Berner, 2003).

Buabeng-Andoh's (2012) study also revealed inverse correlation between ICT use, age and teaching experience. This partly contradicts his own study (Buabeng-Andoh & Totimeh, 2012) which claims that teachers with more years of teaching experience seem to use ICT more frequently to transform their teaching. Baek, Jong and Kim (2008), in Buabeng-Andoh (2012) also claimed that experienced teachers are less likely to integrate ICT into their teaching.

Similarly, in United States, the U.S National Centre for Education Statistics (2000), in Buabeng-Andoh (2012), reported that teachers with less experience in teaching were more ready to integrate computers in their teaching than teachers with more experience in teaching. On the other hand, a qualitative study by Granger, Morbey, Lotherington, Owston and Wideman (2002) found no relationship between teachers' teaching experience and experience in the use of ICT. This shows that literature yields mixed result about the association of teaching experience with ICT use.

Buabeng-Andoh's (2012) finding of the negative correlation between age and ICT use also contradicts Jegede's (2009) finding which revealed that age was not a factor when considering ICT use, skills and time spent using ICT devices by teacher educators in Nigeria. This also shows that body of literature yields mixed results about the association of age and ICT use.

Olaniyi Alaba Sofowora (2012) conducted an exploratory study in Nigerian schools using questionnaire as data gathering instrument. One of the objectives of the study was to determine factors or challenges affecting the integration and diffusion of ICT in education. The finding of the research revealed that techno-phobia (extreme fear of technology), lack of commitment on the part of the government, and epileptic electric power supply were the challenges facing the utilization and diffusion of ICT in education in Nigeria. This is in line with the findings of other researchers. For example, referring to earlier research findings, Goetze and Stansberry (2003) contend that barriers to using technology in instruction include factors like techno-phobia, fear of and resistance to change, and frustration with new, difficult, and unreliable technologies.

A study by Johnston, Begg, and Tanner (2013) from South Africa classified factors that influence the adoption of Open Source Software in Western Cape schools as positive influences and negative influences. The researchers conducted in-depth interviews with senior staff in the Department of the Premier, and the Department of Education, as well as users at school level. The interviewees were totally thirteen. The researchers used thematic analysis to identify themes and patterns in the data. The research was not intended to make generalization but to provide some awareness about the factors that may have impact on the adoption of open source software. The researchers found in their study that cost, performance and positive

attitudes were positive influences and incompatibility, lack of resources and time, and lack of support were inhibitors to the adoption of Open Source Software.

A study conducted in Zimbabwe by Chitiyo and Harmon (2009) also identified lack of resources, both hardware and software, and the lecturers' own lack of preparedness to integrate technology as hindering factors to the integration of ICT in pre-service teacher education in Zimbabwe. Chitiyo and Harmon (2009) also identified absence of an ICT integration policy framework, lack of funding and the lack of appropriate initial and continuous staff development as constraints to technology integration in pre-service teacher education in Zimbabwe. Chitiyo and Harmon used a qualitative research method in this study.

A cross-sectional and correlation study was conducted in two public institutions in Uganda by Moya, Musumba, and Akodo (2011). The researchers used cross-sectional survey design. They used questionnaire and observation as the key data collection methods. The study investigated the effect of management attitude on integration of ICT in classroom environment. The findings of their study revealed that positive attitude and support by the management positively affect integration of ICTs in the teaching and learning process. This is in line with other findings which have shown that the commitment and interest of the management is the most critical factor for successful integration of technology in schools (Blair & Madigan, 2000; Epper, 2001).

A similar study was conducted at Addis Ababa University by Tibebu, Bandyopadhyay and Negash (2009). They conducted a descriptive survey study, semi-structured interview and document analysis. These researchers used a situational modified version of Tearle's model (2004). Tearle (2004) identified three categories of factors that may have impact on pattern of ICT using in the teaching and learning processes. The first category includes the whole school characteristics or organizational factors. The second category contains the nurturing environment. The third category contains individual factors.

Tibebu and the associates (2009) found that lack of resource and time, lack of pedagogical support, inadequacy of pre-service ICT training and lack of students' ICT skill were the major barriers to integrate ICT in the teaching-learning process. One drawback that can be seen in this study is that the researchers excluded some factors, such as organizational factors and

subjective norms that could have strong impact on instructors' use of ICT. They claim that they did this deliberately because they clearly understood that during the time of their study, ICT was not integrated in the teaching-learning process at Addis Ababa University (AAU), and, hence, they thought that it was not worthy to study the effect of organizational and social factors (subjective norms) on pattern of ICT use. However, researchers in the area agree that the study of ICT usage requires the study of a combination or network of factors within a particular environment (Zhao & Frank, 2003).

In general, almost all previous researches in Sub-Saharan Africa put their focus on factors that are related to ICT use in the teaching-learning process, not on factors related to how ICT is used in the teaching-learning process. Other studies in Sub-Saharan Africa in relation to ICT in education focused on level of penetration of ICT in the teaching-learning process (for example, Bass, 2010). This could be attributed to the fact that most Sub-Sahara African countries are at early age in introducing ICT in their education system due to their relatively poor economy and lack of budget to deploy ICT infrastructure in their education institutions (Hennessy et al., 2010).

One more thing that can be observed from the studies conducted in Sub-Saharan Africa is that majority of the studies focused either on context-related factors, on demographic factors, on technology-related factors, or on the combination of the three categories. Chitiyo and Harmon (2009) agree with this by stating that the "review of the limited literature in the African context reveals a focus or emphasis on external (first-order) barriers…" (p.813). This means that the influence of instructor-related variables on pattern of ICT use in the teaching-learning process has not been studied well in Sub-Saharan Africa. However, as ICT integration is part of educational reform and innovation, it should take into account teachers' knowledge, skills, beliefs, and attitudes (Shahan, 1976; Fullan, 1991; Cuban, 2000).

Research findings in different countries have also witnessed that while the conditions like access to technology, moderately trained teachers, and a favorable policy environment are in place, integration of ICT in the teaching-learning process has remained low (Ertmer, 2005). Research tells that successful integration of ICT requires a holistic approach that addresses all the variables (Dexter & Anderson, 2002).

II. Previous research in America, Europe and Asia

One of the long-scale studies that were conducted in USA that could provide a good insight on factors related to ICT use in the teaching learning process is a study of the Apple Classroom Of Tomorrow (ACOT) project. The primary objective of the project was to examine how the routine use of ICT influences teaching and learning (Niederhauser & Stoddart, 2001).

Research findings based on 10 years of data gathered from the Apple Classrooms of Tomorrow (ACOT) project posit that teachers' pattern of ICT use changes as they spend more time with ICT. As it is depicted by Sandholtz et al. (1997), the ACOT project, which lasted approximately ten years beginning in 1985, involved 5 school districts from various areas in the country with a variety of socio-economic levels and student ages. The selected classrooms were provided with a computer for every student and teacher to use in the classroom and another computer to use at home. According to Sandholtz and the associates (1997), teachers transformed their classrooms and their roles as teachers as they routinely used ICT.

Based on the findings from the ACOT project, Sandholtz and associates (1997) argue that ICT has the power to shift classrooms toward student-centered teaching rather than curriculum-centered teaching, collaborative tasks rather than individual tasks, and active rather than passive learning. They concluded from their study that the teachers were not only learning to teach with technology, but truly undergoing a paradigm shift in their teaching philosophy and beliefs. The project suggests that as teachers progress through different stages in ICT use, they gradually replace their traditional beliefs and practices with new ones, provided that their working environment is supportive (Dwyer, Ringstaff, & Sandholtz, 1997).

Contrary to what has been reported by the ACOT project, other studies show that the use of ICT alone does not lead to change in pedagogical belief. Tondeur et al (2008) posit that the presence of ICT alone do not automatically initiate shift in teachers' pedagogical beliefs from traditional beliefs towards constructivist beliefs.

The other study that was conducted in USA in relation to factors influencing pattern of ICT use is the one by Cheryl Franklin (2007). Franklin (2007) conducted a quantitative study to examine the ways elementary teachers integrate ICT for instructional purpose and the factors

that influence their uses. The research was conducted on recent graduate teachers who didn't have long year of teaching experience. One interesting feature of this study is that it examined not only how much teachers use ICT but also in what ways teachers use ICT as well as the factors that influenced the way ICT was used. The researcher tried to measure the influence of four factors on teachers' use of ICT. These factors were: access and availability of ICT, teachers' preparation and training, leadership, and time.

The finding of Franklin's (2007) research showed that teacher preparation, teacher philosophy, and grade level were the main influential factors in the use of ICT in elementary classrooms. Franklin (2007) used both descriptive and inferential statistics for data analysis. The researcher also found that too much curriculum to cover, lack of time, and high stakes testing were barriers to technology integration. Moreover, leadership, access and availability, incentives, personnel support, and external constraints (barriers over which the teacher has no or little control) were found to be factors that influenced ICT integration. Franklin (2007) explains that the number of respondents in the survey study was less than 121. This makes it difficult to make generalization based on the evidence that is obtained from less than 121 respondents.

Keengwe, Kidd and Kyei-Blankson (2009) conducted a qualitative research at a large Mid-southern public university in USA which has seven colleges and provides both students and faculty with state-of-the-art technology resources and support services. Totally 25 participants from various disciplines including academic and technology leadership positions participated in the study. The qualitative analysis helped to identify four major themes: organizational support, leadership, training and development, and resources. Their finding revealed that well-defined policies, departmental and peer support, cross collaboration with other faculty using technology, rewards program, organizational support, strong and supportive leadership, well articulated mission, vision, and goals of such technology initiatives, training and development, availability and quality of resources, availability of time, and funding are enabling factors for technology adoption in the teaching-learning process by faculty members. The drawback with this research is also that the results cannot be generalized to other population.

The other American well known scholar in the area, Peggy A. Ertmer (1999) described barriers to technology integration as first order (external) and second order (internal) barriers. She identified lack of access to ICT, insufficient time to plan instruction, inadequate training, and inadequate technical and administrative support as external barriers; and beliefs about teaching, beliefs about ICT, established classroom practices, and unwillingness to change as internal barriers. In this article she discussed strategies to overcome these barriers. In the same year, Ertmer, et al. (1999) conducted a qualitative study on seven female teachers using a short survey, semi-structured interview and observation data to explore their perception regarding how and why they used ICT and also to identify their perceived barriers. The study revealed that resource and time were barriers for ICT integration.

Ertmer (2005) also examined the relationship between teachers' pedagogical beliefs and their technology practices. She discussed the influence of contextual factors such as social pressure for the inconsistent relationship between pedagogical belief and practice with ICT in the teaching-learning process. The influence of social pressure is supported by Crisan (2004) who conducted a case study on seven secondary school mathematics teachers and found that the use of ICT by teachers is influenced by the sharing of teaching and learning experiences among colleagues.

Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012) conducted a study on K-12 teachers about the correlation of teachers' pedagogical belief and their attitudes & beliefs about the relevance of ICT with their pattern of ICT use. They found that teachers' existing attitudes and beliefs toward technology as well as their current levels of knowledge and skills are the strongest barriers preventing them from using technology. These are congruent with other research findings (Van Braak, 2001; Albirini, 2006; Goktas et al, 2009; Buabeng-Andoh, 2012).

Van Braak (2001) examined individual characteristics influencing teachers' class use of computers. He conducted his study in secondary schools in Brussels. The subjects of the study were 236 secondary school teachers who were familiar with computers. For this study, Van Braak assumed a distinction between attitudes toward computers in general and attitudes toward computers for educational purposes. He measured the relation of age, gender, teaching

a technology-related subject, general computer attitude, attitude toward computers in education, technological innovativeness, and general innovativeness with class use of ICT. He found that all factors except age significantly related to classroom use of ICT.

Using logistic regression analysis, Van Braak found that technological innovativeness (personal innovativeness in the domain of ICT), teaching a technology-related subject, and computer experience accounted for more variation in explaining the use of computers in the class than the computer attitude scales, general innovativeness, age, and gender. The relation of personal innovativeness in the domain of ICT with teachers' use of ICT in the teaching-learning process is also supported by other studies. For example, Fabry and Higgs (1997) noted that ''innate dislike for change'' can be a barrier to ICT use in the teaching-learning process (p. 13). Richard Keith Rogers and J. D. Wallace (2011) also found significant relationships between innovativeness and technology integration in teacher education.

Van Braak, Tondeur, and Valcke (2004) studied factors that had relation with classroom use and supportive use of ICT. The study was conducted in primary schools in Belgium. They included 349 females and 119 males in their study. All teachers in the sample were familiar with ICT use. The instruments that they employed in their study were developed by adapting items from previously used instruments to assess attitudes toward computers and technological innovation attributes. The finding of their study revealed that technological innovativeness and gender were the strongest predictors of ICT use in the teaching-learning process. The researchers found that there was significant correlation between class use of ICT and the independent variables, that is, gender, the computer experience variables and the three attitude measures (personal innovativeness, attitude toward the educational use of ICT, and general attitude toward ICT). They found no correlation between age and class use of ICT.

Dominik Petko (2012) used the 'will, skill, tool' model to study the relation of teachers' pedagogical beliefs with their use of digital media in classrooms. Subjects of the study were 357 Swiss secondary school teachers. Petko's (2012) finding revealed significant positive correlations between will, skill, and tool variables and the combined frequency and diversity of ICT use in teaching. A multiple linear regression model was used to identify factors that affect ICT use. The significant factors identified were: teachers' perceived competence in ICT

use, availability of computers, perceived potential benefit of ICT for students' learning, and constructivist teaching arrangement. The researcher acknowledged the limitation of his study which relied on self-report data. He also admitted the narrowness of the scope of his study which is limited to the will (belief in benefit of ICT), skill (perceived competence in ICT use), tool (availability of ICT) model.

Rastogi and Malhotra (2013) conducted a two-phase study in India to examine teachers' attitude towards ICT; level of their competence in ICT skills; their experiences with ICT; and how best they use ICT in the teaching-learning process. The researchers used a mixed methods approach. They used questionnaire and semi-structured interview as data collection tools. In the first phase of the study, the researchers used questionnaire to collect data about teachers' attitude towards ICT, their competence in ICT use, and how they use ICT in the teaching-learning process.

In the second phase of the study, the researchers conducted a semi-structured interview to "re-affirm and authenticate data collected through Technology Use Questionnaire" (Rastogi & Malhotra, 2013: p.306). Their study revealed that teachers' ICT knowledge and skills as well as their positive attitudes toward ICT play a strong role for effective utilization of the potentials of ICT in the teaching-learning process. This is in line with the findings of Drent and Meelissen (2008) who found in their study that teacher's positive attitude towards computers has a direct positive influence on the innovative use of ICT by the teacher. However, the study of Rastogi and Malhotra (2013) is limited to examining the relations of attitude and ICT competence with teachers' use of ICT. In fact, literature tells us that there are a number of factors that influence teachers' pattern of ICT use.

2.5. Conclusion

It can be seen in this review that more than fifty factors have been identified as variables that have relation with teachers' use of ICT in the teaching-learning process. It can also be seen from the review that factors which are major predictors of ICT use in one context may not be predictors of ICT use in a different context. The major challenges for ICT integration in one country may not be challenges at all in another country. The other conclusion that can be drawn from this literature review is that, unlike the studies in developed countries, studies in

Sub-Saharan Africa have focused on context-related factors such as access to ICT, availability of infrastructure, and technical and administrative support. This may be attributed to the fact that countries in the Sub-Saharan Africa are still struggling to equip their educational institutions with ICT facilities. It appears that in developed countries studies are focusing on teacher-related variables. This could be attributed to the fact that developed countries have addressed the issue of access and teachers' preparedness in ICT competence.

One common feature that one can draw from the studies conducted in both the developed and the developing countries is that majority of the researches were conducted at school level. There are only few studies that have focused on the factors associated with the integration of ICT in higher education institutions. Concerning the methodological approaches employed in these studies, majority of the researches were quantitative by their nature. There are also few qualitative researches that tried to examine factors that are related to teachers' use of ICT in the teaching-learning process. There are only a few studies that have employed a mixed research approach. Studies related to the relation of age, pedagogical belief, and teaching experience with pattern of ICT use appeared to have shown contradicting results. These could be attributed to cultural influences or the method employed in conducting these studies.

Generally, it can be seen from review of previous studies that some areas of research on ICT integration have focused on measuring teacher characteristics, such as teachers' pedagogical beliefs (Ertmer et al, 2007), teachers' computer attitudes (Albirini, 2004; Dementrias, et al., 2003), teachers' innovativeness (Roehrich, 2004; van Braak, 2001) and gender differences (Shapka & Ferrari, 2003; Volman, van Eck, Heemskerk, & Kuiper, 2005). Other research areas have focused on institutional factors such as availability of ICT tools and access to these tools, and support provided (Franklin, 2007; Goktas, Gedik, & Baydas, 2013). These studies largely ignored the complex nature of ICT integration in the teaching-learning process.

The current study tried to consider the association of instructor-related variables, perceptual factors, context-related variables, and demographic variables on pattern of ICT use to get holistic picture of the influential factors on ICT integration in the teaching-learning process by employing a mixed methods research approach.

CHAPTER THREE

METHODOLOGY

This chapter restates the purpose and research questions; presents the philosophical foundation for choosing a mixed methods research approach; examines the rationale for using mixed methods research as a methodology; describes the research design; states the reasons for selecting the study site; explains the selection of participants & respondents and the sampling techniques; describes the data collection methods and procedures; and deals with the development and modifications of the survey instruments. It also deals with pilot testing and validation of the survey questionnaire; describes how data from qualitative and quantitative strands of the study are mixed and interpreted; deals with ethical issues; and finally, makes a link between this chapter and the forthcoming chapters.

3.1. Introduction

The purpose of this study was to explore instructors' patterns of ICT use in the teaching-learning process and to examine what factors influence such patterns of ICT use. A mixed methods approach was used in this study to answer the following research questions:

1. *How do instructors use ICT in the teaching-learning process?*
2. *Why do instructors use ICT the way they use it?*
3. *Which of the anticipated explanatory variables have the strongest significant contribution in explaining variance in instructors' patterns of ICT use in the teaching-learning process?*

The first research question is an exploratory qualitative research question. The second research question is a mixed method research question. The third research question is a confirmatory quantitative research question. Inherent to the third research question are the following sub-questions:

a. *What is the degree of association of the anticipated explanatory variables with instructors' patterns of ICT use (ICTU)?*

b. *How much of the variance in patterns of ICT use can be explained by the independent variables in this study?*
c. *What are the most significant explanatory variables to instructors' Patterns of ICT use?*
d. *What model can be suggested to explain variation in instructors' patterns of ICT use?*

3.2. The Research Approach and Its Philosophical Foundation

A mixed methods research approach was used in this study. Generally, any research needs a foundation for its inquiry, and researchers need to be aware of the perspectives they bring to their studies (Grix, 2004). Creswell (2009) posits that making philosophical assumption explicit will help to explain the reason of a researcher to choose a qualitative, quantitative or mixed method design. The philosophical foundation for this study is based on the pragmatic worldview as outlined by Creswell and Clark (2011). According to them, mixed methods research as a methodology follows a pragmatic paradigm which serves to give direction to the data collection and analysis as well as the mixing of qualitative and quantitative approaches in different phases of a study (Creswell & Clark, 2011).

Advocates of mixed methods research identify themselves with the pragmatic paradigm. They draw strong association with mixed methodology and pragmatism (Onwuegbuzie 2004; Bazeley 2003; Johnson & Maxcy 2003; Tashakkori & Teddlie 2003). Johnson and Onwuegbuzie (2004), argue that pragmatism offers middle position philosophically and methodologically and that it offers a method for selecting methodological mixes that can help researchers better understand and be able to answer many of their research questions.

According to pragmatists, what is right is what functions (Poller, 2006). Cresswell (2009) contends that central to the pragmatic perspective is that the focus lies on the problem rather than the research approach. According to Tashakkori and Teddlie (2003a), pragmatism gives primary importance to the research question than either to the method or to the philosophical worldview that underlies the method. Morgan (2007) and Patton (1990) also contend that the pragmatic world view focuses on the research problem and on the use of pluralistic approaches to derive knowledge about the problem. In general, pragmatists argue that the most

important determinant of which position to adopt is the research question/s (Creswell & Clark, 2011; Saunders et al., 2009). The research questions in the current study are of three types: exploratory, mixed methods and confirmatory questions. As a result, the philosophical perspective adopted by the current research is that of a pragmatic approach which allows the use of pluralistic approach to address these research questions.

3.3. Rationale for Using Mixed Methods Research

As explained above, pragmatism as a world view provides the alternative that choosing between one philosophical position and the other is somewhat unrealistic in practice; and it recognizes that the most important determinant of which position to adopt is the research question (Creswell & Plano Clark, 2011). Flyvbjerg (2011) contends that a good research makes use of the methodology which best helps to answer the research questions at hand. Thus, the rationale for using a mixed methods approach in this study was the presence of three types of research questions that entailed a pluralistic approach to address them.

The first research question is a qualitative exploratory research question and it requires the use of a qualitative method. The second research question is a mixed methods research question which requires the use of both qualitative and quantitative methods. The third research question is a confirmatory research question which can appropriately be addressed by a quantitative method. Neither the qualitative nor the quantitative method separately can address the research questions raised in this study. By combining both qualitative and quantitative methodology, the investigator was able to build on the strengths and make up for the weaknesses in the other so as to address those three research questions (Creswell & Clark, 2011).

The following figure shows schematic representation of the research method based on the objectives of the study and the research questions.

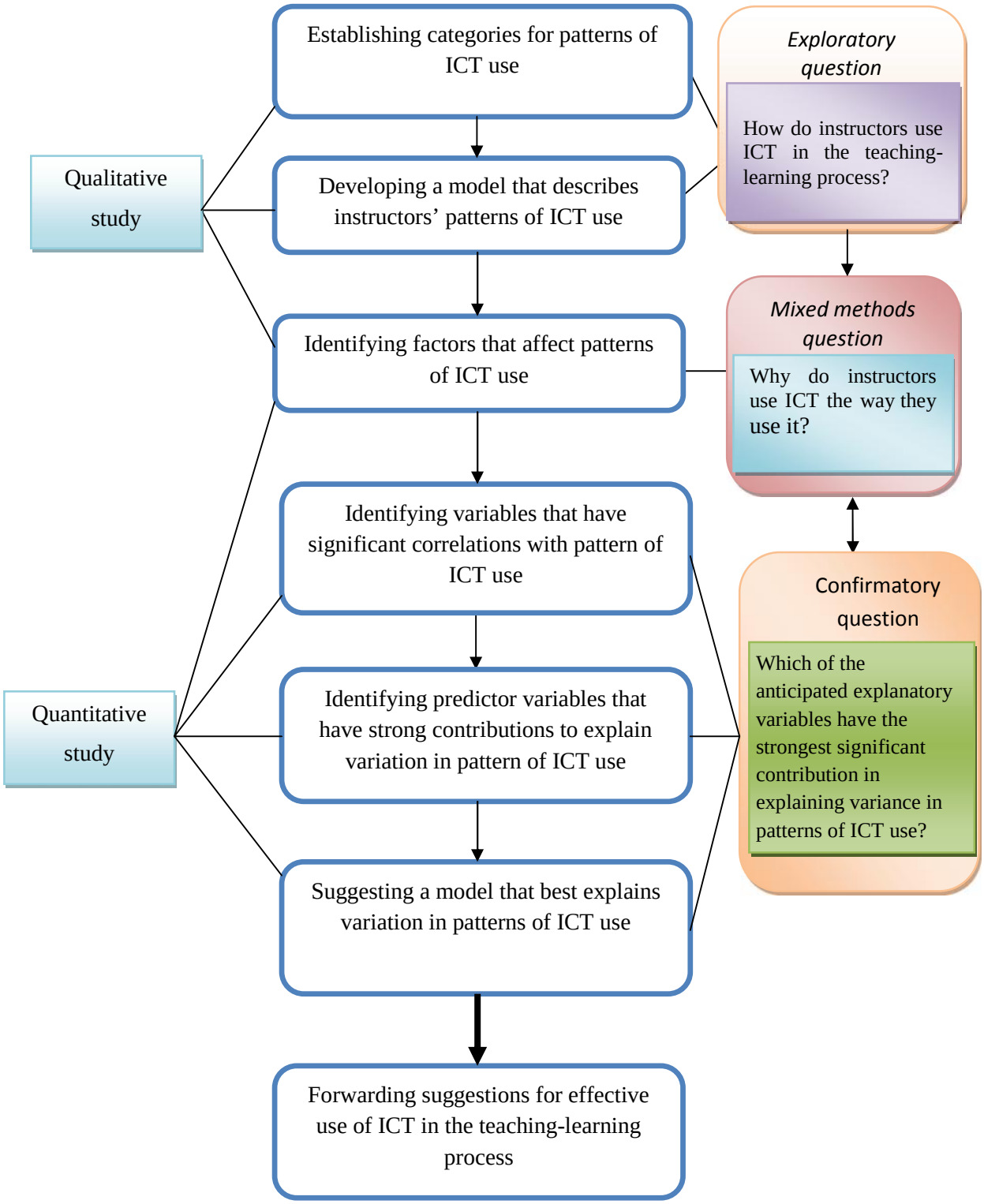

Figure 4: Schematic Representation of the Research Method

3.4. The Research Design

A research design serves as a plan that guides the researcher to connect the empirical data to the study's research questions, and ultimately, to answer the research questions that were set to guide the study (Yin, 2009). Several mixed method design types have been developed by mixed research methodologists (Creswell & Clark 2011; Mertens 2005; Morse 2003; Tashakkori & Teddlie 2003). Creswell and Clark (2011) identified four major design types in mixed methods research: the convergent parallel design, the explanatory sequential design, the exploratory sequential design, and the embedded design. They describe a sequential design as beginning with either a quantitative or qualitative methods phase and then using the resulting data to inform the second phase.

Exploratory Sequential Design is a design type which starts with the collection and analysis of qualitative data followed by the collection and analysis of quantitative data. It is conducted in two phases. The first phase involves qualitative data collection, and the second phase involves quantitative data collection. The purpose of this research design is to use the findings of the qualitative study to develop instruments for the quantitative study, and also to use the quantitative data to test or generalize the findings of the qualitative study (Creswell & Plano Clark, 2007; Teddlie & Tashakkori, 2009).

This study used the Exploratory Sequential Design, taking one public university as a study site. The exploratory sequential design enabled the investigator to obtain themes and specific statements from participants in the qualitative study, and then to use these statements as specific items and themes for scales to enrich the preset survey questionnaire. This type of research design is chosen when a researcher needs to develop an instrument because existing instruments are inadequate or not available (Creswell, 2009). The reason for the selection of this design type was, therefore, to explore new categories for patterns of ICT use and also to identify additional contextual variables that have association with instructors' pattern of ICT use and then to explain which of the anticipated variables influence pattern of ICT use more significantly.

The general framework of the procedure employed in this study is shown in the following diagram.

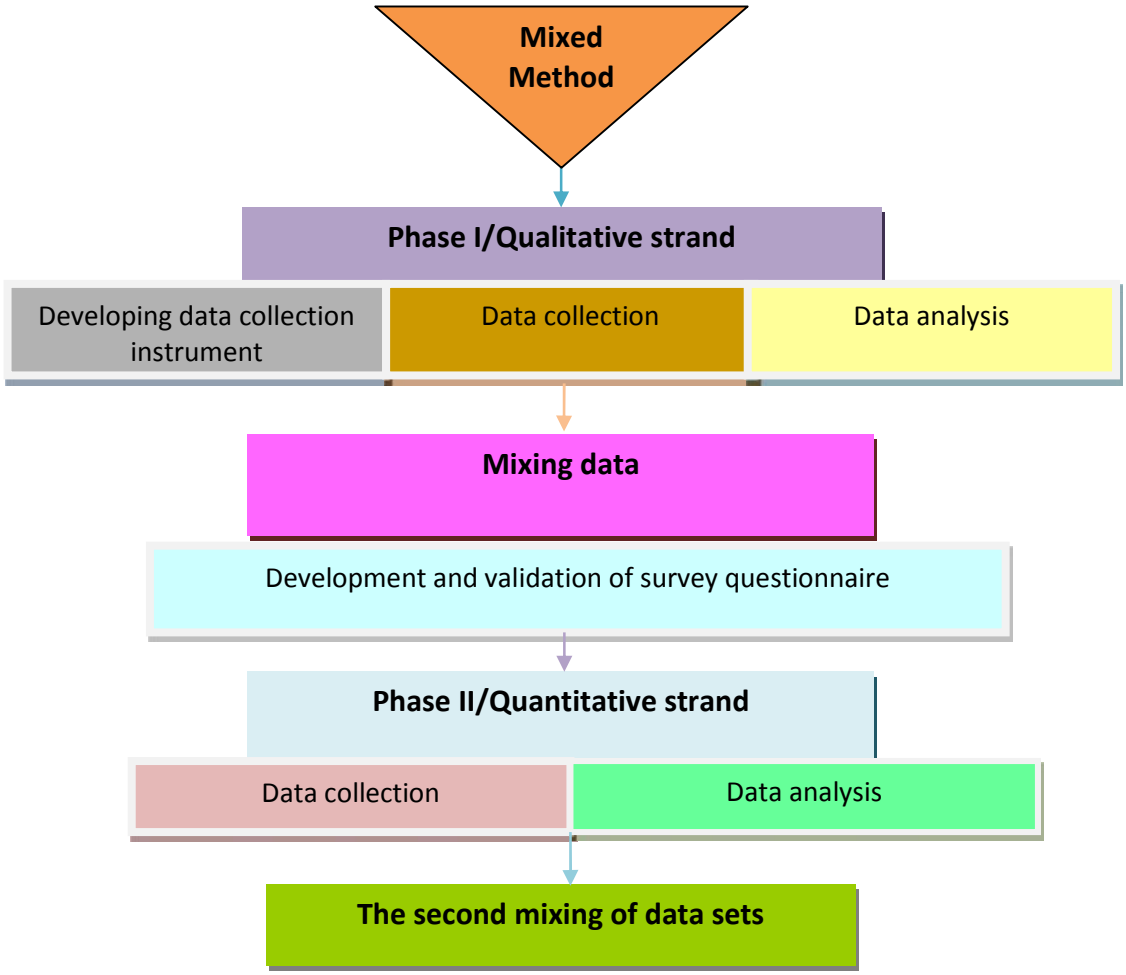

***Figure 5: General Framework of the Research Design** (adapted from Creswell & Clark, 2011)*

3.5. Selection of the Study Site

Before deciding where to conduct the study, a preliminary analysis was conducted by the investigator about the status of public universities in Ethiopia in terms of ICT expansion. The preliminary analysis revealed that Jimma University was the most appropriate site to conduct the current study. This decision was reached based on the evidence obtained from a team of instructors and ICT staff from Dilla University who visited public universities in Ethiopia for experience sharing. The team reported that Jimma University was the best in its ICT facility as compared to the other public universities in the country. Informal interview with members of

the team including the former Dilla University ICT coordinator, who also visited Jimma University for experience sharing, also revealed that the University was the first in the country in establishing and using smart class rooms. Conducting a research on how ICT is being used in the teaching-learning process in an institution where ICT has not been well expanded makes a research practice futile. As a result, the option left was to select Jimma University as a study site for the current research.

3.6. Sampling Techniques and Description of Participants & Respondents

3.6.1. Sampling Techniques for the Qualitative Study

The participants in the qualitative study phase were Jimma University instructors, the Vice President for Academic Affairs, and Representative of the ICT Directorate, amounting to sixteen participants. Totally 14 instructors from five colleges and two institutes were selected for interview by using purposive sampling technique. The selection was made on the basis of college diversity, seniority (one senior instructor and one junior instructor from each college/institute) and age (one below 30 years old and one above 40 years old from each college/institute) to get maximum variation in perspectives and views. Initially two instructors were selected from each college/institute were interviewed, theoretical saturation of data was reached. Therefore, interviewing additional instructors was found to be unnecessary. The Vice President for Academic Affairs and the Representative of the ICT Directorate were also selected purposively with the assumption that they could provide relevant information because of the positions they held.

3.6.2. Sample Size and Sampling Techniques for the Quantitative Study

The respondents for the quantitative study phase were selected from among instructors of Jimma University. Concerning sample size in regression analysis, Stevens (2002) suggests a ratio of 15 subjects for each predictor variable. This study consisted of 12 predictors and according to Steven, 180 subjects were required. However, taking into account the probability of less than 100% return rate and the possibility of receiving incomplete questionnaires, larger sample size was used than what was recommended by Stevens (2002). Consequently, 300 subjects were selected using proportional stratified sampling technique from all the colleges and institutes in the University with the intent of widening the chance of involving instructors

across the University. Once the strata (colleges or institutes) were identified, sub-samples were taken from each college/institute proportionally to their sizes in the population of instructors in the University. First a sample was conveniently picked up from the list of instructors in the college/institute and picking up a sample continued with a fixed interval in the list until the proportionate number of sample size was obtained. Since the data collection time accidentally coincided with the exam time, some of the instructors who were randomly picked up to be included in the sample were not available. As a result, among those instructors who were available, some of them were randomly picked up from the list and included in the sample so as to keep the proportion.

3.7. Methods and Procedures of Data collection and Analysis for the Qualitative Strand

3.7.1. Data Collection Instruments for the Qualitative Strand

The purpose of the qualitative study was to explore instructors' patterns of ICT use and to identify instructor-perceived variables that affect such patterns of ICT use. Realizing this purpose required the use of in-depth semi-structured interview and unstructured observation to get insight about the level of ICT penetration, how ICT was used in the teaching-learning process, and why instructors used ICT the way they used it. These two data collection methods, the in-depth semi-structured interview and unstructured observation, were also used to address internal validity issues.

3.7.2. Data Collection Procedures for the Qualitative Strand

An ethical approval was obtained from the Vice President for Academic Affairs and the Deans of Colleges/Institutes of Jimma University in order to conduct the interviews. Prior to conducting any interview, participants were provided with a consent form describing the objectives of the study, participants' roles and their rights to remain anonymous, to freely participate in the research, to refuse to participate or to withdraw at any time (See the consent form in Appendices A, B, and C).

Then, semi-structured interviews were conducted to create an atmosphere where each participant can speak more openly than they would if the investigator used a structured

interview (Silverman, 2006). The use of semi-structured questions also enabled the investigator to guide the interview and keep participants focused, unlike an open-ended interview where participants are free to speak to a broad range of topics (Silverman, 2006). Each participant was interviewed separately and the interviews occurred at a time and place chosen by the participant. This process of allowing participants to have control over the time and place of an interview increased the investigator's rapport with each participant (Creswell, 2003).

Each interview lasted for approximately an hour. Each interview was digitally recorded and transcribed by the investigator in an effort to better understand the data. The investigator was also taking short notes while recording each interview. The transcription of each interview was done repeatedly to make sure that no relevant information was left unused (See the interview protocol in Appendix D).

An attempt was made to utilize member-check to increase trustworthiness by providing each participant with a hard copy of the transcript to confirm whether or not their responses were correctly recorded (Silverman, 2006). In fact it was difficult to get the participants to revise the transcript since it was exam time and some of the instructors left the compound after they finished giving exams. Only six interviewees were available and volunteered to revise their respective transcripts. This member-check took place within a week after the interviews were conducted.

Unstructured observation was conducted after obtaining permission from the responsible persons such as the Students' Service Team Leader and the Smart Classroom Supervisors. The unstructured observation strategy was employed in this study to perform three tasks: (i) to get insight about the available ICT facilities in the University, (ii) to see if instructors and students have access to these facilities, and (iii) to understand how instructors use these facilities in smart classrooms. The observation was conducted in smart classrooms, computer laboratories, computer rooms around students' dormitories, in the libraries, and in the compounds outside the classroom. Data obtained through observation was also used to triangulate the interview data which enhanced internal validity of the qualitative data.

3.7.3. Method of Data Analysis for the Qualitative Strand

The method of data analysis used in the qualitative study was thematic analysis. Thematic analysis is a process of encoding qualitative data in such a way that researchers review their data, make notes and begin to sort it into categories (Boyatzis, 1998). The data captured through audio records was transcribed for repeated readings and the field-note was scrutinized. The transcription of the audio data and the scrutiny of the field-note was done every evening after each interview was conducted and observation notes taken.

The thematic analysis began with repetitive readings of each field-note and transcription in order to be familiarized with the data and to grasp the participants' expressions and meanings in the broadest context (Emerson et al, 1995). Selection of a research setting which was new to the investigator partly helped him to 'control' researcher bias.

The data obtained from the qualitative strand was examined by isolating and extracting significant statements from field-note and interview transcripts. These statements were then used to create meaning units, which were clustered into common themes (Schram, 2006; Moustakas, 1994). The clustering was done twice before developing the final themes. After establishing the themes, a data reduction process was carried out to eliminate redundant meaning units in an effort to create a manageable set of data to use when developing thematic descriptions (Moustakas, 1994).

Organizational categories such as 'instructor related variables' were used to organize those variables which were known in literature. Teaching level where the instructor teaches (graduate or undergraduate) and instructor-perceived readiness of students to use ICT were new variables that emerged during the qualitative study as variables that affect patterns of ICT use. New categorical names were given to these variables. These organizational categories were used as section headings in presenting the results of this qualitative phase. These steps of organizing the data helped to sort the data for further analysis. In addition to the organizational categories used as section headings, substantive categories, such as 'ICT as a negative influence', or 'ICT as an opportunity' were used to describe participants' conceptions or beliefs.

Trustworthiness of qualitative studies is questioned when transcription is overlooked and some scholars recommend to include transcripts of the raw data in a research report. Transcripts are thought to be used not only for analysis but also as evidences of that analysis (Duranti, 2007). The process of doing transcription involves deciding on what is to count as relevant for the purposes of the project being conducted, and filtering out and emphasizing particular features of the data rather than others. It is not simply writing down what someone or some people said or did; it involves making analytic judgments about what to represent and how to represent it, and choosing to display or focus on certain features of a piece of talk. Therefore it was deemed important to include the most relevant transcripts of the raw data here.

The initial transcription of the audio data was checked by the investigator after each individual interview was transcribed. The whole transcription of the audio data took 32 pages. As a result, only the most relevant transcripts which were directly related to the research questions were extracted and presented in the appendix part (See Appendix L). Some of the transcripts which were found to be repetitive were not included in this report. The transcriptions and field notes have been kept in a securely locked cabinet.

A Microsoft Word document was created for three transcription documents (one for interview related to instructors' perception and two for each interview related to the two research questions that were addressed by the qualitative strand of the study). Each interviewee had been assigned a code to protect their identity, and these codes were used in the transcripts. After completing the transcription process, the Word documents were printed. They were each read and coded for keywords.

Codes were placed wherever participants discussed topics that were relevant to the research questions. Similar or repeating topics were identified by the same code in multiple places. The coded words and phrases were indicated by using shading in a computer. After the coding process was complete, a list of the codes was made. The coding process and the categories are discussed in chapter five.

3.8. Mixing Data

Following the data analysis for the qualitative strand, it was necessary to complete a separate step before continuing on to the quantitative strand. This step, known as mixing the data in mixed methods research (Creswell & Clark, 2011), is a process of relating the two separate data sets. In order for a study to qualify as mixed methods, the data from both qualitative and quantitative methods must be mixed at some point during the study. Creswell and Clark (2011) identify three ways to mix the data to provide the investigator with a clearer understanding of the problem: Merging or converging the two datasets by actually bringing them together, connecting the two datasets by having one build on the other, or embedding one dataset within the other so that one type of data provides a supportive role for the other dataset.

The data for this study were mixed at two separate points, the first of which followed the qualitative strand. This mixing connected the data from the qualitative strand with the data from the quantitative strand. It was done by using the results of the qualitative strand to create the survey questionnaire that was used in the quantitative strand. To complete this process, the investigator used the analyzed data from the qualitative strand as a guide to write or modify each survey item for the quantitative strand.

3.8.1. Development of Survey Questionnaire

At the heart of the link between the qualitative and the quantitative strands of this study, a survey questionnaire was developed to investigate the degree of association between instructors' patterns of ICT use and the variables that were anticipated to explain such patterns of ICT use in the teaching-learning process.

The survey questionnaire that was used in the current study consisted of nine sections. These included (i) demographic data related to teachers' age, teaching experience, experience in teaching ICT, and teaching level; (ii) teachers' level of personal innovativeness in the domain of ICT (PIICT); (iii) General attitude towards ICT (GAICT) and Attitude towards ICT in education (AICTE); (iv) Pedagogical belief (PB); (v) Competence in ICT use (CICT); (vi)

Instructor-perceived readiness of students to use ICT in their learning (RS); (vii) Course nature (CN); (viii) Contextual factors; and (ix) patterns of ICT use (ICTU).

Most of the scales used in the survey questionnaire were adopted from previous studies. Monette, et al. (2002) advise to employ already developed scales, tested and pre-tested for both validity and reliability, rather than merely attempting to independently manufacture such a measure. All the adopted scales were used after getting permission from the developers (See appendix L).

The 4-items PIICT Likert scale was adopted from Agarwal and Prasad (1998) PIIT scale to identify instructors' level of personal innovativeness. Instructors' pedagogical belief (PB) scale was adapted from Woolley et al. (2004). Both the General attitude towards ICT (GAICT) scale and Attitude towards ICT in education scale (AICTE) were adopted from Van Braak (2001). Competence in ICT (CICT) scale was adapted from Albirini (2006). Slight modifications were made on the adapted scales in such as way that the items fitted to the context of higher education in Ethiopia. While adapting the scales, some items were omitted and other new items were included. Such modifications were made based on the results of the qualitative strand and the pilot study.

Survey items for context-related variables (CF), instructor-perceived readiness of students to use ICT (RS), and patterns of ICT use (ICTU) were developed based on literature and the findings of the qualitative strand of this study. Demographic items such as instructors' age, level of teaching, teaching experience, and experience in teaching with ICT were also included in the survey questionnaire. An item that helped to detect instructors' perceptions about the nature of the course they teach in relation to ICT use (CN) was also included in the survey questionnaire.

3.8.2. Pilot Testing

The survey questionnaire was piloted to identify ambiguities, misunderstandings, or other inadequacies and also to assess the reliability and validity of the survey instruments. Backer (1994) noted that 10-20% of the sample size for the actual study is a reasonable number of

participants to consider enrolling in a pilot. Accordingly, the survey was pilot tested on fifteen instructors from Jimma University who were obviously not included in the final sample.

As a result, several valuable feedbacks were obtained from the pilot testing. These helped to reconstruct, delete, or modify some of the items. For example, one item "The course that I teach requires the use of ICT" was initially included in the CF items. But feedback revealed that this item had no relation with the other items in the CF. As a result, it was removed from the CF items.

Moreover, two items "I have access to computers and other ICT tools that are needed in the teaching-learning process" and "I have sufficient access to Internet in the university" were initially framed as separate items in the CF. However, feedback again revealed that these items be merged since they were conceptually the same. Hence, the two items were merged as" I have access to computers and other ICT tools and services like Internet that are needed in the teaching-learning process". There was also one item in the ICTU scale (item 3) which was initially found to be difficult for respondents to give one answer, but it was reframed in such a way that respondents can give only one answer.

3.8.3. Validation of the Survey Questionnaire

A questionnaire is considered valid if it actually measures what it is intended to measure (Churchill, 1979). There are several different types of validity (Polgar & Thomas 1995, Bowling 1997, Bryman & Cramer 1997). The most widely used groups of validity used in these types of research are content validity, face validity, and construct validity (Sekaran, 2003).

Content and Face Validity

Content validity refers to the evaluation of the extent to which a set of items reflects the content domain of the variable. It refers to expert opinion concerning whether the scale items represent the proposed domains or concepts the questionnaire is intended to measure. In other words, it refers to the extent to which items on a questionnaire adequately cover the construct being studied. Typically, it involves asking expert judges to examine items and judge the

extent to which these items sample a specified performance domain. Face validity measures the understanding and acceptance of questionnaire items by researchers and respondents.

In the current research, content validity and face validity of the scales were assessed by peer review. A panel of experts from the department of Curriculum and Instructional Supervision at Dilla University and one expert in measurement and evaluation reviewed the survey instruments for their content and face validity. Therefore, their comments were used to modify the items of the survey instruments. For example, some of the items on the PB scale that were meant for managers were proved irrelevant for instructors and thus removed.

Construct validity

Construct validity refers to how well the items in the questionnaire represent the underlying conceptual structure. Following the evaluation of content and face validity of the instruments, a statistical technique called exploratory factor analysis was performed to support the construct validity. Factorial validity is a form of construct validity that is established through a factor analysis. It refers to the clustering of correlations of responses by groupings of items in the questionnaire.

Factor analysis is a technique "used to discover patterns among the variations in values of several variables" (Babbie, 1990, p. 418), by determining how many factors to extract. In order to determine the construct validity of the constructs, an exploratory factor analysis was performed with SPSS 20.0. Since the questionnaire used in the current study was divided into 9 distinct sections that were not comparable to each other, and which also had different measurement scales, the factor analysis was performed separately for each section of the questionnaire. Factor analysis takes correlated items in a scale and recodes them into uncorrelated, underlying variables called factors. Factorial validity can be evaluated based on whether the items tied onto factors make intuitive sense or not. If items cluster into meaningful groups, then one can infer that factorial validity is attained.

As it was explained earlier in this chapter, while majority of the scales used in the current research have been borrowed from their developers, some other scales or measures (such as CF and ICTU) were developed by the investigator. The construct validities of the borrowed

scales were approved by the developers themselves. On the other hand, the construct validities of the other scales, such as ICTU, CF, and RS, which were developed by the investigator, were evaluated by using exploratory factor analysis. The extraction method used was Principal Axis Factoring method.

Zeller (2006) contends that a sample size between 10 and 50 is sufficient for two factors and 20 items. Here it was anticipated that the three scales (ICTU, RS, and CF) would not have more than two factors each and they have 4, 4 and 10 items, respectively. Hence, the sample size taken for the pilot study (N=15) was found to be sufficient to undergo factor analysis. In addition to sample size, all the assumptions that are required to be met in factor analysis have been considered. The results of exploratory factor analysis for all the three scales (ICTU, CF, and RS) are indicated in Appendix G.

Results of the Factor Analysis of ICTU

Assumption testing

Initially, the factorability of the 4 ICTU items was examined. Several well-recognized criteria for the factorability of a correlation were used. It is agreed among scholars that a Kaiser-Meyer-Olkin measure (KMO) value over 0.5 and a significance level for the Bartlett's test below 0.05 indicate there is a reasonable amount of correlation in the data (Fabrigar et al., 1999; Tabachnik & Fidell, 2007). All the four items in ICTU correlated with at least one of the items in the scale, suggesting reasonable factorability. The minimum correlation between the items was 0.365 (between item2 and item3). Secondly, the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.613, above the recommended value, and Bartlett's test of sphericity was significant ($p < 0.05$). Finally, the communalities were all above 0.3, further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was conducted with all the 4 items of ICTU.

Number of factors and the presumed criteria

All the four items in ICTU loaded on a single factor. As a result, none of the items was eliminated. The rule of thumb in factor analysis is to retain factors with eignvalues greater than 1.0 (Velicor & Jackson, 1990). A single factor with Eigen value of 2.67 was identified for

ICTU, which is similar to what was theoretically and intuitively expected. This single factor represented 66.76% of the total variance. The Scree Plot was also examined in order to determine the factor numbers (See Appendix G). The graph ascertained strong evidence for the single-factor interpretation of the scale. Over all, exploratory factor analysis of ICTU confirmed the factorial validity of the scale.

Results of the Factor Analysis of CF

Assumption testing

Initially, the factorability of the 10 CF items was examined. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.585, above the recommended value of 0.5, and Bartlett's test of sphericity was significant ($p < 0.05$). This shows that the data in CF meets the assumptions of factor analysis. The communalities were all above 0.3, except item 6, whose communality is 0.291. Even though the communality of item 6 is low (nearly equal to 0.3), it was retained for further analysis as the investigator believed that the item contributes to the interpretation of one of the factors which are expected to be extracted by the analysis. The commonalities of the other items further confirm that each item shared some common variance with other items (with the exception of item6). Given these overall indicators, factor analysis was conducted with all the 10 items of CF.

Number of factors and the presumed criteria

Two factors with Eigen values of 5.211 and 1.715 were identified for CF, which was found to be similar to what was theoretically and intuitively expected. All of the items loaded on either of these two factors. From the 10 items in CF, 3 of them (item 8, 9, and 10) loaded in one factor. The remaining 7 items loaded into another factor. The first factor represented 52.112% of the total variance while the second represented 17.148%. The two factors which were extracted from CF were labeled. The first factor was labeled as Availability and Access to ICT resources (AAICT), and the second factor was labeled as Support. None of the items loaded at approximately equal levels on the two factors. As a result, no item was eliminated. Over all, exploratory factor analysis of CF confirmed the factorial validity of the scale.

Results of the Factor Analysis of RS

Assumption testing

Initially, the factorability of the 4 ICTU items was examined. First, all the four items correlated with at least one of the items in the scale, suggesting reasonable factorability. The minimum correlation between the items is 0.396 (between item2 and item3). Secondly, the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.793, above the recommended value of 0.5, and Bartlett's test of sphericity was significant ($p < 0.05$). Finally, the communalities were all above 0.3, further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was conducted with all the 4 items of RS.

Number of factors and the presumed criteria

A single factor was identified for RS, which is similar to what was theoretically and intuitively expected. All of the items of RS loaded on a single factor with Eigen value of 2.72. As a result, no item was eliminated. This single factor represented 67.91% of the total variance. The Scree Plot also confirmed a single factor for RS (See Appendix G). Over all, exploratory factor analyses of RS confirmed the factorial validity of the scale.

In general, it was examined through factor analysis that all the three scales (ICTU, CF, and RS) show factorial validity.

Reliability of the Scales

Although there are several types of reliability, the most widely used and the one that was used in this study is internal consistency reliability, often reported in Cronbach's alpha. Thus, the internal consistency reliability coefficients in Cronbach's alpha were examined for the PIICT Scale, PB scale, AICTE scale, GAICT scale, CICT scale, CF, RS, and ICTU. In judging the goodness of an internal consistency reliability coefficient, Nunnally (1978) suggested using 0.70 as the minimum threshold for acceptable, 0.80 for satisfactory, and 0.90 for adequate. These criteria served as guidelines in interpreting the internal consistency reliability coefficients in this study.

Internal consistency reliability for the survey instrument was tested twice, during the pilot testing and after collecting the final data. Though the reliability test for PB (which had originally 10 items) during the pilot study showed that the items had internal consistency (alpha greater than 0.7), the test after the final data collection showed that the items lack internal consistency (alpha was found to be less than 0.7). As a result, the investigator had to check the reliability by eliminating some items. Finally, removal of items 4, 6, and 10 with the retention of seven items increased alpha value to 0.74.

Cronbach's alpha values for the adopted scales were compared with the reported alpha values by their original developers. Analysis of the data obtained from the pilot study confirmed that the Cronbach's alpha value for all the scales was greater than 0.70. This generally means that the survey instrument that was designed for the current study is reliable. (See Appendix J)

3.9. Methods and Procedures of Data collection and Analysis for the Quantitative Strand

3.9.1. Data Collection Procedures for the Quantitative Strand

After validating the survey questionnaire through pilot testing and several analyses of results, the final copies of the survey questionnaire were delivered in person by the investigator to the department heads so that they could distribute them to the randomly selected respondents within the respective departments. In the absence of the department heads, copies of the questionnaire were handed over to the secretaries of the departments who also distributed them to the respondents.

Names and phone numbers of the instructors who took copies of the questionnaire were documented and coded by the secretaries of the respective departments. This procedure helped to make follow up and to manage response rate. The instructors were given a maximum of 15 days to complete and return copies of the questionnaire to the offices of their respective departments. Those who did not respond within the specified time were contacted through phone by the secretaries of their respective departments. Since copies of the survey questionnaire were distributed in four different campuses, it took three weeks to collect them.

From the 300 copies of the questionnaire which were distributed, 254 filled out copies were collected. This made the response rate to be 84.67 %, which was more than enough for this study (See Appendix K). Out of the collected copies, 24 of them were incomplete and they were left out from analysis. The remaining 230 were used for analysis, which is still greater than the minimum required sample size.

3.9.2. Method of Data Analysis for the Quantitative Strand

The data analysis for the quantitative strand consisted of descriptive, correlation and regression analyses. The descriptive analysis was used to describe instructors' pattern of ICT use and their characteristics in relation to the variables that were anticipated to have influence on such patterns of ICT use. This was necessary for the investigator to have an overall understanding of respondents' characteristics (Thorndike, 2005). The correlation and regression analyses were used to investigate relationships among the variables. According to Creswell (2013), correlation research is used when there is a desire to investigate if two or more variables influence each other. The inferential statistics, including multiple linear regression analysis, was conducted to investigate relationships between the variables and to identify the most significant predictor variables for pattern of ICT use. As the name implies, multiple linear regression analysis helped to include multiple independent variables at the same time in the same model.

The Statistical Package for Social Sciences (SPSS) version 20 was used in analyzing the data in order to determine reliability of the instruments and relationships between the independent and dependent variables. Microsoft excel 2007 was used to calculate average of the responses given by each respondent for the items in each section of the questionnaire.

3.10. The Second Mixing of Data Sets

The second mixing of data sets was worked out after the quantitative analyses. Following a report of the findings for the qualitative and the quantitative strands, the second mixing of data sets was conducted in the discussion part of this study. The mixing involved merging of both the qualitative and quantitative interpretations of the findings to discover a new set of interpretations that were used to answer the central research questions (Creswell & Clark, 2011).

3.11. Ethical Considerations

To ensure ethical treatment of participants in this study, the following measures were taken:

- The research began after obtaining approval from all concerned bodies including Letter of Cooperation from the Department of Curriculum and Teacher Professional Development Studies of Addis Ababa University. Initially the investigator received Letter of Cooperation from the Department. Then the letter was handed over in person to the Vice President for Academic Affairs of Jimma University. The Office of the Vice President, in turn, wrote a consent letter to be given to the respective authorities of the University. Then the investigator took copies of the consent letter to the ICT Directorate Office, the University Security Office, and the Deans' Offices. Following this, the Deans wrote memos to the respective department heads. The department heads, in turn, facilitated the relationship between the investigator and the instructors in their respective departments.
- Participants were made to have access to a consent form. The consent form covers issues such as the purpose of the research, who conducts the research, the length of the research, the participants' right to confidentiality and anonymity, the participants' right to withdraw from the research any time, and other ethical issues (See Appendices A-E).
- Those who were selected to participate in the interview were given copies of the consent form to carefully read and to show their agreements by putting their signature on the consent form. While some of the instructors signed on the consent form, others declined to sign on the form as they understood that participating in the interview does not cause any harm to them.
- Those who were selected to participate in the survey study were given copies of the consent form together with copies of the questionnaire so that they can read and act accordingly.
- The interview was mainly done by audio taping the informants. However, this was not implemented with those who declined to be audio taped.
- Observation was carried out with the permission from and assistance of the concerned authorities such as the Student Service Team Leader and other responsible persons like Smart Classroom Supervisors.

In order to ensure the ethical principle of the anonymity of the instructors who participated in the interview, the investigator used the following codes which were prepared by merging initial letters of the college/institute to which the instructor belongs with numbers representing seniority and age. Number 1 stands for junior staff with younger age (below 40 years old). Number 2 stands for senior staff with older age (above 40 years old).

- PH1: Junior and younger instructor from the college of Public Health and Medical Sciences
- PH2: Senior and older instructor from the college of Public Health and Medical Sciences
- SL1: Junior and younger instructor from the college of Social Science and Law
- SL2: Senior and older instructor from the college of Social Science and Law
- NS1: Junior and younger instructor from the college of Natural Sciences
- NS2: Senior and older instructor from the college of Natural Sciences
- BE1: Junior and younger instructor from the college of Business and Economics
- BE2: Senior and older instructor from the college of Business and Economics
- AV1: Junior and younger instructor from the college of Agriculture and Veterinary Medicine
- AV2: Senior and older instructor from the college of Agriculture and Veterinary Medicine
- IT1: Junior and younger instructor from Jimma Institute of Technology
- IT2: Senior and older instructor from Jimma Institute of Technology
- IPD1: Junior and younger instructor from the Institute of Professional Development Studies
- IPD2: Senior and older instructor from the Institute of Professional Development Studies

3.12. Conclusion

This chapter addressed the methodology and methods that were utilized to answer all the research questions. A rationale for using mixed methods methodology and the specific sampling, data collection, and data analysis procedures used in this study were discussed. The following four chapters discuss the results from each phase of the research. Chapters Four and Five present results of the qualitative study. Chapters Six and Seven deal with the results of the quantitative study. The results obtained from the analyses form the basis for chapters Eight and Nine.

CHAPTER FOUR

DESCRIPTION AND CONTEXT OF THE STUDY SITE

The introductory part of this chapter restates the purpose and research questions of the study and provides an overview of the study site. This is followed by description of the physical and social contexts of the study site in relation to ICT use in the teaching-learning process, which was thought to provide a better understanding about contextual factors that may have influence on instructors' patterns of ICT use in the teaching-learning process.

4.1. Introduction

The purpose of the qualitative strand of this study was to explore instructors' patterns of ICT use and to examine instructor-perceived variables that affect such patterns of ICT use in the teaching-learning process. Many innovation researchers agree that educational improvement or innovation efforts should consider to a larger extent the "power of site or place" (Fullan, 2001). Therefore, it is imperative to study institutional characteristics that may affect ICT integration in education. The research questions that guided the qualitative strand were:

1. *How do instructors use ICT in the teaching-learning process?*
2. *Why do instructors use ICT the way they use it?*

To answer the above two research questions, studying the social and physical context of the study site in relation to ICT use in the teaching-learning process became important. The results of this study are presented in this chapter. Addressing the research questions mentioned above also required analysis of instructors' patterns of ICT use and instructor-perceived variables that affect such patterns of ICT use, the results of which are presented in the next chapter.

It was thought that studying the physical and the social contexts of the study site provides information about the institutional as well as instructors' readiness to integrate ICT in the teaching-learning process. Information about the physical and the social contexts of the study site was extracted by using in-depth semi-structured interview and unstructured observation. These two data collection methods also helped to address internal validity issues through triangulation.

4.2. General Description of the Study Site

Jimma University (JU) is one of the relatively older public universities in Ethiopia. It was established in 1999 by the amalgamation of the former Jimma College of Agriculture and Jimma Institute of Health Sciences. Jimma University is located in Jimma town which is found at about 352 Km away from Addis Ababa, the capital city of Ethiopia, in the southwest direction.

Currently, Jimma University is composed of five colleges and two institutes which are situated in four campuses. The College of Public Health and Medical Sciences, the College of Social Science and Law, the College of Natural Sciences, and the Institute of Professional Development Studies are located in the Main Campus. The College of Business and Economics is located in what is called the 'BECO' campus. The College of Agriculture and Veterinary Medicine is located in what is commonly called the 'Agri' campus. Jimma Institute of Technology (JIT) is in transition to a newly built campus named 'Kito Furdisa' campus.

The number of academic staff members at Jimma University has reached a total of 1400, including expatriates and those who are in study leave. The number of academic staff with first degree and above who are actively engaged in teaching is 902. Currently, the largest number of active academic staff is found in the College of Public Health and Medical Sciences which has reached a total of 324, of these 24 are diploma holders. Currently, Jimma Institute of Technology has 191 active academic staff members. The least number of the academic staff members is found in the Institute of Professional Development Studies, who are currently 16.

Jimma University claims itself to be the first innovative community-oriented higher education institution in Ethiopia. The logo of the University contains a statement which says, "We are in the community". While conducting this study, Jimma University was awarded recognition for the fourth time for standing first in its overall performance among the public universities in Ethiopia. The University celebrated a congratulations day on February 1, 2014 for maintaining its leading position for four consecutive years among the public universities of Ethiopia. As has been learned from the participants of this study, many of the University's community members contended that these successive achievements were mainly the outcomes of the University's community services and its multiple ICT expansion.

The University started to integrate ICT in its system by establishing a computer center to handle issues related to ICT. Following its establishment, the computer center worked closely with different sections in the University to create ICT awareness through short-term trainings, to introduce new technologies, and to support the provision of ICT courses to students. Later on, the computer center shifted its focus to network installation in the different campuses. Currently the University has introduced a new structure called ICT Development Director Office (ICT DDO), which is led by a director. The Office is responsible for the coordination of all ICT related projects and activities.

A first time visit to Jimma University, seeing students here and there holding their laptops connected to the Internet even around recreational areas such as the mini-stadium and noticing networked television screens mounted on buildings to display up-to-date information about what is going on in or outside the University, gives visitors an impression that the University is indeed digitized.

4.3. Physical Context of the Study Site

The physical context of the study site was investigated here from the perspective of ICT infrastructure and ICT services available in the University.

4.3.1. ICT Tools and Infrastructure

Smart classrooms

It was learned from the observation and interview that majority of the class rooms were made smart classrooms. In the context of Jimma University, a smart classroom is technology-enhanced classroom that contains an inbuilt LCD projector and a networked computer. Each computer in smart classroom is connected to Samba fileserver through which instructors can access their files from their personal computers in their offices.

Networked computers in the smart classrooms also provide access to Internet. These facilities in the classrooms enabled instructors to enrich their lectures with resources from the Internet and from the University's server. There are also Interactive White Boards (IWBs) in three postgraduate classrooms in the College of Agriculture and Veterinary Medicine.

Computer/network rooms

It was learned from the observation and interview data that many departments were having their own computer rooms where students could do computer-related activities in relation to the courses they were taking. In addition, there were computer rooms for male students, female students, and students with special educational needs around their respective dormitories. There were also network rooms in the libraries where both undergraduate and graduate students can access electronic materials.

Internet coverage and access points

Analysis of data obtained through both observation and interview revealed that there was high degree of Internet coverage in the University. All the buildings in the University were connected to the Central Data Center through fiber optics. A 260 Mb Internet connection was leased for all campuses of the University. Classrooms, computer laboratories, offices, and staff residences had access to wired Internet connections. Most of the computers in the computer rooms around the dormitories were also connected to Internet through network cables.

There were also wireless Internet access points/Wi-Fi zones in different corners within the University campuses. Lounges, computer rooms, mini stadium in the main campus, buildings, recreational areas such as the alumni's park in the Agri Campus and other areas provide access to wireless Internet connections. The computer rooms around dormitories also provide access to wireless connection. Those students and staff members who had laptops had access to the wireless Internet connections. Interview with instructors revealed that almost all instructors had at least one desktop computer and the majority had laptops. Majority of the interviewees agree that there was high speed Internet connection, although it used to fluctuate from time to time.

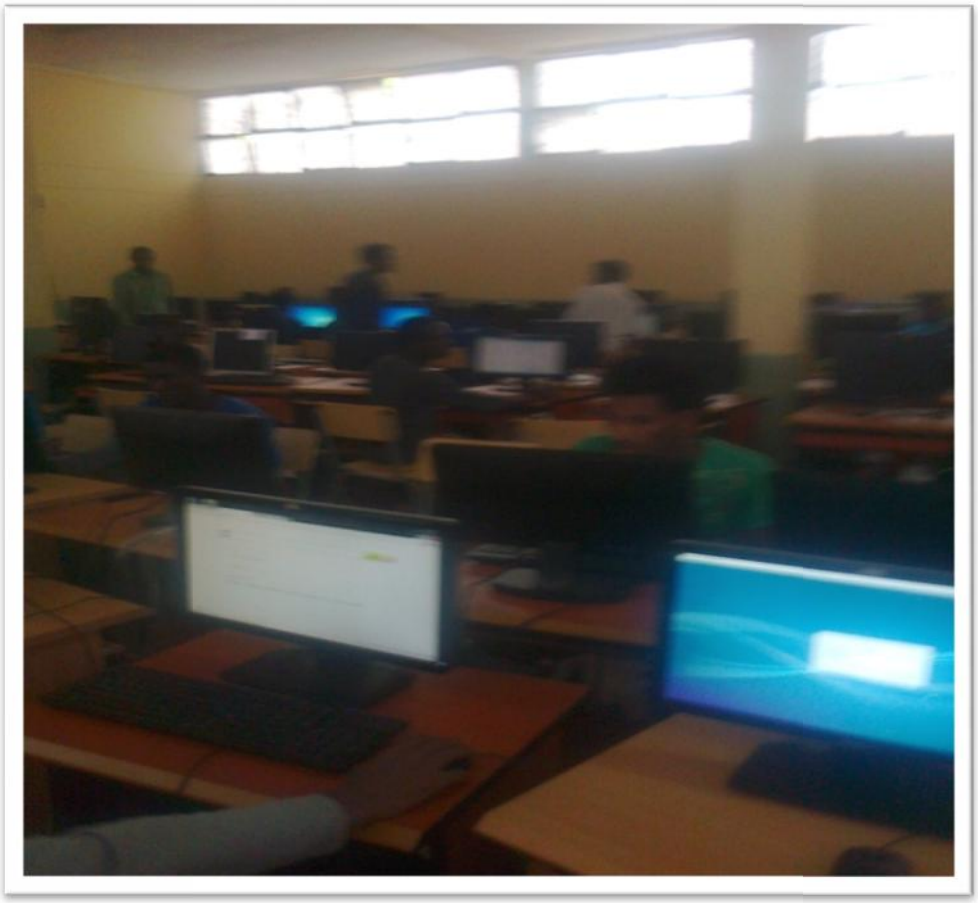

Figure 6: Students Connecting to Internet with the Computers in the Computer Lab around their Dormitories

Figure 7: Students using Wireless Internet Connection in the Computer Room around their Dormitories

Figure 8: Computer Room around Female Students' Dormitories in the Agriculture Campus

4.3.2. ICT Services

According to the information obtained from the interview, the wide computer network of the University was a pillar for all the services related to ICT. The major ICT services available in the University included e-mail services, e-learning services, videoconferencing and telemedicine, automated registrar system, and automated hospital system.

It was learned from the qualitative data that Jimma University had its own mail server, and each member of the University was given e-mail account. At the time, more than 600 instructors of the University (43%) were reported to have used the email service that the University provided. It was also revealed that the University had videoconferencing facilities. The College of Public Health and Medical Sciences tried to provide students with the opportunity of attending live surgical procedures and learn by participating in a two-way communication forum.

The investigator had the opportunity to visit the telemedicine center which was found around Jimma University Referral Hospital. It was learned from the observation and informal discussion with students that students were not using the full potential of the telemedicine center as they used it only as an ordinary Internet service.

It was also learned that the e-library platform had been set for students. One of the services provided in the platform was that each student could access learning materials as long as they happened to be in the University compound. Using this service, teachers could also spot and access available books while still being in their offices.

Additional ICT services provided by the University included a single sign-on application and online grading system. The single sign-on application enabled members of the University to login once and gain access to all systems without being prompted to login again and again.

4.4. ICT Policy of the Study Site

Generally, ICT policy is a legal framework that focuses on the ICT service level agreement, accountability and restrictions that limit access to some Internet services and websites. Studying the ICT policy of the study site was deemed important as it delineates the vision, rationales, and goals and enacts on how institutions ought to work if ICT is to be integrated into the teaching-learning process (Jones & Kozma, 2003). Having an ICT policy can be considered as an institutional readiness to integrate ICT in the teaching-learning process.

Likewise, as learned from the interview data, the ICT policy was in a draft stage. According to the Representative of the ICT Development Directorate Office, components of the ICT policy were expected to include services provided, accountability in relation to ICT use, and restrictions. At the time, the ICT policy could not be ratified due to the absence of general consensus on vital issues of using ICT services such as service level agreement with the University community.

Though the ICT policy was in a draft stage, some regulations were introduced. For example, no member of the University was allowed to use face book during the working hours. It was learned that the University compound was virtually divided into different network areas

(VLAN). Access to any source was allowed to different VLANs after it had been tested in the Working Area. Some websites which could not pass the test of the Working Area were supposed to be blocked. There were cases when some websites were blocked in some areas and allowed in others depending on the privilege of the user and importance of the website to that area. For example, it was reported that some sites which were allowed to the College of Public Health and Medical Sciences, such as sites containing video clips showing the process of labor and delivery stages of child birth, were blocked to others to minimize data jamming.

4.5. Social Context of the Study Site

The social context of the study site here refers essentially to the human resource capacity of the ICT Development Directorate Office. It also includes instructors' perceptions of the ICT environment to which they are exposed.

4.5.1. The Human Resource Capacity of the ICTDDO and its Activities

The ICT Development Directorate Office was composed of 69 technical staff members who are organized under four divisions: Computing Services Division, Networking and System Administration Division, User Support Division, and Training and Consultancy Division.

The major activities of Computing Services Division include application software development, website development, providing learning technologies and introducing e-learning. The major activities of the Networking and System Administration Division include providing wired and wireless network connectivity, ensuring the security and reliability of local network connection and the Internet, providing videoconferencing services and also equipping smart classrooms with the available technology. The major activities of the User Support Team include providing preventive maintenance to ICT tools and services, providing onsite support to end users in relation to ICT use and also performing network installation. The major activities of Training and Consultancy Team include preparing and administering ICT related trainings, and preparing and consolidating proposals for rendering training and consultancy services.

As learned from the qualitative data, in addition to the technical staff members in the ICTDDO, there were also ICT helpdesk teams in every college or institute. Moreover, there

were ICT coordinators at College/Institute level who were selected from among the academic staff. These ICT coordinators, together with the ICT help desk team at the college level, work in collaboration with the ICT technical staff members at the central office.

4.5.2. Instructors and their Perceptions of the New ICT Environment

As has been explained earlier, there were about 1400 instructors in the study site, including expatriates and those who were in study leave.

It was thought that instructors' perceptions of the new ICT environment gives insight about their readiness to integrate ICT in the teaching-learning process, which is also part of the institutional readiness. Based on this conviction, instructors were asked to tell how they perceived the new ICT environment. The qualitative data revealed that instructors' perceptions to the new ICT environment were not the same. Some of the instructors perceived the new ICT environment as an opportunity to, while others perceived it as a negative influence on quality of education.

Table1 below shows how the five categories of patterns of ICT use emerged from the transcript. As it can be seen from the table, the underlined words or phrases represent important ideas related to instructors' perceptions about ICT in the teaching-learning process. The shaded words or phrases after these ideas represent the codes. The words or phrases next to the codes which are bold and in italics form represent the categories (themes) to which the codes belong. As it can be seen from table 1, 29 codes were detected. As it can also be seen from the table, some of the codes appeared two times and some three times. These 29 codes were put under two major categories, ICT as a negative influence and ICT as an opportunity.

Table 1: The coding and the themes identified for instructors' perceptions about ICT use in the teaching-learning process

PH2.	For me ICT is an opportunity (opportunity) ***(blessing)***. It helped me to disseminate knowledge to my students very easily (simplify work) ***(blessing)***. ---I can cover 50 to 60 slides in two hours (cover large portion shortly) ***(blessing)***.
SL1.	---they can get lots of reference materials from Internet (source of information) ***(blessing)*** which could have been impossible otherwise. ---It helps them to advance their understanding by reading different perspectives from Internet about a single issue (advances understanding) ***(blessing)***. ---they can learn from each other (facilitates interaction) ***(blessing)***.
NS1.	ICT --- has simplified my work (simplifying work) ***(blessing)***. I can display visuals for my students from Internet which would have been impossible otherwise (display visuals) ***(blessing)***. ---If you don't use computer, you will find it difficult to teach this part (difficult to teach some portions of a lesson without ICT) ***(blessing)***.
BE2.	I have seen both systems. ---Experience has thought me that the disadvantage of using ICT overweighs its advantage (disadvantageous) ***(curse).*** ICT is contributing for the deterioration of quality of education (low quality) ***(curse).*** ---Students have become PowerPoint dependent (dependency) ***(curse).*** --- They do not refer additional things (dependency) ***(curse)***. Their knowledge is shallow (shallow knowledge) ***(curse)***. They have lost interest to read books (lost interest to read books) ***(curse)***. Whenever I was using traditional tools like black board, students had chance to listen to what I say, now they don't listen (no attention to instructor) ***(curse).*** They simply copy notes from the slides (simply copying) ***(curse)***. I also noticed that some instructors totally stopped preparing for their lessons (not getting prepared) ***(curse)*** since they get everything ready made from Internet. When there is power-cut, these instructors dismiss classes (dismissing class) ***(curse)*** because they are not ready to teach without the technology. Some instructors cover their courses with PowerPoint presentation in few periods and they get engaged in part-time jobs outside the University (covering course superficially) ***(curse)***. I had a chance to see some instructors just reading their slides (reading from slides) ***(curse***), which does not help the students.
AV1.	ICT --- requires you to make additional preparation by looking for relevant and up-to-date information that benefits your students (relevant and up-to-date information) ***(blessing)***. ---- ICT helped me to attend free on-line tutorials to upgrade my knowledge and skills (upgrade knowledge and skills) ***(blessing).***
AV2.	Instructors were misusing the technology by logging into a content provider's website and using PowerPoint slide from the website without any revision or modification (misuse by some instructors) ***(curse)***. I can see also that currently the disadvantage overweighs the advantage (disadvantageous) ***(curse)***. --- This is now impossible in smart classrooms (impossible to discuss) ***(curse)***.
IPD2.	I am not satisfied with this new learning environment because of the stress it adds on me (stress related to ICT use) ***(curse)***. I feel that the use of ICT requires additional time for preparation and for fixing some technical problems related to its use (additional time required) ***(curse)***.

ICT as a negative influence

There were instructors who argued that ICT was contributing to the deteriorating situation of quality of education in the University. This was evident from the comments given by the instructors during the interview session. Some of the instructors argued that ICT hampered students' creativity by making them dependent on gadgets, small or big. Others who participated in the interview complained that ICT was being misused by some instructors. Interviewee BE2, for example, expressed his concern that instructors had stopped pedagogical preparations for lessons since they were getting everything ready made from the Internet. The interviewee desperately expressed his concern that these instructors used to dismiss classes in the event of power-cut for they had not been prepared to teach without ICT.

Likewise, interviewee AV2 also complained that instructors were misusing the technology by logging into a content provider's website and using PowerPoint slide from the website without any revision or modification.

Some instructors felt that ICT's disadvantage overweighs its advantage. Interviewee AV2, for example said:

> *Currently the disadvantage overweighs the advantage. Traditionally, students had chance to listen to what the instructor says, to analyze what is said, and to ask questions. This is now impossible in smart classrooms. It rather helped me to bring latest and up-to-date information to my students.*

Some instructors argued that the use of ICT made students and the instructors themselves ICT-dependent. It was reported by a couple of instructors that ICT was unnecessarily encouraging block teaching. They said that some instructors covered 20 to 30 slides in a single period and superficially covered courses very early. Interviewee BE2 said: "Some instructors cover their courses with PowerPoint presentation in few periods and they get engaged in part-time jobs outside the University".

Some instructors also noted that students had become passive learners and had been exposed partly to daydreaming and mechanically copying notes from slides because they did not have time to spare a thought for what they were supposed to learn. Interviewee BE2 argued:

> *Smart class rooms made students busy copying notes from power point slides instead of listening to what you say. It is impossible for them to listen to what the instructor says, to think about what is said, and to ask questions based on that.*

Moreover, interviewee NS1 complained that students did their assignments directly from the Internet without making any change. The interviewee reported that these students submitted their assignments without making any modification to what they downloaded from the Internet.

Some of these comments from instructors appear to have emanated either from their negative attitude towards ICT use in education, lack of competence in pedagogical use of ICT, or lack of awareness of the potentials of ICT in the teaching-learning process. Interviewee BE2, for example, expressed his dissatisfaction with ICT by commenting that it inhibited interaction between the teacher and the students. He further commented:

> *I had a chance to see some instructors just reading their slides, which does not help the students. For me, that is not teaching. I want students to communicate with me when I teach. I prefer chalk board and marker board to the ICT in the classroom. I use these traditional tools to interact with my students. I use these tools for my students to put their ideas on them.*

It is evident from this comment that the instructor requires his students to interact with him while the lesson is going on. The instructor felt that ICT inhibits classroom interaction. In fact ICT can enhance classroom interaction if properly used. It is also evident from the comment that the instructor believes in the importance of students' active participation in their learning. The problem was that he might not know how to use ICT for classroom interaction. Accordingly, this has the implication that constructivist pedagogical belief does not necessarily lead to the use of ICT as a constructivist learning tool.

Some of the instructors who perceived the new ICT environment as a negative influence on quality of education related their dissatisfaction with the new environment to the stress it adds on them. Some instructors said that use of ICT requires additional time for preparation and for fixing some technical problems related to its use. Some of these instructors reported that they totally avoided ICT use in the classroom because of the time it required for preparation and fixing technical problems. Some of them pointed out that lack of skill and technical support that is needed to use the technology in teaching made them reluctant to welcome it.

Generally, the major complaints on ICT use in education in the University seem to be related to lack of skill, lack of support, and misuse of the technology.

ICT as an opportunity

Unlike those instructors who complained about the new ICT environment, there were others who welcomed it as an opportunity. The supporting instructors advocated the benefits of ICT in education from two perspectives: one is from their own perspective and the other is from students' perspective.

Those instructors who expressed ICT's benefit from their own perspective noted that ICT has made teaching simpler and effective, enhanced lecture presentation, and made delivery of knowledge to a large group of students simpler. These instructors contended that ICT had brought the opportunity to teach a lesson effectively which would have been impossible otherwise. For instance, interviewee NS1 said:

> *ICT has simplified my work. I can display visuals for my students from Internet which would have been impossible otherwise. There are portions in a course which require you to display models. If you don't use computer, you will find it difficult to teach this part.*

It can be understood from what has been mentioned above that some instructors perceived ICT positively, especially in relation to its capacity to simplify teaching. Nevertheless, there were instructors who argued against this comment. Interviewee AV1, for example, argued: "ICT doesn't simplify instructor's work. It rather requires you to make additional preparation by

looking for relevant and up-to-date information that benefits your students". This is particularly against the argument that ICT made instructors to be less prepared for their lessons.

One major reason that instructors raised for their appreciation of ICT is its capacity to help them develop their own knowledge and skills. Some instructors witnessed that ICT had helped them to attend free on-line tutorials to upgrade their knowledge and skills which, in turn, helped them to get their students acquainted with latest and up-to-date information.

Those instructors who commented on the benefit of ICT use in the teaching-learning process reported that ICT contributed to students' better learning. Interviewee SL1, for example, noted:

> *ICT helps students in such a way that they can get lots of reference materials from Internet which could have been impossible otherwise. They can get lots of examples from Internet in relation to what they learn in classroom. It helps them to advance their understanding by reading different perspectives from Internet about a single issue. They can interact with their friends through social media and they can learn from each other.*

Generally, it has been learned from the interview data that the study site is composed of instructors who perceived the new ICT environment in two major different ways. Some have positively welcomed the new ICT environment while the others considered it as a negative influence on quality of education. Overall, even though the institution has gone further in expanding ICT infrastructure, the data suggests that a lot has to be done to make sure that the social context of the institution also supports the integration of ICT in the teaching-learning process.

4.6. Summary

There were relatively sufficient ICT resources in Jimma University that created opportunities for instructors to use them in the teaching-learning process. Nevertheless, the resources were not evenly distributed across the colleges. This study also showed that students had relatively sufficient access to ICT resources. This was evident from the fact that there were computer

centers around the dormitories for male students, female students, and students with special educational needs. Students were observed using these centers.

The ICT DDO provided various ICT related services to the University community. This was evident from the field observation and interview data which witnessed that different services had been provided to the University community. The ICT DDO was organized with what can be said sufficient technical staff that could give support to the University community in different aspects related to ICT. This was evident from the number of technical staff members of the ICT DDO.

The ICT Policy was in a draft stage. Yet, there were policy-related issues that were practiced in the University, such as regulation of access to some websites depending on user privilege.

Instructors perceived the new ICT environments in different ways: some of them welcomed it as an opportunity to while others considered it as a negative influence on the quality of education. Overall, based on the data obtained from interview and observation, it can be said that there is institutional readiness in the University to integrate ICT in the teaching-learning process.

CHAPTER FIVE

INSTRUCTORS' PATTERNS OF ICT USE AND PERCEIVED VARIABLES THAT AFFECT THEIR USES

5.1. Introduction

The way instructors use ICT in the teaching-learning process and the instructor-perceived variables that affect their uses are presented in this chapter. The data were obtained through interview. These data helped to address the following two research questions:

1. *How do instructors use ICT in the teaching-learning process?*
2. *Why do instructors use ICT the way they use it?*

5.2. Instructors' Patterns of ICT Use

One of the objectives of this study was to identify categories of patterns of ICT use in the teaching-learning process. The findings in this study suggested that even though instructors showed variations in their patterns of ICT use, almost all of them used to use ICT in relation to the teaching-learning process. Some instructors used ICT to enhance their traditional way of teaching while others tried to use it to engage students in knowledge construction. Generally, five patterns of ICT use in the teaching-learning process emerged from the interview data: *ICT as a course preparation tool, ICT as a presentation tool, ICT as an information exchange tool, ICT as a collaboration tool, and ICT as a cognitive tool.*

Table 2 shows how the five categories of patterns of ICT use emerged from the transcript.

Table 2: The coding and the themes identified for patterns of ICT use

PH1.	Usually I use LCD projector in smart classrooms to deliver my lecture note (deliver) **(*ICT as presentation tool*)** to the students. I sometimes send my lecture notes (Send) **(*ICT as information exchange tool*)** to the students through e-mail. I also ask students to present a seminar (present) **(*ICT as a cognitive tool*)** using LCD projector in smart classrooms
PH2.	I use ICT to download some information from Internet and include it into the note (download) **(*ICT as a course preparation tool*)** that I give to my students. I usually use ICT for this purpose. I also use LCD projector in smart classroom to disseminate more knowledge (disseminate) **(*ICT as a presentation tool*)** in a short period of time.
SL1.	I usually use ICT to download additional things (download) **(*ICT as a course preparation tool*)** related to my course such as video from YouTube. I also use LCD projector to **present** my lecture notes (present) **(*ICT as a presentation tool*)** to the students.
NS1.	I upload soft copies of the material that I teach so that students can access it (students access) **(*ICT as information exchange tool*)**. They go to library and can easily access the notes from the computers there. I also use ICT to display visuals (display) **(*ICT as a presentation tool*)** from Internet for my students to understand abstract concepts.
BE1.	I use ICT in my teaching. For example, I created an online discussion group called "The economics group" (online discussion group) **(*ICT as a collaboration tool*)**, where I post an issue for discussion. My students read the issue that I posted online and they reflect what they understand about the issue. Their views about the issue may not be the same and hence they make a dialog. Ultimately, they learn from each other through this process.
AV1.	I send assignments to my students using e-mail (send) **(*ICT as information exchange tool*)** and they send what they do using e-mail. We are using e-mail for this purpose. I also use ICT to post a debatable issue so that students read it and reflect their views (post debatable issue) **(ICT as a collaboration tool)** about the issue or one of them forwards his/her view opposing the views forwarded by the others. Finally we discuss the issue in class and we come to consensus.
IT1.	I use ICT in smart classroom to present my lecture note (present) **(*ICT as a presentation tool*)** using LCD projector. I usually use ICT to display pictorial representations. I include animation and other visuals. I also download video from You-tube and present it to the students. I also created a yahoo group where I share ideas with my students (yahoo group) **(*ICT as a collaboration tool*)** about a given topic. Students also do assignments in group and report the results to the class by representing their ideas in graphic form using computer software (represent ideas)
IPD2.	I use ICT to access materials from Internet to enrich and update what I teach (students access) **(*ICT as a course preparation tool)***.

As it can be seen from table 2, the underlined words or phrases represent important ideas related to the research questions. The shaded words or phrases after these ideas represent the codes. The words or phrases next to the codes which are bold and in italics form represent the categories (themes) to which the codes belong. As it can be seen, 19 codes were detected. As

it can also be seen from table 3, some of the codes appeared two times and some three times. These 19 codes were put under five categories (themes).

5.2.1. ICT as a Course Preparation Tool

In this study the term ICT as a course preparation tool is used to refer to the use of any ICT tool to develop course materials. The interview data revealed that some instructors used ICT to prepare course materials by downloading related and up-to-date sources from the Internet. Interviewees PH2, IPD2 and SL1, for example, reported that they used ICT to download course-related materials from the Internet.

It was reported by some interviewees that some of the instructors who used ICT for course preparation downloaded ready-made lecture notes such as PowerPoint slides from the Internet and presented it to their students without making any change, while others downloaded materials to incorporate latest information or to supplement their own lecture notes or course materials. One can easily infer from this category of ICT use that there were no students' engagements in ICT use in the teaching-learning process. It was the instructor who decided about the material to be included in the course and also it was only himself/herself who completely used it in the teaching-learning process.

5.2.2. ICT as a Presentation Tool

The interview data revealed that some of the instructors used ICT to present their lectures using PowerPoint slides. It was learned that some of the instructors used the Internet to download graphics, video, models, animation, or documentary films to enrich their lecture presentation. Interviewee IT1, for example, said:

> *I use ICT in smart classroom to present my lecture note using LCD projector. I usually use ICT to display pictorial representations. I include animation and other visuals. I also download video from You-tube and present it to the students.*

Other interviewees SL1 and PH1 also reported to have used ICT to present lectures by including short movies related to their lessons.

Some instructors complained against such patterns of ICT use by stating that students i do not get time to analyze, critically think about, and internalize what they learn since they get busy copying notes from slides.

Here one can easily see that students' engagement in ICT use as a presentation tool is very limited. Students can only see from their instructors how ICT can be used to present a lesson. They are simply observers of ICT use.

5.2.3. ICT as an Information Exchange Tool

Some instructors used ICT to exchange information with their students. It was learned from the interview data that some of the instructors used ICT to upload course materials on servers in the libraries so that students could access the uploaded materials by making use of the e-library platform. Some instructors used ICT to exchange lecture notes, assignments, or other related information with their students. Interviewee AV1, for example, used ICT to send assignments to his students to be submitted through e-mail. Interviewee NS1 also reported that he uploaded softcopies of his courses on computers in the library so that students can access and use them. Interviewee PH1 also reported that he sent his lecture notes to his students through e-mail. One can easily see that students were engaged in ICT use in this category of ICT use by exchanging information with their instructors.

5.2.4. ICT as a Collaboration Tool

It was learned that some instructors created discussion groups to exchange ideas with their colleagues in their departments or with their students using ICT as a forum. For example, some instructors informed the investigator that they have created a yahoo group with students for this purpose. Some others have started peer learning by creating online group. Some instructors created online discussion group like "The banker group" with their colleagues to exchange ideas and latest information in relation to the courses they teach, although some instructors showed little interest to participate in it.

Interviewee BE1, for example, reported that he created "The economics group" to discuss online on some issues with his students. Interviewee AV1 also said that he posted different

debatable issues to the group so that each one could reflect on what he/she thinks about the issue. The interviewee also reported that students could post ideas against what had been posted by others and this is how students learned from each other through online groups. Interviewee IT1 reported that he created a yahoo group after the students sent him their e-mail accounts. He said that he gave assignments to students to work in group and report to the class by representing their ideas in graphic form using computer software.

As it can be inferred from the interview data, instructors' role here was mainly facilitating the teaching-learning process. The instructor poses questions or issues to be discussed by students in group and to reflect their views using ICT. One can understand from this category that students were engaged in collaborative work using ICT.

5.2.5. ICT as a Cognitive Tool

Some instructors reported that they engaged their students to use ICT to search for information from different sources using Internet, organize this information, analyze it, and present it to the class using the available ICT in smart classrooms. Some instructors also said that they had given tasks to students to be presented independently to the class. For example, interviewee PH1 said that he asked students to present seminar using LCD projector.

As it can be inferred from the interviews, students in this category of ICT use are not expected to present what they have gained from Internet or from other source. They are expected to look at a given issue from different perspectives and to organize and analyze the information obtained, make their own meanings and add their input, construct their own knowledge, represent their views in some form using ICT and share what they have learned using ICT.

Here it can be seen that students' engagement in this pattern of ICT use is utmost. The instructor in this category of ICT use acts as a co-learner. He/she also learns from students' view. In this pattern of ICT use, the method of teaching employed is student-centered. This pattern of ICT use corresponds to what Jonassen (1996) referred to as a 'cognitive tool'.

5.3. A Model Describing Instructors' Pattern of ICT Use

This study indicated that there were variations among instructors in the way they used ICT in their lessons. These patterns were observed in the forms of ICT use as: a course preparation tool, a presentation tool, an information exchange tool, a collaboration tool, and a cognitive tool.

Although instructors' patterns of ICT use can be put into five categories, a closer inspection of the interview data revealed that instructors used ICT in more than one way. For example, interviewee SL1 used ICT both as a course preparation tool and as a presentation tool. It can also be seen that interviewee PH1 used ICT as information exchange tool, as a collaboration tool, and as a cognitive tool. This suggests that instructors' patterns of ICT use falls in a continuum between ICT as a course preparation tool and ICT as a cognitive tool. This is evident from what interviewee BE1 said:

> *Formerly, I was using ICT only to prepare course materials and then to deliver courses in the form of PowerPoint presentation. But through time, I started to use ICT to exchange information with students and also to engage students to use it in an online group discussion.*

This shows that instructors may start by using ICT for course preparation and may proceed to use it for lesson presentation. Then through time, they may progress from using ICT as a course preparation or presentation tool to ICT as an information exchange tool, ICT as a collaboration tool, and ICT as a cognitive tool.

Generally, it can be argued that instructors' patterns of ICT use fall in a continuum between ICT use as a course preparation tool and as a cognitive tool. Based on these findings, the following model was developed to describe instructors' patterns of ICT use in the teaching-learning process. This model, called the PICT model, shows the different categories of patterns of ICT use in a continuum.

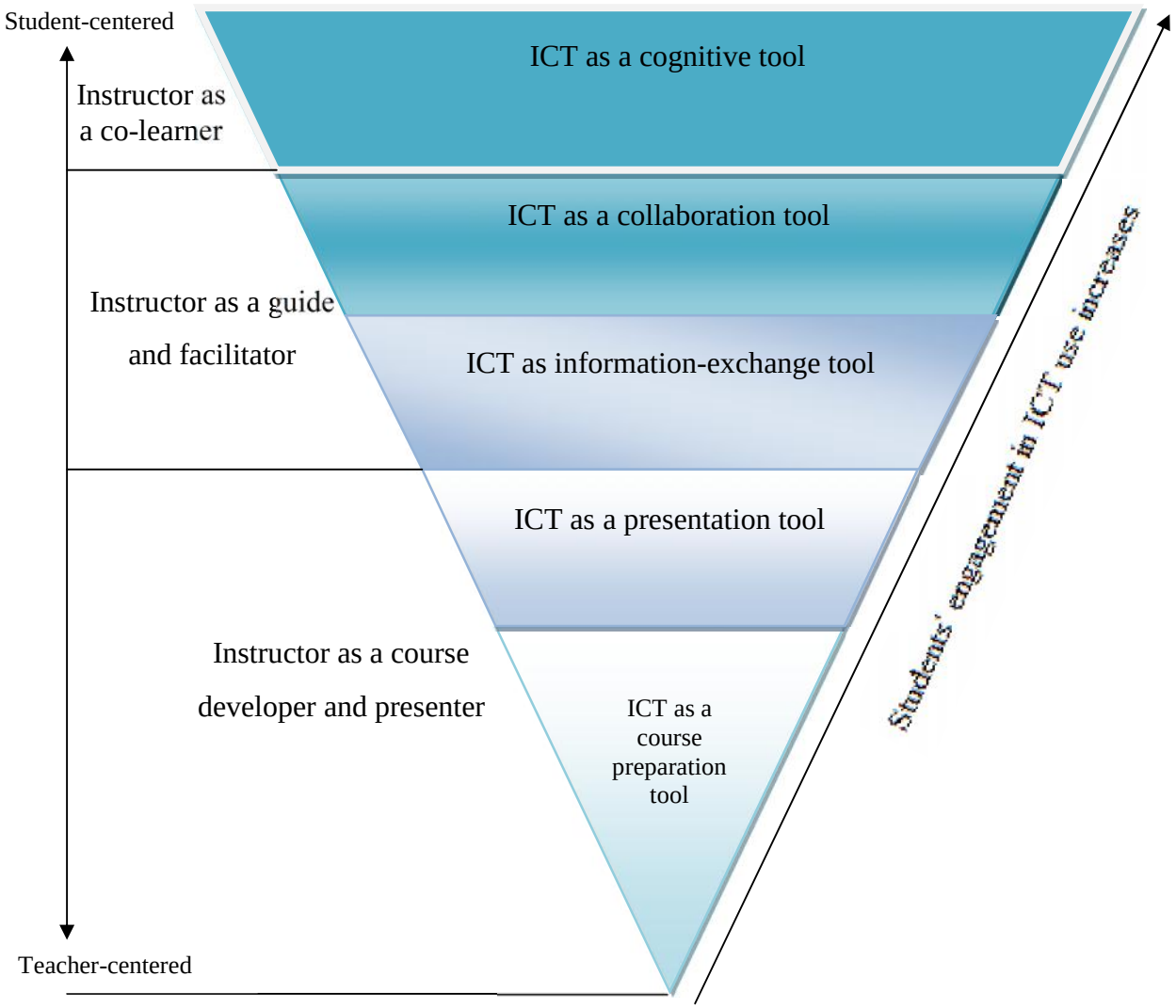

Figure 9: The PICT Model

The PICT model is an inverted cone which shows the transition from one pattern of ICT use to the other in a continuum.

The PICT model depicts that instructors' pattern of ICT use falls in a continuum between ICT use as a course preparation tool and ICT use as a cognitive tool. It shows that instructors' pattern of ICT use can be seen from three dimensions: level of students' engagement in ICT use, teachers' role in the ICT-enhanced teaching-learning process, and the overall method of teaching employed in an ICT-enhanced learning environment.

The model shows that students' engagement in ICT use increases as one moves from bottom to top in the model. It also shows that the instructor's role shifts from course developer and presenter to co-learner as one moves up the model. One can also see from the model that teaching method shifts from teacher-centered approach to student-centered approach as one moves from bottom to top in the continuum. As it can be seen, the background color of the model fades as one moves from top to bottom to show that students' engagement in ICT use decreases in moving from ICT use as a cognitive tool to ICT use as a course preparation tool.

5.4. Instructor-Perceived Barriers and Enablers that Affect ICT Use

Different barriers and enabling factors were identified by instructors in relation to their use of ICT in the teaching learning process. Some of the variables that affect instructors' pattern of ICT use in the teaching-learning process were identified in chapter two of this study. Almost all of these variables were identified in the current study as factors that affect instructors' pattern of ICT use in the teaching-learning process.

In addition to the variables identified in the literature, two new variables- instructor's teaching level and instructor-perceived readiness of students to use ICT in their learning-emerged in this study. One of the newly emerged variables, instructor's teaching level, falls under the category of demographics while the second-instructor-perceived readiness of students to use ICT in their learning-stands as one category with four dimensions. One of its dimensions is whether students have or do not have time to use ICT in their learning. The second is whether students have or do not have access to ICT. The third is whether students had or had not developed the required attitude to use ICT. The fourth dimension is whether students had or did not have acquired the required competence to use ICT.

Generally, the instructor-perceived variables that affect their patterns of ICT use were put in five major categories: Instructor-related variables, Context-related variables, Demographics, Instructor-perceived readiness of students to use ICT, and Course nature. Table 3 shows the coding and the categories identified in relation to variables that affect ICT use.

Table 3: The coding and the themes identified for instructor-perceived barriers/enablers

PH2.	ICT helped me to disseminate knowledge (knowledge transmission) ***(Instructor-related, pedagogical belief***) to my students very easily. --- I feel that not all students have access to computers (students' access) (***perceived readiness of students, access***).
SL1.	There is strong influence of colleagues (peer' influence) ***(Context-related***, ***pressure***) that discouraged those who are committed to use ICT for effective teaching and learning. --- Moreover, students prefer to do assignments from books than from the Internet (students' interest) (***perceived readiness of students, attitude***).
SL2.	Some of us do not have ICT skills (instructors' competence) ***(instructor-related, competence)*** and that hindered us from using ICT effectively. We should be given appropriate training (training) (***Context-related, support)***. In fact, we do not even have equal access to the technology (instructors' access) (***Context-related, accessibility***). --- ICT technicians' reluctance (technical support) (***Context-related, support***) to fix problems was also affecting our use of ICT in the teaching-learning process. I feel that there should be continuous follow-up (***Context-related, pressure***) to check whether the technology was working or not.
NS1.	We were given only two trainings (training) (***Context-related, support***) on ICT use. --- In addition, I feel that students do not have interest to use ICT (students' interest) (***perceived readiness of students, attitude***) for their learning. --- In spite of all these problems, my courses are difficult to teach them without the use of ICT (course nature) (***perceived course nature***).
NS2.	I think our level of ICT use depends on the level we teach (teaching level) (***Demographics, level of teaching***). ---Instructors can send notes to graduate Students using e-mail since almost all these students have ICT skills and access to ICT (students' access and students' competence) (***perceived readiness of students, access & competence***) in one way or another. --- Moreover, the course we teach also matters. I think mathematical courses do not require the use of ICT (course nature) (***perceived course nature***).
BE1.	---Top managers believe in report and they do not know what happens on the ground (follow up) (***Context-related, pressure***). Even the restriction not to use Face Book (restriction) (***Context-related, policy***) and other websites was unnecessarily affecting our works. Our age (age) (***demographics, age***) also matters. --- Those who lack experience in ICT use (instructors' experience) (***demographics, experience in ICT use***) find it difficult to use it in their teaching.
IT2.	--- We use it for office purposes. We have not used this system in the teaching-learning process (trying out new ways) (***Instructor-related, personal innovativeness***). We did not think about it. We have no role model (seeking role model) (***Instructor-related, personal innovativeness***) whom we follow in this respect.
IPD1.	Effective integration of ICT in the teaching-learning process requires planning which, in turn, requires time. We have lots of duties and responsibilities to carry out. We also do research works for our academic promotion. I think it is difficult to invest time to plan for ICT use (incentive) ***(Context-related, incentive).*** The monitoring and evaluation system is also weak (follow up) (***Context-related, pressure***).

As it can be seen from table 3, the underlined words or phrases represent important ideas related to the research questions. The shaded words or phrases after these ideas represent the codes. The words or phrases next to the codes which are bold and in italics form represent the categories (themes) to which the codes belong. Totally 36 codes were detected from instructor-perceived barriers/enablers. Some of these codes can be seen from table 3 above. As it can be seen from the table, some of the codes appeared four times and some three times, still some other two times. These 36 codes were put under five major categories and 17 sub-categories.

Table 4 summarizes the variables that were identified based on the interview data.

Table 4: Major themes and their categories

Barriers/Enablers
Instructor-related variables • ICT competence • Attitude towards ICT in education • Pedagogical belief • Personal innovativeness
Context-related variables • Incentive • Administrative and peer pressure • Access/Availability • Support • Policy-related issues
Demographics • Age • Experience in ICT use • *Level of teaching
***Instructor-perceived readiness of students to use ICT** • Time • Access to ICT • Attitude • ICT competence
Course nature

*New variables that emerged from this study

As it can be depicted from table 4, some of the variables that are indicated by asterisk emerged from this study as new variables that may influence instructors' pattern of ICT use in the teaching-learning process. Unlike the others, these variables have not been described well in the literature.

5.4.1. Instructor-Related Variables

Some of the variables that were found to have influence on instructors' patterns of ICT use were categorized under 'instructor-related variables' as these variables vary from instructor to instructor. These variables were instructor's ICT competence, attitude towards ICT in education, pedagogical belief, and personal innovativeness.

Instructor's ICT competence

Though majority of the interviewees agreed that instructors were skilled in their ICT use, some instructors still mentioned that they have gap in their ICT competence which hindered them from properly utilizing the ICT potential in the teaching-learning process. Interviewee AV2, for example, said:

> *I have no experience in using ICT. I know that I am expected to use the ICT tools in smart classroom. But I can't access video and audio from Internet. I think LCD projector does not support these formats.*

Here the instructor mentioned about his lack of experience in ICT use and the gap in ICT competence. It is known from practice that experience does not necessarily lead to competence. What can be understood from the view of this instructor is that he did not know how to use LCD projector to display audio and video files in his teaching. He thought that LCD projector did not support these files. In fact, LCD projector can support both audio and video files. It is due to lack of competence that this instructor couldn't use these files in his PowerPoint presentation. This shows the influence of ICT competence in pattern of ICT use. Interviewee SL2 also witnessed that some instructors including himself were not using ICT due to lack of skill and he stressed the need to get training to use ICT properly.

Instructor's attitude towards ICT in education

Two instructors who participated in the interview witnessed that they had negative attitude towards the use of ICT in education. One of them perceived that ICT killed students' effort in their learning. According to him, since whatever information they need was available from the Internet, whenever students were given assignments, they used to browse for information from the Internet and they used to submit it without making any effort to understand it. Interviewee BE2 said:

> *I have seen both systems. I was teaching using traditional tools like blackboard. Now I sometimes use computer and LCD projector. Experience has thought me that the disadvantage of using ICT overweighs its advantage. ICT is contributing for the deterioration of quality of education.*

Interviewee BE2 also added,

> *Students have become PowerPoint dependent. They simply copy notes from the PowerPoint slide, they read it, and they sit for exams. They do not refer additional things. Their knowledge is shallow. They have lost interest to read books. Whenever I was using traditional tools like black board, students had chance to listen to what I say, now they don't listen. They simply copy notes from the slides.*

Whenever asked about their ICT use, these instructors said that they preferred to use the traditional teaching tools and they did not frequently use ICT in their teaching. It appears from what the instructor said that instructor's attitude towards ICT influences their patterns of ICT use.

Instructor's pedagogical belief

Instructor's pedagogical belief was also found to have influence on their patterns of ICT use. Those instructors who believed that teaching is imparting knowledge reported to have used ICT for presentation of their lectures or to prepare teaching materials for their students.

Interviewee PH2, for example, said that ICT helped him to disseminate more knowledge and he used ICT (LCD projector and computer in smart class room) to present 50 to 60 slides in two hours. In this regard, interviewee AV2 said:

> *I feel that the technology does not simplify teachers' work. A teacher has a lot to do including bringing up-to-date information to the students. My responsibility is to bring latest and up-to-date information and to present it to my students. I feel that I have better information than my students.*

This instructor thought that he had better knowledge than his students and this affected how he used ICT. He used ICT to equip himself with rich knowledge and to impart that knowledge for his students. This shows how instructors' pedagogical beliefs influence the way they use ICT.

Instructor's personal innovativeness in the domain of ICT

Some of the instructors reported that they used their past habit in using ICT in their teaching and they did not have role model in ICT use in the teaching-learning process in an innovative way. Interviewee IT2, for example, said:

> *We have online department group to communicate administrative information with members of the department. We do not post notes on notice board. We communicate through our online group. We use it for office purposes. We have not used this system in the teaching-learning process. We did not think about it. We have no role model whom we follow in this respect.*

This is a clear indication of how innovativeness influences patterns of ICT use. This instructor and his department colleagues had the skill to form online group. But they could not use it in the teaching-learning process. They needed someone as a role model to show them how to use it in the teaching-learning process. They did not want to take risk or to try out new ways of using ICT in the teaching-learning process. They are not innovative. Innovative people take risk and try out new ways of doing things. It is not lack of skill which inhibits these instructors

from using ICT to form online group with their students, it is rather their lack of innovativeness. This shows the influence of personal innovativeness on pattern of ICT use in the teaching-learning process. This interview data also has the implication that role models play significant role for less innovative instructors to adopt new ways of doing things.

5.4.2. Context-Related Variables

Some of the instructor-perceived variables that influenced their pattern of ICT use were categorized under 'Context-related variables' or 'contextual factors' as these were out of instructors' control. These factors included accessibility and availability of ICT resources, incentive, support, pressure, and policy-related issues.

Accessibility and Availability of ICT Resources

The majority of instructors who were interviewed agreed that there were sufficient ICT facilities that enabled them to use ICT in the teaching-learning process. They also agreed that they had access to these resources. It was learned from the interview that almost all instructors had at least one networked computer in their offices and the majority of them had laptop computers.

There were few instructors who complained that there was no equal access to ICT resources among colleges and departments. For example, instructors from the College of Social science and Law said that computers in their smart classrooms were not connected to the Samba Fileserver. Instructors from Jimma Institute of Technology (JIT) also complained that there were no sufficient ICT facilities in the newly built technology campus and thus they couldn't use ICT to teach first year technology students who were taking courses there.

There were also instructors who complained about Internet connection failure in a day which was affecting their work. This shows the influence of accessibility and availability of ICT resources in the use of ICT in the teaching-learning process.

Incentive

It was learned from the interview data that one of the plans of the University in using ICT in the teaching-learning process was to use ICT to upload electronic course materials. Instructors were told to prepare electronic course materials and upload them on servers in the libraries so that students could download and use them through the e-learning system. Though instructors asked to be paid for preparing and uploading the course materials, the University officials failed to respond positively with the conviction that preparing and providing course materials for students were part of the duties and responsibilities of instructors. As a result, the majority of instructors refrained from uploading course materials.

Some instructors raised the issue of time as barrier to effectively integrate ICT in the teaching-learning process. Interviewee IPD1 commented:

> *Effective integration of ICT in the teaching-learning process requires planning which, in turn, requires time. We have lots of duties and responsibilities to carry out. We also do research works for our academic promotion. I think it is difficult to invest time to plan for ICT use.*

It is evident from the report that instructors tended to invest their time in something that benefited them in return. This implies that they expected some sort of incentive to invest their time to plan for effective use of ICT in the teaching-learning process. This is in line with other studies that recognize the fact that institutions with a promotion system supporting research as a primary means for advancement can hinder technology integration (Anderson & Starrett, 2001).

This interview data has implication that incentives influence instructors' willingness to use ICT in the teaching-learning process. It is believed that ICT use requires additional preparation. New skills may have to be learned, which may require additional time and effort. This could be the reason why instructors expected some sort of incentive to effectively use ICT in their teaching.

Support

Some instructors witnessed that the university administrators provided support to the expansion and utilization of ICT in the teaching-learning process. It was also observed that there were ICT technicians at college/institute level to give technical support when instructors faced problems while they used ICT in the teaching-learning process. The structure of ICT DDO also shows the effort being made in the university to support ICT use in education. However, there were also instructors who reported that some of the computers in smart classrooms failed to work and some ICT technicians were reluctant to give prompt response when they were told to fix the problems. These instructors added that ICT technicians' reluctance to fix problems was affecting their use of ICT in the teaching-learning process. It was also commented by some instructors that there had to be continuous follow-up to check whether the technology was working or not.

The other issue raised by instructors in relation to support was the availability of training. Some instructors reported that the University provided training every year in relation to teaching and ICT use. It was also learned from the interview with the Vice President for Academic Affairs that there was a center called Academic Resource Center (ADRC) which was meant to serve as a training center to provide pedagogical and ICT trainings. However, there were instructors who reported that they did not get any training about pedagogical as well as technical use of ICT. This gave the impressions that there was no consistency and continuity in the trainings given. An expatriate staff, for example, complained that the trainings were given only for Ethiopian staff. Another instructor complained that the trainings were not sufficient. Interviewee NS1 said:

> *We were given only two trainings on ICT use. One is how to access file from the samba file server. The other is about the online grading system that we are going to implement it from now on. The trainings were not based on our needs. They were not timely. Only a small number of pedagogical trainings were given, but they were not given in a way that you can apply them in your teaching.*

Similarly, another interviewee PH1 gave the following comment, *"Training is very important. But it should not be given for the sake of giving. Needs should be assessed"*.

It was evident from the above comments that the trainings were not based on needs assessment. This highlights the importance of needs assessment before giving trainings. Trainings which are given without assessing the needs of the trainees may not be relevant. The comment also implies the need to give sufficient training that helps the trainees to put it into practice. Interviewee AV1 also commented:

> *There was a pedagogical training that was given in the main campus. I started it and I stopped it later because I was expected to go to the main campus every time the training was given. I had transportation problem. They were supposed to arrange transportation or to provide the trainings in our own campus. Generally I can say that there was no follow up about the training. There was no training on how to use ICT in teaching.*

It was evident from the comment that there was no consistent follow up while conducting the trainings. The comment also implies that trainings had to be given by considering the conveniences of the trainees.

The above comments generally show that support given by the University administration and by the ICT technicians were not sufficient, especially in relation to providing appropriate and consistent trainings. Instructors who do not have sufficient pedagogical and ICT skills may find it difficult to effectively integrate ICT in the teaching-learning process.

Pressure

Some instructors reported that there was peer pressure from colleagues which was affecting their ICT use. Interviewee SL1, for instance, reported that there was strong influence of colleagues that discouraged those who were committed to use ICT for effective teaching and learning. He said that some instructors used to mock those who consistently used ICT in their teaching. It was evident from the comment that peer pressure influences ICT use in the teaching-learning process.

Interviewee IPD1 commented that there should be a system that enforces students as well as instructors to use ICT in the teaching-learning process. Other interviewees also reported that there was no follow up from higher university officials. These interviewees complained that the officials believed on paper-based reports and they did not see what was happening on the ground. Interviewee BE2, for example, reported that due to lack of follow up from higher University officials, some instructors were misusing the technology by simply downloading and presenting ready-made materials to the students without making any change, and this was leading the teaching-learning process to harsh situation. Interviewee IPD1 also added:

> *The monitoring and evaluation system is also weak. There is no concerned body that makes classroom observation to see how ICT in smart classroom is used. Instructors are using the ICT tools in smart classrooms in the way they like. I feel that monitoring and evaluation is important to minimize the problems that we see now.*

Interviewee BE1 also commented:

> *I believe that level of ICT use as compared to the resources we have is less. Top managers believe in report and they do not know what happens on the ground.*

It is obvious that follow up entails reward or punishment (positive or negative pressure). There is no follow up means that there is no positive or negative pressure. According to the instructors, absence of administrative pressure was affecting the way they used ICT in their teaching. Generally, it can be learned here that administrative or peer pressure has influence on patterns of ICT use in the teaching-learning process.

Policy-related Issues

Regulating access and privilege to selected websites is a policy issue which needs consensus among the university community. It was learned from the interview data that there were some restrictions on some websites depending on the users' privileges. It was not allowed, for example, to use face book during the working hours (8:00 AM to 5:00 PM). One instructor

commented that the restriction on the use of face book during the working hours was controversial. There were instructors who complained that the restriction was unnecessarily affecting their works. This is one indication of how a university ICT policy may influence patterns of ICT use.

5.4.3. Demographics

Variables such as age, experience in ICT use, and teaching level were the other factors that were identified in this study to have influence on patterns of ICT use. These variables were categorized under 'Demographic variables'.

Age

The interview data revealed that some instructors believed that Age affects instructors' patterns of ICT use. For example, interviewee BE1 reported that some elder staff members were not responsive to the technology. Interviewee IT1 also said that the 'new generation' was open to technology. It can be learned here that instructors' age may influence their patterns of ICT use in the teaching-learning process. It was also evident from the interview data that some elder instructors had no trust in the technology.

Experience in ICT use

Some instructors reported that their experience in ICT use was affecting their patterns of ICT use. Interviewee BE1, for example, said: "Experience matters". The interviewee said that he was not well experienced in ICT use and hence he couldn't use the full potential of ICT in the teaching-learning process. This implies that experience in ICT use had influence on instructors' patterns of ICT use.

Teaching level

Some instructors reported that teaching level had influence on patterns of ICT use. According to these instructors, those who taught at graduate and post graduate level made use ICT as a cognitive tool more than those who were teaching at undergraduate level. Concerning this, one interviewee said:

There is better ICT use at graduate and post graduate level. Instructors can send notes to graduate Students using e-mail since almost all these students have ICT skills and access to ICT in one way or another. In addition, graduate students conduct a research and use computer software to analyze their data and report the results using computer.

This implies that the nature of the program itself required graduate students to engage in ICT use in their learning. With this regard, other instructors also added that those who taught at graduate or post graduate level required their students to use ICT to gather, organize, analyze, and present course related reports or project works. Teaching level (TL) was one of the two factors that emerged in this study as having influence on instructors' pattern of ICT use. There are very limited reports which showed the influence of teaching level on pattern of ICT use and these are limited to school level. For example, Franklin (2007) found that patterns of ICT use at lower grade levels differ from those at higher grade levels.

5.4.4. Instructor-Perceived Readiness of Students to Use ICT

Instructors perceived that the time that students had, their attitudes towards ICT in learning, their accesses to ICT resources, and their ICT competences affected the way instructors used ICT in the teaching-learning process. Instructor-perceived readiness of students to use ICT (RS) is another factor that emerged as a variable that could influence instructors' patterns of ICT use. Interviewee AV2, for example, said: "Students do not have time. They do not have skills to use ICT. They have also very limited access to ICT resources. It is very difficult to engage them in ICT use". Interviewee BE2 agrees with interviewee AV2 by stating that he couldn't engage his students in using the technology because he felt that students did not have time and the required ICT skills.

Time

Some instructors felt that students did not have enough time to use ICT to do different activities since they were engaged in a lot of course works. As a result, these instructors did not attempt to influence their students to use ICT such as the Internet to do assignments or

project works. This perception might have emanated from the instructors' personal belief that ICT use was something additional to the actual teaching-learning process.

Attitude towards ICT in Learning

Some instructors reported that students had negative attitude towards ICT use in their learning. Interviewee SL1, for example, said that students preferred to do assignments from books than from the Internet. Interviewee NS1 also said: "I feel that students do not have interest to use ICT for their learning. As a result, it seems to me that it is wastage to tell students to do assignments or other course related activities from the Internet". This instructor indirectly reported that he did not attempt to influence the students to use ICT in their learning.

Access to ICT Resources

Some instructors reported that they thought that students did not have access to computers or the Internet and, therefore, they did not attempt to influence their students to use ICT to do assignments or project works. Interviewee PH2, for example, said: "Not all students have access to computers and this hampers the full utilization of ICT in the teaching-learning process". Interviewee IT2 also reflected his concern by stating that all students did not have equal access to ICT. In fact, it was observed that students had access to ICT resources if they were interested to use these resources. The observation data revealed that there were networked computer centers around students' dormitories. There were also network rooms in the libraries which were open to students to use them. The information given by some of the instructors in relation to students' access to ICT resources imply that these instructors did not have enough information about the access that their students had to the ICT resources.

ICT Competence

Some instructors reported that their students did not have enough competence to use ICT and this was a barrier for them to involve their students in ICT use. Other instructors, on the other hand, reported that their students were more competent in ICT use and they helped them in classrooms whenever they needed technical help in ICT use. These contradicting views imply that instructors did not have the same information about their students' ICT competence.

5.4.5. Instructor-Perceived Nature of a Course

Some instructors reported that their courses did not require the use of ICT. One instructor, for example, said that mathematical courses did not require the use of ICT. Some other instructors said that their courses were difficult to teach them without the use of ICT. This shows that Course Nature as perceived by the instructors influenced their patterns of ICT use.

5.5. Summary

Instructors exhibited different patterns of ICT use in the teaching-learning process. Some of them used the technology to enhance their traditional way of teaching while others used it to involve students in constructing their own knowledge. Five patterns of ICT use emerged from this study. Generally, the findings suggest that instructors' patterns of ICT use fall in a continuum between ICT use as a course preparation tool and a cognitive tool. Based on the findings of the study, a PICT model was developed to illustrate instructors' patterns of ICT use as a continuum.

Instructors identified different variables as factors that influenced their use of ICT in the teaching-learning process. These variables included: instructor-related variables such as ICT competence, attitude towards ICT in education, pedagogical beliefs, and personal innovativeness; Context-related variables such as accessibility and availability of ICT resources, support from the administration and the ICT technical staff, administrative or peer pressure, incentives from the administration, and policy-related issues; Demographics such as age, experience in ICT use, and teaching level; Instructor-perceived readiness of students to use ICT such as time, access to ICT resources, attitude towards ICT in learning, and ICT competence; and instructor-perceived nature of a course with regard to ICT use.

It is important to note here that two new variables that may influence instructors' ICT use emerged from this qualitative strand of the study. These variables included level of teaching (LT) and instructor-perceived readiness of students to use ICT (RS). The other variables which were identified in this study as barriers or facilitators to ICT use were supported by the literature.

CHAPTER SIX

INSTRUCTORS' CHARACTERISTICS ASSOCIATED WITH THEIR PATTERNS OF ICT USE

6.1. Introduction

The purpose of this research project was to explore instructors' patterns of ICT use and to examine what factors influence their patterns of ICT use in the teaching-learning process. It is important to recall that this research project was conducted in two phases. The first phase was the qualitative study phase and the second phase was the quantitative study phase. The qualitative study was conducted before carrying out this quantitative study. The results of the qualitative study are presented in chapter four and five. The findings from the qualitative study helped to identify five categories of instructors' pattern of ICT use in the teaching-learning process and to develop a model that describes instructors' pattern of ICT use in the teaching-learning process. Two new variables which may influence instructors' pattern of ICT use also emerged from the qualitative study. These factors which emerged during the qualitative study include teaching level (TL) and Instructor-perceived readiness of students to use ICT (RS).

Based on the results of the qualitative study, some modifications were made on the survey questionnaire which was initially developed based on theories and previous studies. Some items were added and some were modified based on the result obtained from the qualitative study. Following this, the quantitative study was carried out to determine if the results from phase one (the qualitative phase) can be generalized to a population of instructors at the study site and to answer the following research question:

> *Which of the anticipated explanatory variables have the strongest significant contribution in explaining variance in instructors' patterns of ICT use in the teaching-learning process?*

Inherent to this question are the following sub-questions:

a. *What is the degree of association of the anticipated explanatory variables with instructors' patterns of ICT use (ICTU)?*

b. *How much of the variance in patterns of ICT use can be explained by the independent variables in this study?*
c. *What are the most significant explanatory variables to instructors' Patterns of ICT use?*
d. *What model can be suggested to explain variation in instructors' patterns of ICT use?*

Before attempting to answer these research questions, the investigator conducted a pilot study. As it was stated in chapter three of this research project, the pilot study was carried out to ensure the reliability and validity of the survey questionnaire and to identify ambiguities, misunderstandings, or other inadequacies. On completion of the pilot study, a few revisions were made to the survey questionnaire. Then the questionnaire was distributed to 300 instructors after the revision, of which 254 questionnaires were collected back.

Preliminary screening of the collected data enabled the investigator to identify 24 questionnaires which were incomplete or which appeared to be biased due to lack of response variation. Therefore, of the 254 surveys that were returned, 230 were used for analysis after removing 24 surveys that were incomplete or that appeared to be biased. The negatively worded items in PIICT, PB, and GAICT scales, which were included to detect response biases, were reversed before the analysis. The negatively worded items helped to identify responses which showed no variation, and hence appeared to be biased, and to remove them from the dataset.

Results of the quantitative study are presented in this chapter and in the next chapter (chapter five). This chapter describes characteristics of the respondents who participated in the quantitative study. The next chapter investigates the relationship between instructors' patterns of ICT use and the anticipated predictor variables.

6.2. Description of Respondents' Characteristics

Once preliminary screening of the survey data was done, the next step was to conduct descriptive analysis. Pallant (2001) identified three uses of descriptive analysis:

- It helps to describe the characteristics of the respondents
- It helps to check violation of the assumptions underlying the statistical technique that is used to address the research questions
- It helps to address some research questions

Accordingly, descriptive analysis was used in this chapter to describe respondents' characteristics which are associated with their patterns of ICT use. Descriptive analysis was also used to check whether the assumptions of regression analysis were violated or not (See chapter eight).

This chapter presents respondents' characteristics which are associated with their patterns of ICT use. Frequencies and percentages were used to obtain descriptive statistics for characteristics of the respondents. The results of this descriptive analysis were reported here in tabular form.

6.2.1. Demographic Characteristics of the Respondents

Demographic characteristics of the respondents here refer to their age, teaching experience, experience in ICT use, and teaching level (teaching at undergraduate or graduate level). These characteristics were included in the current study based on evidence obtained from theory, literature review and empirical study that they affect instructors' patterns of ICT use in the teaching-learning process. Four questions were used to collect data about demographic characteristics of the respondents.

The scores of responses about age of the respondents ranged from 0 (the youngest staff) to 4 (the old staff).An instructor with the age range of [20-25) is given 0; instructor with the age range of [25-30) is given 1; instructor with the age range of [30-35) is given 2; instructor with age range of [35-40) is given 3; and instructor with age range of 40 and above is given 4. An instructor with the age range of 30 to 40 is considered in this study as middle aged staff. An instructor with the age range below 30 is considered as the young staff.

The scores of responses about teaching experiences of the respondents ranged from 0 (almost no teaching experience) to 4 (well experienced). An instructor with teaching experience of [0-

1) years is given 0; instructor with teaching experience of [1-2) years is given 1; instructor with teaching experience of [2-3) years is given 2; instructor with teaching experience of [3-4) years is given 3; and instructor with teaching experience of 4 and above years is given 4. An instructor with teaching experience of less than or 2 years is considered in this study as less experienced, while instructor with teaching experience above 4 years is considered as well experienced.

The scores of responses about experience in ICT use of the respondents ranged from 0 (almost no experience in ICT use) to 4 (sufficient experience in ICT use). An instructor with ICT experience of [0-1) years is given 0; instructor with ICT experience of [1-2) years is given 1; instructor with ICT experience of [2-3) years is given 2; instructor with ICT experience of [3-4) years is given 3; and instructor with ICT experience of 4 and above years is given 4. An instructor with experience in ICT use of less than or 2 years is considered in this study as less experienced in ICT use, while instructor with experience in ICT use of above 4 years is considered as well experienced in ICT use.

The scores of responses about teaching level of the respondents ranged from 0 (completely teaches at undergraduate level) to 4 (completely teaches at graduate level). An instructor who teaches completely at undergraduate level (BA or BSc degree) is given 0; instructor who mostly teaches at undergraduate level is given 1; instructor who teaches equally at undergraduate and graduate level (MA, MSc, or PhD level) is given 2; instructor who teaches mostly at graduate level is given 3; and instructor who teaches at completely at graduate level is given 4.

The four questions that were used to collect data about demographic characteristics of the respondents are presented in Appendix F: Instruction I.

Table 5: Demographic Characteristics of Respondents

Characteristics		Number N=230	Percentage
Age	20-25	22	9.6
	26-30	61	26.5
	31-35	60	26.1
	36-40	53	23
	Above 40	34	14.8
Teaching Experience	0-1	36	15.7
	1-2	21	9.1
	2-3	31	13.5
	3-4	27	11.7
	Above 4	115	50
Experience in ICT use	0-1	24	10.4
	1-2	15	6.5
	2-3	33	14.3
	3-4	35	15.2
	Above 4	123	53.5
Teaching Level	At undergraduate level	112	48.7
	Mostly at undergraduate level	61	26.5
	Equally at graduate and undergraduate level	39	17
	Mostly at graduate level	11	4.8
	At graduate level	7	3.0

Table 5 depicts that more than 75% of the respondents are in the age range between 26 and 40 years old. Only 9.6% of the respondents are below 26 years old, and also only 14.8 % of the respondents are above 40 years old. About half of the respondents (49.5%) are middle aged.

As it can be seen from this table, half of the respondents (50%) have more than 4 years of teaching experience. This shows that half of the respondents in this study are well experienced in teaching.

It can also be seen from this table that more than 50% of the respondents have experience of ICT use for more than 4 years. This shows that more than half of the respondents in this study are well experienced in ICT use.

The table also depicts that majority of the respondents teach at undergraduate level. Only 3% of the respondents reported to teach only at graduate level. It can be seen from the table that about half of the respondents (48.7%) teach at undergraduate level.

6.2.2. Attitude, Belief and Competence of the Respondents in Relation to ICT Use

Instructors' level of personal innovativeness PIICT), their attitude to ICT in education (AICTE), their general attitude towards ICT (GAICT), their pedagogical belief (PB) and their competence in ICT use (CICT) were investigated.

In the PIICT scale, respondents were asked to respond to 4 items to indicate their level of personal innovativeness in the domain of ICT. The scores of responses ranged from 0 (lowest level of innovativeness) to 4 (highest level of innovativeness). Here PIICT scale assesses individual innovativeness as a simple continuum from high to low using a Likert-type scale. Accordingly, an instructor is said to have high score in PIICT if s/he scores an average greater than 3 in the PIICT scale and s/he is said to have low score in PIICT if s/he scores an average less than or equal to 2 in the PIICT scale. S/he is said to have medium score in PIICT if s/he scores between 2 and 3 in the PIICT scale.

In this study, those instructors who score an average of greater than 3 in the PIICT scale are referred to as innovators while those who score less than or equal to 2 are said to be laggards. Those who score an average between 2 and 3 are average adopters. The four items that were used to measure instructors' level of personal innovativeness are presented in Appendix F: Instruction II.

In the AICTE scale, respondents were asked to respond to 5 statements to indicate their attitude towards ICT in education. The scores of responses ranged from 0 (negative attitude towards ICT in education) to 4 (positive attitude towards ICT in education).

In this study, an instructor is said to have positive attitude towards the use of ICT in education if s/he scores an average greater than 3 in the AICTE scale and s/he is said to have negative attitude towards the use of ICT in education if s/he scores an average less than or equal to 2 in the AICTE scale. S/he is said to have average attitude towards the use of ICT in education if s/he scores between 2 and 3 in the AICTE scale. The five items (Item 1-5) that were used to measure instructors' attitude towards ICT in education are presented in Appendix F: Instruction III, Items 1-5.

In the GAICT scale, respondents were asked to respond to 5 statements to indicate their attitude towards ICT in general. The scores of responses ranged from 0 (negative attitude towards ICT in general) to 4 (positive attitude towards ICT in general).

In this study, an instructor is said to have positive attitude towards ICT if s/he scores an average greater than 3 in the GAICT scale and s/he is said to have negative attitude towards ICT if s/he scores an average less than or equal to 2 in the GAICT scale. S/he is said to have average attitude towards ICT if s/he scores between 2 and 3 in the GAICT scale. The five items (Item 6-10) that were used to measure instructors' general attitude towards ICT are presented in Appendix F: Instruction III, Items 6-10.

In the PB scale, respondents were asked to respond to 10 items to indicate their pedagogical beliefs. The scores of responses ranged from 0 (traditional pedagogical belief) to 4 (constructivist pedagogical belief).

In this study, an instructor is said to be constructivist in his/her pedagogical belief if s/he scores an average greater than 3 in the PB scale and s/he is said to be traditional in his/her pedagogical belief if s/he scores an average less than or equal to 2 in the PB scale. S/he is said to have mixed pedagogical belief if s/he scores between 2 and 3 in the PB scale (See Appendix F: Instruction IV).

In the CICT scale, respondents were asked to respond to 10 items to indicate their competence in ICT use. The scores of responses ranged from 0 (low competence in ICT use) to 4 (High competence in ICT use). In this study, an instructor is said to have high competence in using ICT if s/he scores an average greater than 3 in the CICT scale and s/he is said to have low

competence in using ICT if s/he scores an average less than or equal to 2 in the CICT scale. S/he is said to have medium competence in using ICT if s/he scores between 2 and 3 in the CICT scale. Conceptually CICT can be considered as a composite variable that measures instructors' technical ICT competence as well as their pedagogical ICT competence. The ten items that were used to measure instructors' competence in ICT use are presented in Appendix F: Instruction V.

Table 6 below summarizes the results obtained with regards to instructor's level of personal innovativeness, attitude towards ICT in education, general attitude towards ICT, pedagogical belief, and competence in using ICT.

From table 6, it can be clearly seen that majority of the instructors (87.4%) have got above 2 in their level of personal innovativeness (PIICT). As it was explained earlier, a person who scores above 2 in the PIICT scale is said to be either within the category of adopters or an innovator. This implies that majority of the instructors in this study are either within the category of adopters or innovators. In fact, the table depicts that 44.8% of the instructors are within the adopter category and 42.6% of them are innovators. Only 12.6% of the instructors were found to be laggards.

When it comes to attitude towards ICT in education, the table depicts that more than 50% of the instructors scored above 3 in the AICTE scale. It was explained earlier that a person who scores more than 3 in the AICTE scale is said to have positive attitude towards the use of ICT in education. This implies that majority of the instructors in this study have positive attitude towards the use of ICT in education. The table depicts that only 12.2% of the instructors scored less than 2 in the AICTE scale which, in turn, implies that only 12.2% of the instructors showed negative attitude towards the use of ICT in education. Almost similar result was obtained about the general attitude of instructors towards ICT. As it can be depicted from table 6, majority of the instructors showed positive attitude towards ICT in general. Only 7.3% of the instructors scored less than 2 in the GAICT scale (showed negative attitude towards ICT in general).

Table 6: Level of Innovativeness, Attitude, Belief, and Competence of Instructors

Characteristics		Number N=230	Percentage
PIICT	0-1	7	3
	1-2	22	9.6
	2-3	103	44.8
	3-4	98	42.6
AICTE	0-1	3	1.3
	1-2	25	10.9
	2-3	76	33.1
	3-4	126	54.7
GAICT	0-1	2	0.9
	1-2	15	6.4
	2-3	88	38.3
	3-4	125	54.4
PB	0-1	1	0.4
	1-2	9	3.8
	2-3	157	68.4
	3-4	63	27.4
CICT	0-1	1	0.4
	1-2	47	20.5
	2-3	92	40
	3-4	90	39.1

Table 6 shows that majority of the instructors (68.4%) scored between 2 and 3 in the PB scale. Only 4.2% of the instructors scored less than or equal to 2 in the PB scale. A little higher than a quarter of the instructors (27%) scored above 3 in the PB scale. As it was explained earlier, a person who scores less than or equal to 2 in the PB scale is said to have traditional pedagogical belief and a person who scores above 3 in the PB scale is said to have constructivist pedagogical belief. This result shows that only very few instructors were found

to have traditional pedagogical belief; and about a quarter of the instructors were found to have constructivist pedagogical belief.

Table 6 also shows that more than one-third of the instructors scored above 3 in the CICT scale. About one-fifth of the instructors scored less than or equal to 2 in the CICT scale. It was explained earlier that a score above 3 in the CICT scale means high competence in ICT use. It was also explained earlier that a score less than or equal to 2 in CICT scale means low competence in ICT use. This result shows that significant number of instructors in this study (about one-fifth of them) still have low competence in ICT use.

6.2.3. Instructors' Perception with Regards to Contextual Factors that May Affect ICT Use

Instructors' perception here refers to their perception about the availability of and access to ICT resources (AAICT), their perception about administrative as well as technical supports provided during ICT use (Support), their perception about whether the course they teach requires ICT use or not (CN), and their perception about students' readiness to use ICT in their learning (RS).

In the CF scale, three items (item8, item9, and item10) measure instructors' perception about the availability of and access to ICT resources. The scores of responses ranged from 0 (no ICT tool or no access to the ICT resources) to 4 (plenty of ICT tools or adequate access to the ICT tools). A score greater than 3 in AAICT means that instructors perceive that there is sufficient ICT resource and sufficient access to these resources in the university. A score of 2 or below 2 in AAICT means that instructors perceive that there is no sufficient ICT resource in the university and also access to these resources is limited. A score between 2 and 3 in AAICT means that instructors perceive that the availability of ICT resources and access to these resources in the university is at an average level. The three items (item8, item9 and item10) that were used to measure instructors' perception about access to and availability of ICT resources in the study area (AAICT) are presented in Appendix F: Instruction VIII.

The remaining seven items in the CF scale measure perceptions of instructors in relation to whether administrative or technical support was given during ICT use in the teaching-learning

process (Support). The scores of responses ranged from 0 (no support) to 4 (adequate support). A score greater than 3 in Support means that there is sufficient administrative as well as technical support while using ICT in the teaching-learning process. A score of 2 or below 2 in Support means that there is no sufficient administrative as well as technical support while using ICT in the teaching-learning process. A score between 2 and 3 in a support scale signifies that there is medium administrative as well as technical support while using ICT in the teaching-learning process The seven items that were used to measure instructors' perceptions about Support are presented in Appendix F: Instruction VIII, Items 1 to 7.

In the RS scale, respondents were asked to respond to 4 items to indicate their perception about student-related factors which focus on whether students have time, access, interest, and competence to use ICT. The scores of responses ranged from 0 (no time, access, interest, or competence to use ICT) to 4 (sufficient time, access, interest, or competence to use ICT). In this study, an instructor with an average score of greater than 3 in RS is said to perceive that there is readiness of students to use ICT in their learning. An instructor with an average score of 2 or less than 2 in RS is said to perceive that there is no readiness of students to use ICT in their learning. An average score between 2 and 3 signifies the instructor's perception that there is medium level readiness of students to use ICT. The four items that were used to measure instructors' perception about their students' readiness to use ICT in their learning are presented in Appendix F: Instruction VI.

There is also one item that asks respondents to indicate their perception about the nature of the course they teach in relation to whether it requires the use of ICT or not. The scores of responses ranged from 0 (the course doesn't require ICT use) to 4 (the course requires ICT use). In this study, an instructor with a score of 4 in CN means that s/he perceives that her/his course always requires the use of ICT. An instructor with a score of 2 or less than 2 in CN means that her/his course requires the use of ICT rarely. An instructor with a score of 0 in CN means that her/his course doesn't require the use of ICT at all. An instructor with a score between 2 and 3 in CN means that her/his course sometimes requires the use of ICT. An instructor with a score between 3 and 4 in CN means that her/his course usually requires the use of ICT. The item that was used to measure instructors' perception about the nature of the course they teach with regards to ICT use is presented in Appendix F: Instruction VII.

Table 7 shows instructors' perception about availability of and access to ICT resources, about whether there is any administrative and technical support given to instructors while they use ICT in the teaching-learning process, about whether students' are ready to use ICT in their learning, and about whether the course that they teach requires use of ICT or not.

Table 7: Perceptions of Instructors

Perception about		Number N=230	Percentage
AAICT	0-1	6	2.6
	1-2	32	13.9
	2-3	116	50.4
	3-4	76	33.1
Support	0-1	34	14.8
	1-2	90	39.1
	2-3	82	35.7
	3-4	24	10.4
RS	0-1	5	2.2
	1-2	79	34.4
	2-3	101	43.9
	3-4	45	19.5
CN	0-1	24	10.5
	1-2	36	15.7
	2-3	98	42.6
	3-4	72	31.3

Table 7 depicts that relatively higher number of the respondents (50%) gave medium score to AAICT. Only 16.5 % of the respondents scored less than or equal to 2 in the AAICT scale. The table also depicts that 33.1% of the respondents gave high score to AAICT. It was explained earlier that a score less than or equal to 2 in AAICT scale means that there is no sufficient ICT resource in the study area or there is no sufficient Access to these resources. This shows that only about one-sixth of the instructors perceived that there is no sufficient ICT

resource or no sufficient access to these resources. Majority of the instructors agreed that there is sufficient ICT resource and/or sufficient access to these resources in the study area.

It is clear from table 7 that majority of the respondents (53.9%) scored less than or equal to 2 in the Support scale. Only 10% of the instructors scored above 3 in the Support scale. As it was explained earlier, a person who scores less than or equal to 2 in the Support scale shows that he/she perceives that there is no sufficient administrative and/or technical support to enhance ICT use in the teaching-learning process. It is a person who scores above 3 who is said to perceive that there is sufficient administrative and/or technical support to enhance the teaching-learning process. Result of this study shows that majority of the instructors in this study perceived that there was no sufficient administrative and/or technical support in the study area to enhance the use of ICT in the teaching-learning process. Only one-tenth of the instructors perceived that there is sufficient administrative and/or technical support in the study area to enhance the teaching-learning process.

A close inspection of table 7 also reveals that majority of the instructors (56.4%) scored less than or equal to 2 in the RS scale. About one-fifth of the instructors (19.5%) scored above 3 in the RS scale. As was stated above, a person who scores less than or equal to 2 in the RS scale is said to perceive that students lack readiness to use ICT in their learning. Accordingly, the result of this study shows that majority of the instructors (above 50%) perceive that students lack readiness to use ICT in their learning.

One last point that can be depicted from table 7 is that about one-fourth of the instructors (26.2%) scored less than or equal to 2 in the CN measure. It was explained earlier that a person who scores less than or equal to 2 in the CN measure implies that the person perceives that the course that he/she teaches doesn't require the use of ICT in the teaching-learning process. Accordingly, the result of this study shows that about a quarter of the instructors perceive that their course doesn't require the use of ICT in the teaching-learning process.

6.2.4. Instructors' Patterns of ICT Use

Respondents were asked to give response to four questions which were developed to measure ICTU. Percentage was used to identify the ICT score that majority of the instructors in the

study site gained. The scores ranged from 0 (the lowest ICTU score) to 4 (the highest ICTU score). An instructor is said to have got high score in ICTU if s/he scores 3 or more in the ICTU scale. An instructor is said to have got medium score in ICTU if s/he scores from 2 up to 3 in the ICTU scale. S/he is said to have got low score in ICTU if s/he scores 2 or below 2 in the ICTU scale.

According to this study, an instructor who gets low score in ICTU is said to use ICT as a traditional teaching tool. Those who get high score in ICTU are said to use ICT as a cognitive tool. The higher the ICT score of the instructor, the more his/her ICT use as a cognitive tool; and the lower the ICT score of the instructor, the more his/her use of ICT as a traditional teaching tool. In the ICTU scale, choice "a" represents 0, choice "b" represents 1, choice "C" represents 2, choice "d" represents 3, and choice "e" represents 4. The average score that an instructor gets from the four questions (or indicators), which quantify the four dimensions of ICTU, represents the ICTU score of the instructor.

The result of this analysis helps to identify patterns of ICT use that were employed by majority of the instructors in the study site in the teaching-learning. The four questions which were used to measure instructors' pattern of ICT use are presented in Appendix F: Instruction IX.

Table 8: Instructors' Pattern of ICT use

	Score	**Number N=230**	**Percentage**
ICTU	0-1	54	23.5
	1-2	73	31.7
	2-3	78	33.9
	3-4	25	10.9

It can be depicted from table 8 that only 10.9% of the respondents have got high score in ICTU. It can also be seen that 33.9% of the respondents got medium score in ICTU. As it was stated earlier, a person is said to use ICT as a traditional teaching tool if he/she scores less than or equal to 2 in the ICTU scale. Here it can be seen from table 8 that majority of the

instructors (55.2%) scored less than or equal to 2 in the ICTU scale. This shows that majority of the instructors in the study area used ICT as a traditional teaching tool. In other words, the result showed that instructors more frequently used ICT as a course preparation tool or as a presentation tool.

This result also confirmed that there is variation among instructors in their pattern of ICT use in the teaching-learning process. It can be seen from table 8 that instructors' pattern of ICT use ranged from use of ICT as a traditional teaching tool (0-2 in the ICTU scale) to use of ICT as a cognitive tool (above 3 in the ICTU scale).

6.2.5. Summary

Generally, the descriptive analysis revealed that relatively higher number of the respondents (36.1%) was at a younger age. Result of the analysis also showed that relatively higher number of the respondents (50%) was found to have above 4 years of teaching experience. Moreover, the majority of the respondents (more than 50%) have more than 4 years of experience in ICT use. Relatively higher number of the respondents (48.7 %) was found to teach completely at undergraduate level.

The descriptive analysis also showed that the majority of the respondents gave high score to attitude towards ICT use in education (AICTE) and to general attitude towards ICT (GAICT). High score in AICTE means positive attitude towards ICT in education, and high score in GAICT means positive attitude towards ICT in general. Therefore, the result of the analysis implies that the majority of instructors in the study site had positive attitude towards ICT use in education and also positive attitude towards ICT in general.

Majority of the respondents got medium score in their personal innovativeness in the domain of ICT (PIICT). This implies that majority of the instructors in the study site were neither laggards nor innovators in the domain of ICT. They were in the category of adopters of ICT. The majority of the respondents also got medium score in pedagogical belief (PB). Only 4.2% of the instructors scored less than or equal to 2 in the PB scale. This implies that only very few instructors in the study area have traditional pedagogical belief. More than a quarter of them (27%) were found to have constructivist pedagogical belief. This study also revealed that

significant number of instructors in this study (about one-fifth of them) had low competence in ICT use.

This study showed that only about one-sixth of the instructors perceived that there is no sufficient ICT resource or no sufficient access to these resources. The majority of instructors agreed that there was sufficient ICT resource and/or sufficient access to these resources in the study area. The majority of instructors in this study also perceived that there was no sufficient administrative and/or technical support in the study area to enhance the use of ICT in the teaching-learning process. Moreover, the result of this study shows that the majority of instructors (above 50%) perceived that students lacked readiness to use ICT in their learning. About a quarter of the instructors also perceived that their course did not require the use of ICT in the teaching-learning process.

Result of the descriptive analysis has also shown that the majority of instructors (above 55% of the respondents) got low score in the ICTU scale. This shows that the majority of instructors in the study area used ICT as a traditional teaching tool (as a course preparation tool or as a presentation tool). The result of the study also showed that only few instructors (10.9%) in the study area scored above 3 in the ICTU scale. This shows that only few instructors used ICT as a cognitive tool.

The result of the study in this chapter also confirmed that there is variation among instructors in their pattern of ICT use, which ranged from use of ICT as a traditional teaching tool to use of ICT as a cognitive tool.

CHAPTER SEVEN

VARIABLES THAT EXPLAIN VARIANCE IN INSTRUCTORS' PATTERNS OF ICT USE

7.1. Introduction

This chapter mainly presents the result of multiple regression analysis. Before conducting multiple regression analysis, it is important to check whether the variables meet the assumptions of multiple regression and also to conduct correlation analysis. Therefore, the chapter begins by checking the assumptions of multiple regression. Then correlation analysis was carried out to check if there is significant correlation among the variables. Finally, multiple regression analysis was carried out to identify predictor variables that explain variation in instructors' patterns of ICT use.

7.2. Checking the Assumptions of Multiple Regression

Basic assumptions of multiple regression model were reviewed prior to performing the regression analysis. The key assumptions of multiple regression model are: linearity, homoscedasticity (homogeneity of variance), normality, and multicollinearity. The assumptions were checked by examining scatter plot, normal P-P plot, and VIF and tolerance from the coefficients table.

7.2.1. Checking Linearity

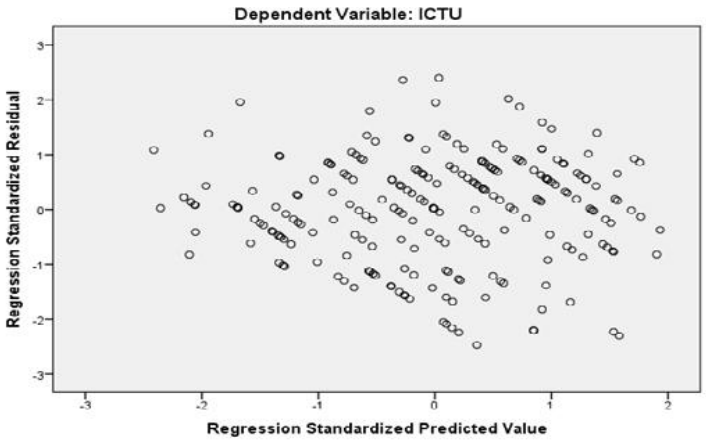

Figure 10: Scatter Plot

The model used in this study is linear regression model. This model can only accurately estimate the relationship between dependent and independent variables if the relationships are linear in nature. One method of detection is examination of residual or scatter plot. The above scatter plot of residuals (figure 10) shows linear relationship between the dependent variable and the independent variables used in this study.

The deviation from linearity test was also used to check the issue of linearity. When you do this, if the Sig value for Deviation from Linearity is less than 0.05, the relationship between the predictor variable and the dependent variable is not linear, and thus is problematic. Table 9 shows the result of the deviation from linearity test. As it can be seen here, it is only the relationship between ICTU and GAICT that doesn't show linearity. The rest predictors have linear relationship with the dependent variable. As a result, GAICT was removed from the list of predictor variables that were used in the regression analysis.

Table 9: Deviation of Independent Variables from Linearity

	Sig. for Deviation from Linearity
ICTU * Age	0.065
ICTU * TE	0.350
ICTU * EICT	0.680
ICTU * TL	0.286
ICTU * PIICT	0.180
ICTU * AICTE	0.082
ICTU * GAICT	**0.000**
ICTU * PB	0.118
CTU * CICT	0.276
ICTU * CN	0.152
ICTU * Support	0.102
ICTU * AAICT	0.616
ICTU * RS	0.125

7.2.2. Checking Homoscedasticity

Scatter (residual) plots are also used to check equality of variances or to check the constant variance assumption (homoscedasticity). Homoscedasticity simply means having your data scattered to about the same extent. If there is no violation of this assumption, standardized residuals should scatter randomly around a horizontal line of 0. As it can be seen from the above scatter plot, the residuals are scattered randomly around 0 and the constant variance assumption is not violated. This suggests that the assumption of homoscedasticity has been met.

Histogram and Normal p-p plot of standardized or studentized residuals are used to check normality assumption. If the points are clustered reasonably tightly along the diagonal straight line, the residuals are said to be normally distributed.

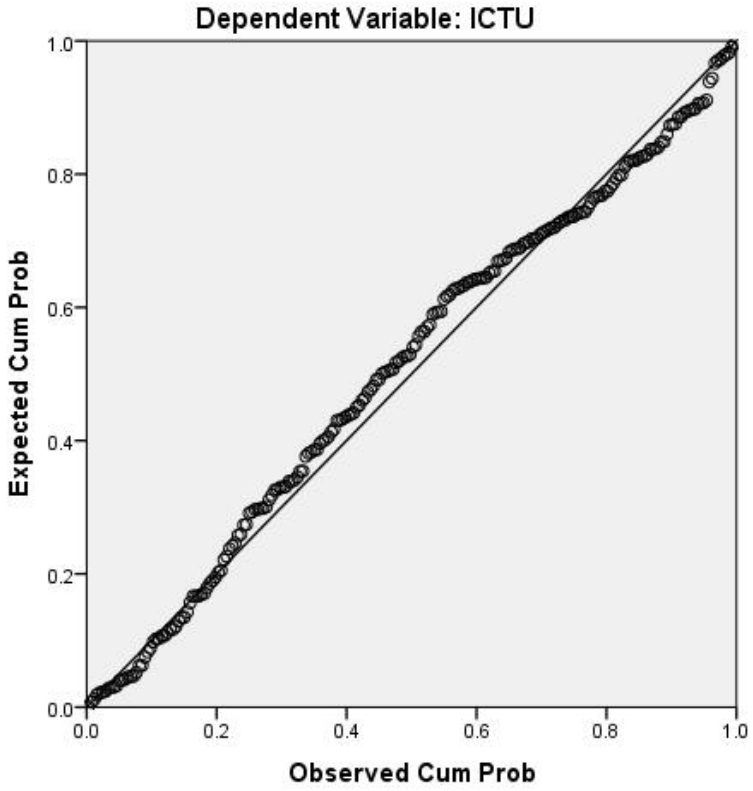

Figure 11: Normal P-P Plot

As it can be seen from the above P-P plot, all the residual points are clustered around the diagonal line which shows that the residuals are normally distributed.

7.2.3. Checking Multicollinearity

Multicollinearity means that two or more variables contribute redundant information to the multiple regression model. Multicollinearity is said to exist if there is moderate to high inter-correlations among the independent variables. If there is multicollinearity, that is, if the independent variables are highly correlated, the regression model is said to be statistically unstable in terms of prediction.

Variance Inflation Factor (VIF) measures the extent of multicollinearity problem. If VIF is more than 10, the problem needs remedial measures. VIF greater than 4 is usually considered problematic. As it can be depicted from table 10, for all the independent variables, VIF is less than 4 which shows that there is no multicollinearity problem.

Tolerance is the percentage of the variance in a given predictor that cannot be explained by the other predictors. When the tolerances are close to 0, there is high multicollinearity and the standard error of the regression coefficients will be inflated.

Table 10: Extent of Multicollinearity

	Collinearity Statistics	
	Tolerance	VIF
Age	.731	1.368
TE	.622	1.608
EICT	.609	1.643
TL	.910	1.099
PIICT	.601	1.665
AICTE	.395	2.529
PB	.389	2.568
CICT	.340	2.941
Support	.654	1.530
AAICT	.673	1.485
RS	.582	1.718
CN	.663	1.509

As it can be seen from table 10 above, tolerance is also not close to zero, which is another indication that there is no multicolleanireaty problem.

7.2.4. Checking Categorical Variables

Regression analysis requires variables to be continuous variables, that is, either interval or ratio. Ten independent variables such as Age, Teaching Experience (TE), Experience in ICT use (EICT), Personal Innovativeness in the domain of ICT (PIICT), Attitude towards ICT in Education (AICTE), Pedagogical Belief (PB), Competence in ICT use (CICT), Support, Access and availability of ICT resources(AAICT), and instructor-perceived readiness of students to use ICT (RS) and the dependent variable (ICTU) are continuous. Concerning this, Carifio and Perla (2007) noted:

> *If one is using a 5 to 7 point Likert response format, and particularly so for items that resemble a Likert-like scale and factorially hold together as a scale or subscale reasonably well, then it is perfectly acceptable and correct to analyze the results at the (measurement) scale level using parametric analyses techniques such as the F-Ratio or the Pearson correlation coefficients or its extensions (i.e., multiple regression and so on), and the results of these analyses should and will be interpretable as well.(p.115).*

James Dean Brown (2011) also agrees with this argument by stating:

> *…Likert scales contain multiple items and can be taken to be interval scales so descriptive statistics can be applied, as well as correlational analyses, factor analyses, analysis of variance procedures, etc. (if all other design conditions and assumptions are met).*

Their arguments are that while Likert questions or items may well be ordinal, Likert scales, consisting of sums or means across many items, will be interval. These scholars caution that Likert items should not be confused with Likert scales which contain usually 4 or more items.

All the Likert scales and the ICTU questionnaire meet these requirements to be labeled as continuous variables, except Teaching Level (TL) and Course Nature (CN) which have failed to meet the requirements. Brown (2011) noted that test scores are usually based on nominal right/wrong items, yet the total scores are always treated as interval data. The ICTU questionnaire is similar to the total scores of a test, which makes ICTU a continuous variable. The two variables (TL and CN) failed to meet the requirements because each of them contains only one item. They are categorical variables.

7.2.5. How the Categorical Variables Were Handled

Teaching level (TL) and course nature (CN) are categorical variables. Normally it is continuous variables that are used in multiple regression. However, these two variables are included in the list of explanatory variables to explain variance in pattern of ICT use because they were theoretically and empirically found to relate with pattern of ICT use. One way of using categorical variables in multiple regression is creating dummy variables. Dummy variables are used to represent categorical variables in multiple regression.

TL has five categories: completely at undergraduate level (completelyunder), mostly at undergraduate level (mostlyunder), equally at graduate and undergraduate level (equallyunder), mostly at graduate level (mostlygrad), and completely at graduate level (completelygrad). A set of n-1 dummy variables represent n categories of a variable. Hence, 5-1=4 dummy variables were used to represent teaching level (TL): completelyunder, mostlyunder, equallyunder, and mostlygrad. The dummy variable completelygrad was used as a reference (omitted category).

CN also has five categories: always requires use of ICT (alwaysICT), usually requires use of ICT (usuallyICT), sometimes requires use of ICT (sometimesICT), rarely requires use of ICT (rarelyICT), and does not require use of ICT (noICT). Four dummy variables (usuallyICT, sometimesICT, rarelyICT, and noICT) were used to represent instructor's perception about the nature of course he/she teaches in terms of ICT requirement (CN). The dummy variable alwaysICT was used as a reference (omitted category).Then the dummy variables were used in the regression analysis instead of the categorical variables.

7.3. Multiple Regression Analysis

After checking that the assumptions of multiple regression have not been violated, a multiple regression analysis was carried out to identify the explanatory variables that can explain large proportion of variance in instructors' pattern of ICT use. The research questions in the current study seek to understand and explain why pattern of ICT use varies from instructor to instructor, that is, why, for example, some instructors use ICT totally for delivering lecture while others use it to engage students in construction of their own knowledge. The multiple regression analysis was conducted to explain this phenomenon and also to make predictions.

Multiple linear regression produces a model that identifies the best linear combination of independent (explanatory) variables to explain variance in the dependent (criterion) variable, in this case, pattern of ICT use. It assesses the contribution of the combined variables to change the dependent variable. The method used in this multiple linear regression model is the enter method (sometimes called simultaneous method), whereby the investigator specifies a set of explanatory variables that make up the model.

Totally 13 explanatory variables were proposed to make up the model, but general attitude towards ICT (GAICT) was removed from the list due to the fact that it failed to show linearity with the dependent variable. The remaining 12 anticipated explanatory variables are Age, teaching level (TL), Teaching Experience (TE), Experience in ICT use (EICT), Personal Innovativeness in the domain of ICT (PIICT), Attitude towards ICT in Education (AICTE), Pedagogical Belief (PB), Competence in ICT use (CICT), Support, Access and availability of ICT resources (AAICT), course nature (CN) and Instructor-perceived readiness of students to use ICT (RS). The selection of these variables was based on theories and empirical evidences. Some of the variables that were used in the model building were obtained from theories and empirical evidences while the other variables emerged during the qualitative study in this research project.

7.3.1. Correlation Analysis

Gay and Airasian (2000) recommend performing simple correlations (using Pearson and Spearman analyses) between the dependent variable and the independent variables before

conducting regression analysis. Accordingly, correlation analysis was performed to identify independent variables that individually correlate with the dependent variable (instructors' pattern of ICT use).

First, Spearman analysis was performed between the two categorical independent variables (teaching level and course nature) and the dependent variable. Spearman correlation coefficient is appropriate to measure the relationship of categorical and continuous variables. Table 11 depicts the strength of correlation between the two independent variables and the dependent variable. Concerning the strength of the relationship, Cohen (1988) suggested the following rule of thumb:

r=±.10 to ±.29	Small/Weak
r=±.30 to ±.49	Medium/Modest
r=±.50 to ±1.0	Large/Strong

Table 11: Spearman's Correlation between ICTU, CN, and TL

	ICTU	CN	TL
Spearman Correlation	1	**.579****	.122
Sig. (2-tailed)		.000	.064
N	230	230	230

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

*. Correlation is significant at the 0.05 level (2-tailed).

Table 11 shows that there is strong positive correlation between course nature (CN) and pattern of ICT use. This result suggests that there is strong relationship between course nature as perceived by instructors and their pattern of ICT use. Table 11 also indicates that there is weak correlation between teaching level and pattern of ICT use. However, the correlation of teaching level with pattern of ICT use was not statistically significant at 0.05 level. As a result, teaching level was removed from the list of predictor variables.

Following Spearman's Rank Order Correlation analysis, Pearson product-moment correlation analysis was first performed between the remaining 10 continuous variables (Age, TE, EICT, AICTE, PIICT, PB, CICT, Support, AAICT, RS) and the dependent variable (ICTU) to

identify independent variables that individually correlate with the dependent variable (pattern of ICT use). The Pearson's correlation coefficients (r) in column 1 of table 12 measure the strength of the linear relationship between each of the independent variables and the dependent variable (ICTU).

Table 12: Pearson Product-Moment Correlations

	Variables	1	2	3	4	5	6	7	8	9	10	11
Pearson Correlation	1. ICTU	1.000										
	2. Age	-.565	1.000									
	3. TE	.000	.058	1.000								
	4. EICT	.161	-.097	.574	1.000							
	5. PIICT	.524	-.335	.005	.151	1.000						
	6. AICTE	.588	-.381	.000	.153	.522	1.000					
	7. PB	.629	-.421	-.039	.132	.479	.678	1.000				
	8. CICT	.731	-.439	.047	.207	.584	.641	.687	1.000			
	9. RS	.556	-.353	.013	.010	.332	.377	.448	.524	1.000		
	10. Support	.359	-.274	.031	.077	.160	.219	.314	.374	.425	1.000	
	11. AAICT	.259	-.241	.084	.113	.140	.144	.200	.283	.383	.479	1.000

Note: All correlations are significant at $p < 0.05$, 1-tailed, except the correlation of TE with ICTU, which is not significant (P-value =0.499)

Table 12 shows that instructors' personal innovativeness in the domain of ICT (PIICT), instructors' pedagogical belief (PB), instructors' competence in ICT use (CICT), instructors' attitude towards the use of ICT in education (AICTE), and age have strong correlation with pattern of ICT use in the teaching-learning process. Support has modest correlation with pattern of ICT use. Table 12 shows that experience in ICT use (EICT) and AAICT have weak correlations with pattern of ICT use. It also shows that teaching experience has no correlation with pattern of ICT use. The table also shows that the correlation between experience in ICT use (EICT) and pattern of ICT use (ICTU) is significant at 0.05 level where as the correlation between the remaining 8 variables (age, PIICT, PB, AICTE, CICT Support, AAICT, and RS) and pattern of ICT use (ICTU) is significant at 0.01 level. Since teaching experience (TE) has shown no correlation with the dependent variable, it was removed from the list of explanatory variables for the rest of the analysis.

Generally, all the independent variables except teaching experience and teaching level showed statistically significant correlation with pattern of ICT use (ICTU) and hence they were retained in the list of explanatory variables in the regression model.

7.3.2. Variance in Pattern of ICT use that can be Explained by the Anticipated Explanatory Variables in this Study

The full set of variables that were included in the regression analysis after the removal of Teaching Experience (TE) and teaching level were Age, experience in ICT use (EICT), instructors' personal innovativeness in the domain of ICT (PIICT), instructors' pedagogical belief (PB), instructors' competence in ICT use (CICT), instructors' attitude towards the use of ICT in education (AICTE), age, Support, Access and availability of ICT resources (AAICT), Instructor-perceived readiness of students to use ICT (RS), and the dummy variables that represented course nature(CN). Table 13 shows the R square and the adjusted R square. R Square (R2) tells the proportion of the variance in the dependent (criterion) variable (pattern of ICT use) which is accounted for by the above predictor variables.

Table 13: Model Summary1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.831[a]	.690	.671	.51320

a. Predictors: (Constant), AAICT, noICT, rarelyICT, EICT, sometimesICT, Age, PIICT, Support, usuallyICT, RS, AICTE, PB, CICT

The R square and the adjusted R square are 0.690 and 0.671, respectively, which are both greater than 0.5. This shows that our predictors are good at predicting pattern of ICT use. Since the sample size is large (230), the value of R square is used. This value tells us that collectively, all the variables accounted for 69 percent of the variance in pattern of ICT use, which shows that the model used is a good model. Table14 reports the significance of the model. Since $p<0.05$, the model is significant ($F_{13, 216}= 36.996$; $p<0.05$).

Table 14: The ANOVA Table1

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	126.671	13	9.744	36.996	.000[b]
	Residual	56.889	216	.263		
	Total	183.560	229			

a. Dependent Variable: ICTU

b. Predictors: (Constant), AAICT, noICT, rarelyICT, EICT, sometimesICT, Age, PIICT, Support, usuallyICT, RS, AICTE, PB, CICT

7.3.3. The Most Significant Explanatory Variables that have Impact on Instructors' Patterns of ICT Use

Standardized regression coefficients, or "betas" allow comparison of the relative importance of each variable in explaining instructors' pattern of ICT use. The b coefficient measures the amount of increase or decrease in the dependent variable for a one-unit difference in the independent variable, controlling for the other independent variable(s) in the equation. Table 15 below depicts the value of b coefficient, the beta value, and the statistical significance of each predictor variable.

Table 15: The Coefficients Table1

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.391	.336		1.162	.247
	Age	-.173	.033	-.234	-5.298	.000
	EICT	.004	.026	.007	.173	.863
	PIICT	.095	.061	.075	1.545	.124
	AICTE	.065	.066	.056	.988	.324
	PB	.148	.100	.088	1.473	.142
	CICT	.337	.076	.288	4.440	.000
	RS	.193	.058	.164	3.353	.001
	noICT	-.638	.210	-.131	-3.040	.003
	rarelyICT	-.588	.159	-.167	-3.690	.000
	sometimesICT	-.404	.121	-.164	-3.335	.001
	usuallyICT	-.319	.085	-.176	-3.757	.000
	Support	.034	.051	.032	.677	.499
	AAICT	-.054	.056	-.044	-.980	.328

Table 15 also shows that three continuous variables (Age with p<0.05, RS with p<0.05, and CICT with p<0.05) have attained significance. Moreover, all the dummy variables that represented nature of the course in terms of ICT use attained significance. This implies that age, RS, CICT, and the aforementioned dummy variables contributed more to the prediction of ICTU.

Table 16 shows that the three variables (CICT, Age, and RS) and the dummy variables that represented nature of course (CN) can predict a significant portion of the variability in instructors' pattern of ICT use. Among these, CICT is the most significant explanatory variable that has impact on pattern of ICT use.

Table 16: Degree of Significance of Predictor Variables

Predictor Variable	**Beta**	***p***
Age	-.234	p =0.000
CICT	.288	p = 0.000
RS	.164	p = 0.001
noICT	-.131	*P=0.002*
rarelyICT	-.167	*P=0.000*
sometimesICT	-.164	*P=0.001*
usuallyICT	.176	*P=0.000*

7.3.4. Model Specification

In multiple regression the major goal is to determine which independent variables contribute significantly to explaining the variability in the dependent variable, that is, to determine a best-fitting model. One part of determining a best-fitting model is to determine which variables are significant predictors of the response variable. Researchers generally include a number of explanatory variables in a model because they think all of them may be significant predictors. But, not all of them may be found to be significant predictors. There are different selection methods that are used to include only significant predictors in a final model. One of the selection methods used in this study is the backward selection method.

In a backward selection method, all the anticipated explanatory variables are included in the initial model. Then the least significant explanatory variable is removed from the model and the model is re-fit with the remaining explanatory variables. Again, the least-significant

explanatory variable is removed and the model is re-fit with the remaining explanatory variables. This process of removing one explanatory variable at a time is continued until all remaining explanatory variables are significant predictors of the response variable. As a rule of thumb, if the p-value for a variable is less than or equal to 0.1, then the variable will be included in the model as an explanatory variable.

Backward elimination based on p-values follows the following steps:

- Start with all predictors in the model.
- Remove the predictor with the highest p-value when this p-value is greater than 0.1.
- Refit the model on the remaining variables and continue until all p-values are smaller than 0.1.

1. Result of the Regression Analysis after the Removal of EICT

As it can be seen from table 15 on the previous page, the variable with highest p-value is EICT (p-value =0.863). It was, therefore, removed first and then another regression analysis was carried out. Table 17 shows result of the regression analysis after the removal of EICT. It shows that the R square and the adjusted R square are 0.690 and 0.673, respectively. This shows that our predictors after the removal of EICT are good at predicting pattern of ICT use. This value tells us that collectively, all the remaining variables accounted for 69 percent of the variance in pattern of ICT use.

Table 17: Model Summary2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.835[a]	.690	.673	.51113

a. Predictors: (Constant), AAICT, completelyunder, usuallyICT, PIICT, mostlygrad, rarelyICT, noICT, Age, equallyunder, Support, sometimesICT, RS, AICTE, PB, CICT, mostlyunder

Table 18 below shows significance of the model. Since $p<0.05$, the model is significant ($F_{12, 217}= 40.257$; $p<0.05$).

Table 18: ANOVA Table2

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	126.663	12	10.555	40.257	.000[b]
	Residual	56.897	217	.262		
	Total	183.560	229			

a. Dependent Variable: ICTU

b. Predictors: (Constant), AAICT, noICT, rarelyICT, sometimesICT, Age, PIICT, Support, usuallyICT, RS, AICTE, PB, CICT

Table 19 shows that Support has the highest P-value (0.498), followed by AAICT (P-value=0.332) and AICTE (P-value=0.321).

Table 19: The Coefficients Table2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.402	.330		1.219	.224
	Age	-.173	.033	-.234	-5.312	.000
	PIICT	.095	.061	.075	1.556	.121
	AICTE	.065	.066	.056	.995	.321
	PB	.147	.100	.088	1.471	.143
	CICT	.338	.075	.289	4.499	.000
	RS	.192	.057	.162	3.369	.001
	noICT	-.638	.210	-.131	-3.046	.003
	rarelyICT	-.591	.158	-.168	-3.740	.000
	sometimesICT	-.407	.120	-.165	-3.379	.001
	usuallyICT	-.320	.084	-.177	-3.784	.000
	Support	.035	.051	.032	.679	.498
	AAICT	-.054	.055	-.044	-.972	.332

a. Dependent Variable: ICTU

2. Result of the Regression Analysis after the Removal of Support

As it can be seen from table 19 above, Support has the highest P-value and, hence, backward selection method suggests that it has to be removed from the list.

Table 20 shows the result of the regression analysis after the removal of Support.

Table 20: Model Summary3

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.830[a]	.689	.674	.51142

a. Predictors: (Constant), AAICT, noICT, rarelyICT, sometimesICT, Age, PIICT, RS, usuallyICT, AICTE, PB, CICT

Table 20 shows that the R square and the adjusted R square are 0.689 and 0.674, respectively. This shows that our predictors after the removal of Support are good at predicting pattern of ICT use. This value tells us that collectively, all the remaining variables accounted for 68.9 percent of the variance in pattern of ICT use.

Table 21 below shows significance of the model. Since $p<0.05$, the model is significant ($F_{11, 218}= 43.983$; $p<0.05$).

Table 21: ANOVA Table3

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	126.542	11	11.504	43.983	.000[b]
	Residual	57.018	218	.262		
	Total	183.560	229			

a. Dependent Variable: ICTU
b. Predictors: (Constant), AAICT, noICT, rarelyICT, sometimesICT, Age, PIICT, RS, usuallyICT, AICTE, PB, CICT

Table 22 shows that AAICT has the highest P-value (0.434), followed by AICTE (P-value=0.331) and PIICT (P-value=0.133). The backward selection method suggests that AAICT has to be removed from the list of predictor variables.

Table 22: The Coefficients Table3

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.401	.329		1.220	.224
	Age	-.174	.032	-.236	-5.358	.000
	PIICT	.092	.061	.073	1.510	.133
	AICTE	.064	.065	.055	.975	.331
	PB	.152	.100	.091	1.530	.128
	CICT	.345	.074	.295	4.632	.000
	RS	.199	.056	.168	3.557	.000
	noICT	-.636	.209	-.130	-3.039	.003
	rarelyICT	-.593	.158	-.169	-3.758	.000
	sometimesICT	-.403	.120	-.164	-3.353	.001
	usuallyICT	-.323	.084	-.179	-3.836	.000
	AAICT	-.040	.052	-.033	-.784	.434

a. Dependent Variable: ICTU

3. Result of the Regression Analysis after the Removal of AAICT

As it can be seen from table 23, the next variable with the highest P-value which has to be removed from the list of explanatory variables is AAICT. The result of the regression analysis after the removal of AAICT is shown as follows.

Table 23 shows that the R square and the adjusted R square are 0.689 and 0.674, respectively. This shows that our predictors after the removal of AAICT are good at predicting pattern of ICT use. This value tells us that collectively, all the remaining variables accounted for 68.9 percent of the variance in pattern of ICT use.

Table 23: Model Summary4

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.830[a]	.689	.674	.51097

a. Predictors: (Constant), usuallyICT, CICT, noICT, rarelyICT, Age, RS, PIICT, sometimesICT, AICTE, PB

Table 24 below shows significance of the model. Since $p<0.05$, the model is significant ($F_{10, 219}= 48.405$; $p<0.05$).

Table 24: The ANOVA Table4

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	126.382	10	12.638	48.405	.000[b]
	Residual	57.179	219	.261		
	Total	183.560	229			

a. Dependent Variable: ICTU

b. Predictors: (Constant), usuallyICT, CICT, noICT, rarelyICT, Age, RS, PIICT, sometimesICT, AICTE, PB

Table 25 shows that now AICTE has the highest P-value (0.305), followed by PIICT (P-value=0.126) and PB (P-value=0.121). The backward selection method suggests that AICTE has to be eliminated from the list of predictor variables.

Table 25: The Coefficients Table4

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.296	.300		.987	.325
	Age	-.171	.032	-.232	-5.310	.000
	PIICT	.093	.061	.074	1.535	.126
	AICTE	.067	.065	.058	1.028	.305
	PB	.155	.099	.092	1.557	.121
	CICT	.340	.074	.290	4.584	.000
	RS	.187	.054	.158	3.478	.001
	noICT	-.644	.209	-.132	-3.084	.002
	rarelyICT	-.583	.157	-.166	-3.712	.000
	sometimesICT	-.392	.119	-.160	-3.290	.001
	usuallyICT	-.316	.084	-.175	-3.777	.000

a. Dependent Variable: ICTU

4. Result of the Regression Analysis after the Removal of AICTE

Among the remaining variables AICTE has the highest P-value and, hence, it was removed from the list of the explanatory variables. Table 26 shows that the R square and the adjusted R square after the removal of AICTE are 0.687 and 0.674, respectively. This shows that our predictors after the removal of AICTE are good at predicting pattern of ICT use. This value tells us that collectively, all the remaining variables accounted for 68.7 percent of the variance in pattern of ICT use.

Table 26: Model Summary5

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.829[a]	.687	.674	.51103

a. Predictors: (Constant), usuallyICT, CICT, noICT, rarelyICT, Age, RS, PIICT, sometimesICT, PB

Table 27 below shows significance of the model. Since $p<0.05$, the model is significant ($F_{9, 220}= 53.653$; $p<0.05$).

Table 27: The ANOVA Table5

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	126.106	9	14.012	53.653	.000[b]
	Residual	57.454	220	.261		
	Total	183.560	229			

a. Dependent Variable: ICTU

b. Predictors: (Constant), usuallyICT, CICT, noICT, rarelyICT, Age, RS, PIICT, sometimesICT, PB

Table 28 shows that now all the remaining variables have the required significant level (P-value less than 0.1).

Table 28: The Coefficients Table5

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.339	.297		1.139	.256
	Age	-.174	.032	-.235	-5.395	.000
	PIICT	.105	.060	.083	1.749	.082
	PB	.194	.092	.116	2.124	.035
	CICT	.353	.073	.301	4.833	.000
	RS	.186	.054	.157	3.453	.001
	noICT	-.674	.207	-.138	-3.258	.001
	rarelyICT	-.589	.157	-.168	-3.747	.000
	sometimesICT	-.408	.118	-.166	-3.450	.001
	usuallyICT	-.321	.084	-.178	-3.839	.000

a. Dependent Variable: ICTU

Now after the removal of all the variables with p-values greater than 0.1, six variables (Age, PIICT, PB, CICT, RS, and CN described with its dummy variables) were found to have significant contribution to explain variance in pattern of ICT use.

The estimated regression equation is therefore:

ICTU=0.339-0.174Age+0.105PIICT+0.194PB+0.353CICT+0.186RS-0.674noICT-
0.589rarelyICT-0.408sometimesICT-0.321usuallyICT

It can be seen from the regression equation that

- As age of instructors increases, the value of ICTU decreases;
- As instructors' personal innovativeness in the domain of ICT increases, the value of ICTU also increases;
- As the value of the value of instructors' pedagogical belief increases, the value of ICTU also increases;
- As instructors' competence in ICT use increases, the value of ICTU also increases;
- As instructors' perception about students' readiness to use ICT increases, it appears that their use of ICT as a cognitive tool also increases.

Each of the dummy variables which are included in the regression equation (noICT, rarelyICT, sometimesICT and usuallyICT) has only two possible values, 0 and 1. If we substitute 1 for noICT and leave the other dummy variables to be 0, the regression equation for instructors who perceive that their course doesn't require ICT use will become:

ICTU=0.339-0.174Age+0.105PIICT+0.194PB+0.353CICT+0.186RS-0.674noICT
=0.339-0.174Age+0.105PIICT+0.194PB+0.353CICT+0.186RS-0.674 (1)
=0.339-0.174Age+0.105PIICT+0.194PB+0.353CICT+0.186RS-0.674
=-0.335-0.174Age+0.105PIICT+0.194PB+0.353CICT+0.186RS

If we substitute 1 for rarelyICT and leave the other dummy variables to be 0, the regression equation for instructors who perceive that their course requires the use of ICT rarely will become:

ICTU=-0.25-0.174Age+0.105PIICT+0.194PB+0.353CICT+0.186RS

Similarly, if we substitute 1 for sometimesICT and leave the other dummy variables to be 0, the regression equation for instructors who perceive that their course sometimes requires the use of ICT will become:

ICTU=-0.069-0.174Age+0.105PIICT+0.194PB+0.353CICT+0.186RS

Finally, if we substitute 1 for usuallyICT and leave the other dummy variables to be 0, the regression equation for instructors who perceive that their course usually requires the use of ICT will become:

ICTU=-0.018-0.174Age+0.105PIICT+0.194PB+0.353CICT+0.186RS

This implies that, keeping the other variables constant, instructors who perceive that their course usually requires the use of ICT score high in ICTU and those who perceive that their course doesn't require ICT use score low in ICTU.

7.4. Summary

Instructors' personal innovativeness in the domain of ICT (PIICT), pedagogical belief (PB), competence in ICT use (CICT), attitude towards the use of ICT in education (AICTE), perceived nature of course (CN), perceived readiness of students to use ICT (RS), and Age showed strong correlation with pattern of ICT use in the teaching-learning process. Support as well as accessibility and availability of ICT resources (AAICT) showed modest correlation with their patterns of ICT use. Experience in ICT use showed weak correlations with pattern of ICT use. Teaching experience showed no correlation with pattern of ICT use and thus it was excluded from the list of explanatory variables. The correlation of teaching level (TL) with pattern of ICT use was not significant at 0.05 level and hence it was also removed from the list of explanatory variables.

Instructors' competence in ICT use (CICT), Age, personal innovativeness in the domain of ICT (PIICT), pedagogical belief (PB) and perceived readiness of students to use ICT (RS) as well as dummy variables that represented nature of course (CN) were found to have significant contribution to explain variance in instructors' patterns of ICT use in the teaching-learning process. Instructors' competence in ICT use (CICT) was found to have the highest beta value implying that it makes the highest unique contribution in explaining variance in instructors' patterns of ICT use.

CHAPTER EIGHT

DISCUSSION

8.1. Brief Description of the Study

This report was written based on a research which was conducted at Jimma University, Ethiopia, during the 2013/2014 academic year. The purpose of this study was to explore instructors' patterns of ICT use in the teaching-learning process and to examine what factors influence such patterns of ICT use. The three overarching research questions underlying the study were:

1. *How do instructors use ICT in the teaching-learning process?*
2. *Why do instructors use ICT the way they use it?*
3. *Which of the anticipated explanatory variables have the strongest significant contribution in explaining variance in instructors' patterns of ICT use in the teaching-learning process?*

Inherent to the third question are the following sub-questions:

a. *What is the degree of association of the anticipated explanatory variables with instructors' patterns of ICT use (ICTU)?*
b. *How much of the variance in patterns of ICT use can be explained by the independent variables in this study?*
c. *What are the most significant explanatory variables to instructors' Patterns of ICT use?*
d. *What model can be suggested to explain variation in instructors' patterns of ICT use?*

A mixed research approach was employed in this study to answer the above research questions. The research design used was a sequential exploratory design, whereby first a qualitative study is conducted followed by a quantitative study. The qualitative study was conducted mainly to explore how instructors use ICT in the teaching-learning process and to

identify some variables that may have influence on their patterns of ICT use. A total of 14 instructors, one representative from the ICT Development Directorate Office, and the Vice President for Academic Affairs of the university participated in the qualitative strand of this study. Unstructured observation and semi-structured interview were the data collection methods used in the qualitative strand of the study.

Following the qualitative study, a quantitative study was conducted to check the generalizability of the findings of the qualitative study and also to identify the most significant explanatory variables that have impact on instructors' patterns of ICT use. Multiple linear regression analysis was used to identify the most significant explanatory variables. In addition, descriptive analysis was carried out in order to have overall understanding of instructors' responses (Thorndike, 2005). Here percentage was used for the descriptive analysis. Totally 230 instructors participated in the quantitative study phase. Survey questionnaire was used as data collection instrument.

The main body of this chapter begins by summarizing the major findings of the study followed by explaining the findings in relation to the above research questions, theories and previous studies.

8.2. Summary of the Major Findings

The current study revealed that there were variations among instructors in their patterns of ICT use. Generally, five categories of instructors' patterns of ICT use emerged from the qualitative strand of this study. These patterns were observed in the forms of ICT use as: a course preparation tool, a presentation tool, an information exchange tool, a collaboration tool, and a cognitive tool.

It was emphasized in this study that instructors' patterns of ICT use fall in a continuum between ICT use as a course preparation tool and ICT use as a cognitive tool. It was also found in this study that the majority of Jimma University instructors used ICT either as a course preparation tool or as a presentation tool. Only few instructors were found to use ICT as a cognitive tool or as a collaboration tool.

This study found that instructors' patterns of ICT use had strong association with some set of variables like instructors' age, instructors' competence in ICT use, instructors' attitude towards the use of ICT in education, instructors' pedagogical belief, instructors' personal innovativeness, course nature as perceived by instructors, and instructor-perceived readiness of students to use ICT in their learning. All these explanatory variables except age showed positive correlation with instructors' patterns of ICT use. Age showed negative correlation with instructors' pattern of ICT use.

A regression model that was designed from nine explanatory variables was found to be statistically significant regression model to explain variance in instructors' patterns of ICT use in the teaching-learning process. The study also found that instructors' competence in ICT use (CICT), age, level of innovativeness in the domain of ICT, pedagogical belief, perceived readiness of students to use ICT (RS), and course nature (CN) explained significant portion of the variability in instructors' patterns of ICT use. Among these, instructors' competence in ICT use (CICT) was found to be the most significant explanatory variable that has the greatest impact on pattern of ICT use.

8.3. Discussion of the Findings

8.3.1. Instructors' Patterns of ICT Use

The current study revealed that instructors' patterns of ICT use could be classified into five categories. These were ICT use as: a course preparation tool, a presentation tool, an information exchange tool, a collaboration tool, and a cognitive tool. These variations among instructors in patterns of ICT use in the teaching-learning process were thought to be attributed to different factors which could be intrinsic or extrinsic to the instructors.

The finding that instructors' patterns of ICT use can be classified into different categories is congruent to previous research findings. For example, Baylor and Ritchie (2002) made distinction between types of educational computer use, including the use of computers for collaboration or the use of computers for higher order skills. Study conducted by Tondeur, et al. (2007) on pattern of ICT use suggested a three-factor structure, labeled as 'basic computer skills' (to develop students' technical computer skills), 'the use of computers as an

information tool' (to search and process information) and 'the use of computers as a learning tool' (to practice knowledge and skills).

As it was also indicated in chapter three, Ainley, Banks, and Fleming (2002) categorized educational computer use as 'computers as information resource tools', 'computers as authoring tools' and 'computers as knowledge construction tools'. Van Braak et al. (2004) classified activities using ICT during teaching into the following eight types: encouraging collaborative learning; using ICT for differentiation activities; encouraging students to improve their ICT skills; requiring students to complete assignments on a computer; using ICT as a demonstration tool; using ICT as an instruction tool; encouraging students to search for information on the Internet; and, teaching students about the possibilities of ICT use. Inan and Lowther (2010) identified three broad categories of patterns of ICT use: ICT for instructional preparation, ICT for instructional delivery, and ICT as a learning tool.

It was obtained from the study that those instructors who used ICT as a course preparation tool used it to prepare course materials. Those instructors who used ICT as a presentation tool used it mainly to deliver courses in the classroom in the form of PowerPoint slides. Those instructors who used ICT as information exchange tool used it to communicate with students through e-mail to exchange course materials or assignments. Those instructors who used ICT as a collaboration tool used it to form online discussion groups and to post materials related to the course they teach for discussion with their students or to exchange ideas, opinions, and views with their students. Those instructors who used ICT as a cognitive tool engaged their students in ICT use to construct their own knowledge either individually or in group by using ICT to gather data, organize data, analyze data, draw meanings form the analysis, and share to others what they have learned.

The current study revealed that the majority of instructors used ICT either as a course preparation tool or as a presentation tool. Using ICT for presentation or to prepare course materials are related to traditional methods of teaching. The traditional role of teaching focuses on the teacher as organizer of learning activity or provider of information for the students. The fact that the majority of instructors use ICT either as course preparation tool or as a presentation tool means that students are not benefiting more from the technology because

this pattern of ICT use excludes students from engaging in ICT use to construct their own knowledge.

Only few instructors were found to use ICT to engage students in construction of their own knowledge (ICT as a cognitive tool). Few instructors were also found to use ICT to exchange course-related materials with their students (ICT as an information exchange tool). Still very few instructors also used ICT to create online discussion groups with their students to exchange ideas, or to make online forums with students (ICT as a collaboration tool).

These findings are in line with previous studies. For example, Barak (2007) noted that instructors showed resistance to change their traditional way of teaching even in ICT rich environments. This could be attributed to context related as well as instructor related variables.

The investigator believes that students benefit more if they happen to be engaged in ICT use to construct their own knowledge, that is, if ICT is used as a cognitive or collaboration tool. Stated in a different way, what is very important is not what instructors do with ICT, rather what students do with the technology. This idea is supported by other scholars (Pea, 1985; Kozma, 1991; Mayes, 1992; Reeves, 1999; Jonassen, 2000). Bransford, Brown, and Cocking (2000) contend that the positive impact of technology depends mainly on how students use ICT in their classes. It is therefore important for instructors to be aware of the importance of engaging students in ICT use to construct their own knowledge.

This finding has practical significance in that it shows the underutilization of ICT in the teaching-learning process in the study site. As has been discussed in chapter, the underutilization of ICT can be seen in two ways: first, in terms of the amount of time ICT is actually used in the teaching-learning process and second, in terms of how it is used. ICT is said to be effectively used if it is used in such a way that it facilitates and enhances students' learning, that is, if it is used as a cognitive tool. The findings of the current study showed that ICT has not been used as a cognitive tool by the majority of instructors in the study site. Generally, it can be stated that ICT has not been utilized to the maximum level.

8.3.2. Factors that Affect Instructors' Patterns of ICT Use

The qualitative strand of this study showed that there were sufficient ICT tools and services in the study site. The study also showed that majority of the instructors and students had access to these tools and services. Even though the majority of instructors had access to ICT tools and services, the study suggests that only few instructors were able to use the technology effectively for the teaching-learning process.

Moreover, not all instructors did welcome the technology. It was found in this study that some instructors had accepted the new ICT environment as a negative influence while others accepted it as an opportunity. Some of the negative perceptions of instructors against the new ICT environment can be attributed to their lack of awareness of the potentials of ICT to enhance students' learning. Another source of this negative perception could be attributed to lack of technical support, which may lead instructors to frustration during failure to fix such technical problems.

Instructors who failed to adopt the technology tried to cope with the environment by using avoidance as coping mechanism. This is in line with the assertion that teachers who lack competence have little or no confidence in using ICT in their work and try to avoid them altogether (Dawes, 2001; Larner & Timberlake, 1995; Russell & Bradly, 1997 in Jones, 2004). Other studies also show that teachers use escape-avoidance as one strategy to cope with ICT-related stresses (Kyriacou, 2001).

Some of the negative perceptions of instructors at Jimma University against the ICT environment were reported to have emanated from the concern that some other instructors were misusing the technology for their convenience rather than using it to enhance students' learning. Those instructors who were suspected of using ICT for their personal benefits were reported to have used ICT to present large portion of a course in few periods and use the rest of their time to do other things. Some of these instructors were also blamed by their colleagues for using ICT to download readymade PowerPoint slides so as to present them to the students without making any change.

It was reported by some of the interviewees of this study that those instructors who misused ICT in this way made less preparations to their lessons and heavily relied on the technology. These same instructors found it difficult to teach without ICT and dismissed classes during power interruption or network failure. It was also reported during the interview that those instructors who were not prepared well to teach tended to totally rely on the Internet for what they taught. They downloaded everything from the Internet and provided it to their students without adapting it. It is obvious that not everything from the Internet is reliable (Vedder, 2001). Some of the information posted on the Internet may be of poor quality, personal opinion or even misleading. Literature also confirms that misuse of ICT can be one factor that contributes to inappropriate use of ICT in the teaching-learning process (Zare-ee, 2011).

What the above finding possibly suggests is that commitment to the teaching profession is one factor that influences instructors' patterns of ICT use. It can be argued that those instructors who misused ICT for their convenience did lack commitment to their teaching profession. But this factor, lack of commitment to the teaching profession, was not included in the list of explanatory variables to patterns of ICT use. All the instructors who reported the case that ICT had been misused tended to blame other instructors and none of them wanted to share the blame. This signals that instructor may not give honest and unbiased answer if they happen to respond to questions related to self-assessment about their commitment to their teaching profession. With the fear that its inclusion may lead to wrong conclusion, the investigator excluded commitment to the teaching profession from the list of explanatory variables. Other researchers in the area may include commitment to the teaching profession as one predictor variable by incorporating students' perspectives.

Even those instructors who perceived the new ICT environment positively expressed the benefits of ICT from two perspectives. Those instructors who expressed ICT's benefits from their own perspective reported that ICT had made teaching simpler and effective, enhanced lecture presentation, and made it easier to deliver knowledge to a large number of students. What one can conclude from this finding is that instructors' belief about effective teaching (or in other words their pedagogical belief) has influence on their use of ICT. It is clear that these instructors believed that teaching is delivering a lesson. It can be argued that these instructors

will not be able to make use of the full potential of ICT in the teaching-learning process unless they change their traditional pedagogical beliefs into constructivist pedagogy.

Those instructors who perceived the benefits of ICT from the students' perspective noted that ICT use in the teaching-learning process simplified students' works, enhanced students' learning, contributed to better student achievement, and created higher level of student interest and motivation. This is consistent with other research findings which assert that ICT can enhance critical thinking and problem solving capacities of students, stimulates students' interest to learn, and can improve students' learning outcomes (Bransford et al, 2000; Lowther, et al. 2008; Weert & Tatnall 2005; McMahon, 2009; Castro Sanchez & Aleman, 2011).

In general, it was found that only few instructors appreciated the benefits of ICT from students' perspective. This implies that even the majority of instructors who showed positive perception to the use of ICT in education did so not because it helped to enhance students' learning, but because ICT simplified their work.

In addition to the above factors (perception, commitment and attitude), the qualitative strand of this study also showed that other factors such as demographic factors including age, experience in ICT use, and teaching level; instructor-related variables such as competence in ICT use, pedagogical belief and personal innovativeness in the domain of ICT; context-related variables (contextual factors) such as availability and accessibility of ICT tools and services, and administrative and technical support; instructor-perceived readiness of students to use ICT, that is, whether they have time to use ICT or not, whether they have access to ICT resources or not, whether they have positive attitude towards ICT or not, and whether they have competence to use ICT or not; and instructor-perceived nature of the course with regard to whether the course they teach requires ICT use or not were identified by the interviewees in the current study to have influence on their patterns of ICT use in the teaching-learning process.

Findings of the qualitative and the quantitative strands of this study supported each other. The quantitative study showed that there was strong correlation of instructors' patterns of ICT use with some set of variables like instructors' competence in ICT use, instructors' age,

instructors' attitude towards ICT in education, instructors' pedagogical belief, instructors' personal innovativeness in the domain of ICT, course nature, and instructor-perceived readiness of students to use ICT.

The current research showed the correlation of Age with instructors' patterns of ICT use. The qualitative strand of the study indicated that elder staff members tended to resist ICT use while new staff members were enthused to try out ICT in their teaching. The quantitative study also showed that Age was one of the explanatory variables that made the greatest contribution to explain variations in instructors' patterns of ICT use. These findings are in line with other research findings. Some research findings (Bradley & Russell, 1997; Venkatesh & Morris, 2000; Volman & van Eck, 2001; Roberts, Hutchinson & Little, 2003) confirmed that Age is one of the influential factors in the use of ICT in the teaching-learning process.

The negative correlation of Age with innovative use of ICT in the teaching-learning process could be attributed to differences in experience in ICT use between the elder and the younger faculty members. Experience in the country tells us that the majority of elder faculty members had little or no exposure to ICT while they were in their school age; whereas the newly recruited faculty members had taken ICT either at university level or at secondary school level. It is supported by different studies that, exposure to ICT helps to develop one's confidence to use ICT. That is, the more a person has experience with ICT, the more his/her tends to use it (Example, Van Braak, 2004).

Other findings also confirm that older people (with age between 40 and 60) tend to resist innovation. Mini and Janetius (2012) put people with age between 40 and 60 (old staff in the current research) under the category of middle age and they found that people in this group are poor in technology adaptation due to the fact that they are not familiar with the modern technologies. Age is one of those variables on which we have no control. The investigator suggests that providing training opportunities related to ICT use in teaching may help elder staff members to develop the confidence to use ICT in their teaching.

The qualitative strand of this study showed that experience in ICT use was one of the factors that had influence on instructors' pattern of ICT use in the teaching-learning process. It was reported in this study that those instructors who had less experience in ICT use couldn't utilize

the full potential of the technology. The quantitative study of this research project also confirmed that experience in ICT use has correlation with patterns of ICT use, though the correlation was weak. Literature also shows that experience in ICT use has influence on patterns of ICT use (Rogers, 1995; Schiller, 2003). Van Braak et al (2004) also found that computer experience is positively related to the use of computer in the teaching-learning process.

Teaching level was one of the new variables that emerged in the qualitative strand to have influence on instructors' patterns of ICT use. The qualitative strand showed that instructors who taught at graduate level used ICT as a cognitive tool more often than those who taught at undergraduate level. This was attributed to the fact that graduate students had better access to technology and also they were expected to be engaged in project works which, in turn, required them to use the technology to gather, organize, analyze, interpret and report their findings with the help of the technology.

However, the quantitative strand of this study showed that teaching level had no significant correlation with instructors' patterns of ICT use and hence it was removed from the list of explanatory variables that explain variance in instructors' patterns of ICT use. This could be attributed to the fact that very small percentage of the instructors reported to have taught at graduate level. This small percentage may fail to show the real picture of how ICT was used by instructors who were teaching at graduate level.

Personal innovativeness in the domain of ICT was also found to have positive correlation with patterns of ICT use in the teaching-learning process. The qualitative strand showed that some instructors were laggards in ICT use in that they followed their past habit and they didn't want to try out new ways of using ICT in the teaching-learning process. These instructors were found to use ICT in the traditional way. The quantitative study also confirmed that there was strong positive correlation between instructors' personal innovativeness in the domain of ICT and their patterns of ICT use. This means that instructors who had higher level of personal innovativeness in the domain of ICT were found to use ICT as a cognitive tool where as those who had low level of personal innovativeness in the domain of ICT tended to use ICT to enhance traditional methods of teaching.

The finding that there was positive correlation between instructors' personal innovativeness and their patterns of ICT use is in line with other research findings which have shown that personal innovativeness influences educational change (Tondeur, Devos, Van Houtte, Van Braak & Valcke, 2009; Hannon, 2009). These findings imply that those persons who are open to new things and who tend to try out new ways of doing things tend to bring about educational change by using ICT more than those who are resistant to innovation.

The qualitative strand of this study showed that attitude towards ICT in education was one of the factors that had influence on instructors' patterns of ICT use in the teaching-learning process. Those instructors who had negative attitude towards ICT in education were found to avoid ICT use in the teaching-learning process. The quantitative strand of the study also confirmed that attitude towards ICT in education had strong positive correlation with patterns of ICT use in the teaching-learning process. This shows that instructors who have positive attitude towards ICT in education tend to make innovative use of ICT in the teaching-learning process and those who have negative attitude towards ICT in education fail to make innovative use of ICT in their teaching.

This is also consistent with other research findings which have shown that attitude towards ICT in education has significant influence on classroom use of ICT. For example, results of a study conducted by Sang and associates (2010) show that teacher's attitude towards computers in education influence ICT integration. This is also consistent with Ma and Liu's (2004) contention that attitude leads to intention which generates behavior (action). The theory of reasoned action (Fishbein & Ajzen, 1975), which is one component of the theoretical framework used in the current study, also confirmed that attitude has influence on action.

Both the qualitative and the quantitative strands of this study have shown that instructors' pedagogical beliefs influence their patterns of ICT use. The qualitative study has shown that those instructors who had behaviorist approach in their teaching reported to have used ICT to enhance traditional teaching approach. The quantitative study also showed that there was strong positive correlation between instructors' pedagogical beliefs and their patterns of ICT use. This implies that instructors who have constructivist pedagogical beliefs tend to use ICT as a cognitive tool in the teaching-learning process. These findings are also supported by

literature. It is documented in the literature that the way teachers integrate computers into their classroom instruction seems to be strongly mediated by their belief systems (Windschitl & Sahl 2002).

Mumtaz (2000), for example, noted that teachers' beliefs about teaching are central in influencing teachers to use ICT in their teaching. Niederhauser and associates (1999) contend that to be successful in computer use and integration, teachers need to engage in conceptual change regarding their beliefs about the nature of learning, the role of the student, and their roles as teachers. Studies have shown that teachers with the most constructivist beliefs are highly active computer users (Becker, 2001; Niederhauser & Stoddart, 2001).

However, teachers with traditional beliefs are less likely to use ICT as advocated (Ertmer, 2005). Teachers who use ICT do so because their conceptions of using ICT already fit within their existing teaching beliefs (Higgins & Moseley, 2001; Riel & Becker, 2000). Ertmer (2005) has documented that teachers who adopt strong constructivist educational beliefs are more likely to use ICT in their classroom practice. All these empirical evidences are also consistent with the model of teacher thought and action by Clark and Peterson (1986) which was used as one component of the theoretical framework of this study. The model posits that a teacher's belief affects his/her action.

Both the qualitative and the quantitative strands of this study have shown that competence in ICT use is one major factor that has influence on instructors' patterns of ICT use. The qualitative strand showed that those teachers who have less competence in their use of ICT found it difficult to make full utilization of the potential of ICT in the teaching-learning process. The quantitative strand of this study also showed that competence in ICT use has strong positive correlation with patterns of ICT use in the teaching-learning process. This finding is also consistent with other research findings. According to Pelgrum (2001), the success of educational innovations depends largely on the skills and knowledge of teachers. Teachers' lack of knowledge and skills is one of the main hindrances to the use of ICT in education both for the developed and underdeveloped countries (Mamun, & Tapan, 2009; Pelgrum, 2001; Ihmeideh, 2009; Williams 1995).

Several studies also reported that teachers' competence in ICT use influenced their use of ICT in the teaching-learning process (Christensen & Knezek, 2008; Vannatta & Fordham, 2004; Watson, 2006). Law et al (2008) also noted that teachers' technical and pedagogical ICT competence is a key factor to explain whether teachers use ICT in their teaching or not. Gisesa (2010) noted that lack of ICT competence is a challenge facing many colleges and universities in Sub-Saharan Africa in adopting and using ICT.

Contextual factors that were found to have association with instructors' patterns of ICT use included availability and accessibility of ICT tools and services, incentives by authorities, administrative and technical support, peer as well as administrative pressure, and policy-related issues. The qualitative strand of this study has shown that those instructors who perceived that there were no sufficient ICT tools and services, as well as those who perceived that there was no sufficient access to these tools and services made less use of ICT in the teaching-learning process.

It was also documented in literature that availability or lack of ICT resources affects the utilization of ICT in the teaching learning process (Example: Hennessy et al, 2010; Chitiyo & Harmon, 2009; Obiri-Yeboah et al, 2013; Tebebu et al, 2009; Goktas et al, 2009; Goktas et al, 2013). Other studies (such as Afshari et al, 2009) also show that efficient and effective use of technology in the teaching-learning process depends on the availability of hardware and software. These studies suggest that effective utilization of ICT in the teaching-learning process requires an environment that is rich in ICT resources as the presence of these resources is one of the major prerequisites for the integration of ICT in the teaching-learning process.

It was found in the current study that majority of the instructors and students have access to ICT tools and services. Those instructors who reported to have used ICT effectively in the teaching-learning process witnessed that they had access to ICT tools and services which inspired them to use ICT in their teaching. On the other hand, some of those instructors who made less use of ICT in their teaching attributed this to lack of access to ICT resources. It is also documented in literature that access to ICT resources is one of those factors that influence the use of ICT in the teaching-learning process (Yildrim, 2007; Law, 2009; Plomp et al, 2009).

Other studies also confirmed that access to ICT infrastructure and resources in educational institutions is a necessary condition to the integration of ICT in education (Plomp, Anderson, Law, & Quale, 2003). Yildrim (2007) noted that access to technological resources is one of the effective ways to teachers' pedagogical use of ICT in teaching. This suggests that the availability of ICT tools and services alone doesn't guarantee the effective utilization of ICT in the teaching-learning process unless there is access to these facilities.

It was learned from the qualitative strand of this study that the absence of incentive from authorities hindered some instructors from using ICT to prepare and upload course materials for their students. This is consistent with previous findings. Studies show that higher education institutions with a merit and promotion system supporting research as a primary means for advancement can hinder technology integration in that faculty are left with little time to learn and integrate ICT in their teaching (Anderson & Starrett, 2001).

The current study also showed that absence of support or reluctance of ICT technicians to give technical support influenced instructors' use of ICT. Literature has also shown that technical support plays significant role in the use of ICT in the teaching-learning process (Johnston et al, 2013; Sife et al, 2007; Stensaker et al, 2007; Goktas et al, 2013). Lack of technical support was reported to be one factor that inhibits the use of ICT in classroom (Fluck, 2011). Other studies have also shown the influence of administrative support on pattern of ICT use. For example, a study by Sandholtz and the associates (1997) revealed that administrative support has positive influence on teachers to decide to use ICT in the teaching-learning process. Becta (2004) contends that lack of technical support influences teachers' use of ICT in the teaching-learning process. It was also noted that lack of technical support for teachers leads them to frustration and unwillingness to use ICT (Tong & Trinidad, 2005).

It was reported during the qualitative study that absence of follow up or pressure from the administration and negative peer pressure affected instructors' pattern of ICT use. It was also learned from the qualitative study that policy-related issues such as restrictions on some websites affected instructors' use of ICT in the teaching-learning process. Both the qualitative and the quantitative strands of this study revealed that there was no incentive mechanism to encourage effective use of ICT in the teaching-learning process which is also believed to have

influenced the use of ICT in the teaching-learning process. Literature tells that incentives affect teachers' implementation of technology (Epper, 2001). A study by Zhao and Frank (2003) demonstrated that teachers who perceived positive peer pressure were more likely to use ICT in the teaching-learning process.

Though the University has been providing pedagogical and technical trainings, the findings suggest that the trainings were neither consistent nor sufficient to equip instructors to keep up with the demands of effective integration of ICT in the teaching-learning process. Both the qualitative and the quantitative studies confirmed that only some instructors received the training given in relation to the use of ICT in teaching. Some instructors who participated in the interview reported that they began attending the trainings and then quitted after some time. This shows inconsistency of the training and lack of follow up. This implies that planned, consistent and continuous training has to be provided to instructors so that they could effectively integrate ICT in their teaching. Ertmer (1999) identified lack of training as one of the first order barriers that impacted teachers' use of ICT in the teaching-learning process.

Instructor-perceived readiness of students to use ICT was also found to have positive correlation with instructors' patterns of ICT use in the teaching learning process. Readiness of students to use ICT in their learning was seen from four angles: availability of time to use ICT, attitude towards ICT in learning, access to ICT resources, and competence in ICT use. The qualitative strand of this study showed that those instructors who felt that their students had not had time to work with ICT failed to influence their students to use ICT in their learning. Those instructors who also felt that students didn't have interest to work with ICT failed to influence their students to use ICT in their learning.

Those instructors who felt that students did not have sufficient access to ICT resources failed to influence their students to use ICT in their learning. Moreover, those instructors who felt that their students did not have competence to use ICT failed to influence their students to use ICT in their learning. Some instructors noted that it was a challenge to deal with students who do not have ICT skills and knowledge. This suggests that students should have adequate preparation at school level to use ICT before they join universities.

In the quantitative strand of this study, instructor-perceived readiness of students to use ICT (availability of time to use ICT, access to ICT resources, interest to use ICT, and competence to use ICT) was investigated. It was found that instructors' perception about their students' readiness to use ICT had strong positive correlation with their patterns of ICT use in the teaching-learning process. This gives an evidence that those instructors who feel that their students are ready to use ICT in their learning may tend to use ICT as a cognitive tool (engage students in the use of ICT for the construction of their own knowledge), where as those who feel that their students are not ready to use ICT in their learning may tend to use ICT to enhance their traditional teaching approach (to prepare course materials or to present lecture notes).

Both the qualitative and the quantitative strands of this study showed the influence of instructors' perception about the nature of the course they teach on their patterns of ICT use in the teaching-learning process. The qualitative study showed that those instructors who believed that the courses they were teaching did not require ICT use tended to avoid the use of ICT in their teaching or used ICT only to prepare course materials or present lectures.

The quantitative strand of this study also showed that there was strong positive correlation between instructor-perceived course nature and pattern of ICT use in the teaching-learning process. This strong positive correlation implies that those instructors who perceive that their courses require the use of ICT may tend to use ICT as a cognitive tool (to engage students in using ICT to construct their own knowledge), and those who feel that their courses do not require the use of ICT may tend to avoid the use of ICT from their teaching or used ICT to enhance their traditional way of teaching.

There are empirical evidences that support these findings. Gray and Souter (2004) conducted a study to see if there is difference in the perception towards the use of ICT in education between science teachers and teachers from other disciplines. They found that, relative to other subject teachers, science teachers came out positively with regard to use of and confidence in ICT. Andrews (2000) contends that one cause for the resistance of English teachers in integrating ICT in their teaching was "the subversive, humanities-based, liberal and book-dominated culture of English" (p.23). Also Selwyn (1999a) contends that ICT was

traditionally regarded as the domain of mathematics, science and technology departments and this legacy might have been apparent in the ways in which different teachers perceive ICT. Hennessy and her associates (2005) found that teachers' concern with preserving their subject culture inevitably led to some pockets of resistance to using ICT in their teaching.

Instructors' experience in ICT use showed weak correlation with their pattern of ICT use. This was found to be contradictory to the ACOT's finding which asserts that experience in ICT use shifts classrooms toward student-centered teaching rather than curriculum-centered teaching, collaborative tasks rather than individual tasks, and active rather than passive learning (Sandholtz & associates, 1997). The possible explanation to this could be that experience in ICT use alone may not have the power to shift teachers' style of teaching with ICT unless it is augmented by other changes such as a shift in pedagogical belief.

8.3.3. Factors that have Strongest Significant Contributions in Explaining Variance in Instructors' Patterns of ICT Use

Results of the multiple linear regression showed that the model which contained the nine independent variables (PB, AICTE, Age, PIICT, CICT, EICT, CF, RS, and CN) was a good model to explain variations in instructors' patterns of ICT use. Among the nine explanatory variables, the most important one was instructors' competence in ICT use. The other five statistically significant explanatory variables to patterns of ICT use were instructors' age, pedagogical belief, personal innovativeness in the domain of ICT, perceived readiness of students to use ICT, and course nature. The rest variables were with insignificant regression and deemed unimportant.

According to the current study, instructors' competence in ICT use in the teaching-learning process makes the strongest contribution to explain variation in patterns of ICT use. This means that those instructors with high competence in ICT use in the teaching-learning process utilized ICT more effectively in the teaching-learning process than those who had low competence in ICT use. The finding that instructors' competence in ICT use was the most significant explanatory variable for such patterns of ICT use in the teaching-learning process is consistent with many other previous studies (Almusalam, 2001; Isleem, 2003; Lee, 2002; Park, 2005; Sahin & Thompson, 2006). Bordbar (2010) noted that teachers' computer

competence is a major predictor of integrating ICT in the teaching-learning process. Sorgo, Verckovnik and Kocijancic (2010) found high correlation between frequency of use of ICT and teachers' competence in ICT use. These researchers made the conclusion that teachers' competence and confidence were predictors of using ICT in teaching. Buabeng-Andoh (2012) also found that teachers' computer competence was a major predictor of integrating ICT in teaching. In addition to teachers' technical competence in ICT use, their pedagogical ICT competence was also reported to be the best positive predictor of the teacher's adoption of ICT in the classroom (Law & Chow, 2008a). This implies that instructors need pedagogical as well as technical ICT competence to use ICT as a cognitive tool, which is referred to as Technological Pedagogical Knowledge (Mishra & Koehler, 2006).

On the other hand, the findings of the current study indicated that the majority of instructors in the study site were using ICT to enhance traditional teaching approach. Taking cognizance of the findings of the study, one possible explanation for these instructors' failure to use ICT as a cognitive tool is that many of them lacked either technical ICT competence or pedagogical ICT competence, or both technical and pedagogical ICT competences. Though it was reported by participants of the study that trainings pertaining to pedagogy and ICT use were provided, it can be inferred that either the trainings were not capable of preparing the instructors to use ICT beyond the traditional teacher-centered method of teaching, or the trainings were not consistently given for all the instructors.

The result of the current study also showed that in addition to their competence in ICT use, instructor's age, personal innovativeness in the domain of ICT, pedagogical belief, perceived nature of a course with regard to ICT use, and perceived readiness of students to use ICT were found to explain the greatest amount of variance in patterns of ICT use.

This study showed that Age was one of those predictor variables which made significant contribution to explain variation in instructors' patterns of ICT use. This implies that elder instructors tended to use ICT to enhance traditional method of teaching while younger instructors had a propensity to use ICT mainly as a collaboration tool or as a cognitive tool. The finding that Age makes a significant contribution in explaining variance in pattern of ICT use is in line with previous research findings. According to Hadjithoma and Eteokleous

(2007), for example, teachers' age appeared to be a significant predictor for teachers' general computer use.

The finding that instructors' pedagogical beliefs made significant contribution to explain variance in instructors' pattern of ICT use implies that those instructors with traditional pedagogical belief used ICT mainly to enhance traditional method of teaching where as those instructors with constructivist pedagogical belief used ICT mainly to engage students in constructing their own knowledge in collaboration or independently. This finding is consistent with other research findings. For example, previous studies found that pedagogical belief was very important predictor variable for ICT use in education. Overbay et al. (2010), for example, found that constructivist pedagogical beliefs were significant predictors for ICT use in the teaching-learning process.

The finding that instructors' level of personal innovativeness in the domain of ICT makes significant contribution in explaining variance in instructors' pattern of ICT use implies that those instructors with high level of personal innovativeness in the domain of ICT engage students in the use of ICT to construct their own knowledge through collaboration or independent work where as those instructors with low level of personal innovativeness in the domain of ICT use ICT to enhance traditional method of teaching (use ICT mainly as a course preparation tool or as a presentation tool).

Studies on the predictive power of personal innovativeness on ICT use in the teaching-learning process are rare. The results of a study conducted by Gu and the associates (2013) showed that the most powerful predictor for classroom use of ICT is the personal factor, which includes personal innovativeness in the domain of ICT. Vannata and Fordham (2004) also reported that the teacher attributes of time commitment and innovativeness, combined with the amount of technology training, were the best predictors of successful technology use in classroom. Van Braak and his associates (2004) also found personal innovativeness to be one of the strongest predictors of ICT use in classroom.

Result of the current study also confirmed that Course Nature made a statistically significant contribution to explain variance in instructors' patterns of ICT use in the teaching-learning process. There are empirical evidences that also support the finding that Course Nature

accounts for variation in instructors' patterns of ICT use. Van Braak and the associates (2004), for example, identified technology-related subjects to account for variation in ICT use in the teaching-learning process.

Studies related to the predictive power of instructor-perceived readiness of students on instructors' patterns of ICT use are very rare. However, the current study showed that instructor-perceived readiness of students to use ICT in their learning predicted significant portion of variation in instructors' patterns of ICT use. The result implies that those instructors who perceived that students were not ready to use ICT in their learning failed to engage students in ICT use in the teaching-learning process.

Attitude towards ICT use in education failed to meet the required level of statistical significance to be said to have significant impact on patterns of ICT use. In fact, there is no statistical significance does not mean that there is no difference in patterns of ICT use between instructors who have positive attitude and those who have negative attitude towards ICT use in education.

The fact that attitude towards ICT use in education failed to meet the required level of statistical significance is contrary to some research findings. For example, Almusalam (2001) found that teachers' attitudes were the major predictors of the use of new technologies in the teaching-learning process. Bai and Ertmer (2008) also found that attitude towards technology was a major predictor of teachers' ICT use in the teaching-learning process. Player-Koro (2012) also found that having positive attitudes to ICT use was one of the variables that best predicted teachers' use of ICT in education.

The majority of instructors in the current study were found to have positive attitude towards ICT use in education, but only few of the instructors were found to use ICT as a cognitive tool. This implies that having positive attitude towards ICT use in education may not necessarily result in the use of ICT as a cognitive tool. The possible explanation to this is that instructors may like to use ICT for lecture presentation or to prepare course materials, but they may not have the skills and knowledge to use it as a cognitive tool or as a collaboration tool.

CHAPTER NINE

CONCLUSIONS AND IMPLICATIONS

9.1. Conclusions

This study explored instructors' patterns of ICT use and examined factors that influenced their patterns of ICT use in the teaching-learning process. The study was conducted in one higher education institution in Ethiopia. The study revealed that there were variations among instructors in their patterns of ICT use. It also identified factors that influence instructors' patterns of ICT use in the teaching-learning process. One public university, Jimma University, was selected for this study because of its relatively better level of ICT expansion to support the teaching-learning process. The status of ICT utilization in the teaching-learning process was examined from the perspective of ICT as a cognitive tool. The following conclusions were drawn based on the findings of the current study.

9.1.1. Patterns of ICT Use as a Continuum between Use of ICT as a Course Preparation Tool and Use of ICT as a Cognitive Tool

One of the conclusions drawn from this study is that there are variations among instructors in their patterns of ICT use in the teaching-learning process. These variations among instructors in their patterns of ICT use can be put into five categories: use of ICT as a course preparation tool, use of ICT as a presentation tool, use of ICT as information exchange tool, use of ICT as a collaboration tool, and use of ICT as a cognitive tool. These five categories fall in a continuum between ICT use as a course preparation tool and ICT use as a cognitive tool. This can be represented by the PICT model (See page 83).

Most of the instructors in the study site were using ICT either as a course preparation tool or as a presentation tool. Only very few of these instructors were using ICT as a collaboration tool or as a cognitive tool. This shows the underutilization of ICT by the majority of instructors. It was discussed in the previous chapters of this study that ICT is said to be effectively utilized if it is used to engage students in constructing their own knowledge and to

represent their ideas in collaboration with others or independently, and this is related to the use of ICT as a collaboration tool or as a cognitive tool.

This study confirmed that ICT by itself is nothing more than a tool. What makes it effective is the way it is used. It is just like a knife being used by a robber to kill or by a doctor to save. Some instructors may take it to their own advantage to teach with least effort and to advance superficial learning, in which case students do not get deep understanding of the subject matter. Other instructors may take ICT to the students' advantage to enhance students' critical thinking and problem solving skills, in which case the students get deep understanding and hence better learning.

Use of ICT as a cognitive tool requires learners to make a deliberate effort and to be engaged mentally and physically in their learning, contrary to the "… habit of learning with least effort", as posited by Amare (1998b). On the other hand, use of ICT as a presentation tool, for example, makes students passive receivers of information with least effort and little engagement in their learning. As it was discussed in chapter two, use of ICT as a cognitive tool requires learners to think deeply about and be involved in what they do.

9.1.2. Instructor's Age, ICT Competence, Pedagogical Belief, Personal Innovativeness, and Perception as Predictors of Patterns of ICT Use

The underutilization of ICT use in the teaching-learning process was mainly found to be related to instructors' lack of competence in using ICT in the teaching-learning process. The other variables that were found to have significantly contributed to the underutilization of the technology were instructors' age, level of personal innovativeness in the domain of ICT, pedagogical belief, instructor-perceived nature of a course with regards to ICT use, and instructor-perceived readiness of students to use ICT in their learning.

It was found that instructors' age, lack of competence in ICT use, having lower level of personal innovativeness in the domain of ICT, having traditional pedagogical belief, having wrong perception about the nature of the course they teach with regards to ICT use, and having wrong perception about students' readiness to use ICT contributed to their traditional use of ICT (using ICT as course preparation tool or ICT as a presentation tool) in the teaching-

learning process or, in other words, to the underutilization of ICT in the teaching-learning process. It is obvious that age cannot be influenced or changed, while the other variables can be influenced by training or support.

Therefore, it can be concluded from this study that age, ICT competence, pedagogical belief, personal innovativeness in the domain of ICT and perceptions of instructors have strong influence on their patterns of ICT use in the teaching-learning process. In addition to this, it can also be concluded from the study that instructors' competence in ICT use makes the highest unique contribution in explaining variance in their patterns of ICT use.

9.1.3. Consistency of the Findings

The other conclusion that can be drawn here from the perspective of the research undertaking is that the majority of the findings in the quantitative study supported the findings of the qualitative study and that these findings can be generalized to the population of instructors in the study site. Moreover, a good number of the findings in this study are consistent with the findings in previous studies.

9.2. Implications of the Study

9.2.1. Practical Implications of the Study

One can learn many things from the experience of Jimma University. Amongst the experiences that can be learnt from the University is the attention given to make ICT resources available and accessible to the University community. The interview and observational data indicated that there are computer centers around students' dormitories which gave students access to Internet. Attention was given to female students and students with special educational needs so that they can get access to Internet facilities around their dormitories. There were wireless access points around recreational areas like mini stadium and Alumni's Park. Instructors were made to have access to Internet around their residences. Majority of the classrooms were made smart classrooms (technology enhanced classrooms). Each of these classrooms had at least one computer which was connected to Internet. There were also Internet rooms in the libraries. Moreover, there were ICT helpdesk teams in each college and

institute that worked together with the technical staff in the ICT directorate office to give support to users whenever they encountered technical problems.

The worldwide tendency to integrate ICT in the teaching-learning process in higher education institutions has put pressure on universities to provide ICT tools and services to support the teaching-learning process. This is mainly due to the conviction that ICT contributes to quality of education. Studies contend that students benefit more if they are given the opportunity to use technology to construct their own knowledge and to represent their views. Moreover, as it was also clearly stated in chapter one, competence-based curricula which are currently in use in Ethiopian public universities are concerned more with how the information obtained through the curricula will be used than with what the information is. Use of ICT as a course preparation tool, as a presentation tool or even as an information exchange tool emphasizes on what the information is and how it can be delivered. On the other hand, use of ICT as a cognitive tool emphasizes on how the information is used.

This study indicated that the instructors at Jimma University used ICT mainly for preparing and delivering information. It suggests that the mere presence of ICT infrastructure and services as well as the mere use of ICT in the teaching-learning process doesn't bring the expected quality in the teaching-learning process unless appropriate interventions are made in relation to the different factors that may hinder or facilitate the effective use of ICT in the teaching-learning process. Therefore, the investigator suggests that the University officials and other concerned bodies should consider the following recommendations for the effective integration of ICT in the teaching-learning process.

In this study instructors' competence in ICT use was found to be crucial for the effective integration of ICT in the teaching-learning process. Therefore, administrators of the University as well as the ICT directorate office should give due attention to enhance instructors' competence in ICT use. Both technical as well as pedagogical competence in ICT is required to make sure that instructors use ICT effectively in their teaching. This calls for a collaborative work among different groups such as the ICT directorate office and those who are in charge of pedagogical trainings. The officials of the University ought to make sure that

these different groups work together to provide need-based trainings to the instructors so that they can use ICT as a constructivist learning environment..

The other crucial factors that were found to have impact on instructors' patterns of ICT use were pedagogical belief and personal innovativeness. Shifting instructors' pedagogical beliefs to constructivist pedagogy requires pedagogical trainings. Enhancing instructors' personal innovativeness in the domain of ICT requires using the more innovative instructors to share their experience to the less innovative ones. This, in turn, requires identifying those who are more innovative in the domain of ICT and using them as role models to the others. Follow up and incentive mechanisms should also be used as a strategy to encourage those who make good use of ICT in the teaching-learning process.

Instructor-perceived readiness of students to use ICT in their learning was the other crucial factor which was found to have effect on instructors' patterns of ICT use. Making sure that students have the basic skills and knowledge to use ICT, giving them access to the available technology, making them aware of the benefits of ICT to enhance learning and encouraging instructors to support their students in ICT use in the teaching-learning process may help to address the problem.

The other factor which was found to be crucial to the effective integration of ICT in the teaching-learning process was the perception that instructors have about whether the courses they teach require ICT use or not. An awareness creation should be made to make sure that every instructor appreciates and makes good use of the benefits of ICT to enhance students' learning irrespective of the subject matter taught.

9.2.2. Methodological Implication of the Study

The majority of the studies in the integration of ICT in the teaching-learning process have been either qualitative studies or quantitative studies. However, the research approach used in the current study was a mixed methods approach and the design was an exploratory sequential design, where a qualitative study was conducted first to inform the quantitative study. The investigator believes that this approach is advantageous in that it helps to explore instructors' patterns of ICT use first and then to identify contextual variables that have influence on such

patterns of ICT use. The investigator believes that patterns of ICT use in the teaching-learning process may be affected by factors specific to the study area. Therefore, it is suggested that other researchers may follow the same research approach to replicate the study in a different context.

9.2.3. Theoretical Implications of the Study

The current study has made three original contributions to knowledge. One of the contributions is the development of a model called the PICT model that illustrates instructors' patterns of ICT use in the teaching-learning process. The PICT model depicts that instructors' patterns of ICT use fall in a continuum between use of ICT as a course preparation tool and use of ICT as a cognitive tool. The model shows that students' engagement in ICT use increases as one progresses from base to apex of the model. It also shows that the instructor's role shifts from course developer and presenter to co-learner as one progresses from the lower to the higher level of the model. One can again see from the model that teaching methods advance from teacher-centered approach to student-centered approach as one progresses upward in the continuum.

The investigator believes that the model helps to examine instructors' patterns of ICT use by using the three dimensions in the model. These dimensions include level of students' engagement in using ICT, instructors' role in a technology-enhanced learning environment, and method of teaching employed by the teacher in the ICT enhanced learning environment. The investigator also believes that the PICT model helps to design training packages for instructors to help enhance their ICT use in the teaching-learning process and to help them advance from lower level of ICT use to the higher level within the continuum.

It is suggested here that instructors should be given support to advance their patterns of ICT use from the lower level to the higher level in the continuum so as to meet the requirements of competence-based curricula which are currently promoted in the public universities in Ethiopia.

The second theoretical contribution of this research is development of a regression model that can be used for prediction of instructor's patterns of ICT use. This research identified a

regression model that can explain large proportion of variance in instructors' patterns of ICT use in the teaching-learning process. The regression model shows variables that should be considered while giving support to advance instructors' patterns of ICT use all the way from the lower to the higher levels in the PICT model. For instance, the regression model shows that enhancing instructors' competence in ICT use helps to advance their patterns of ICT use from the lower to the higher levels in the continuum.

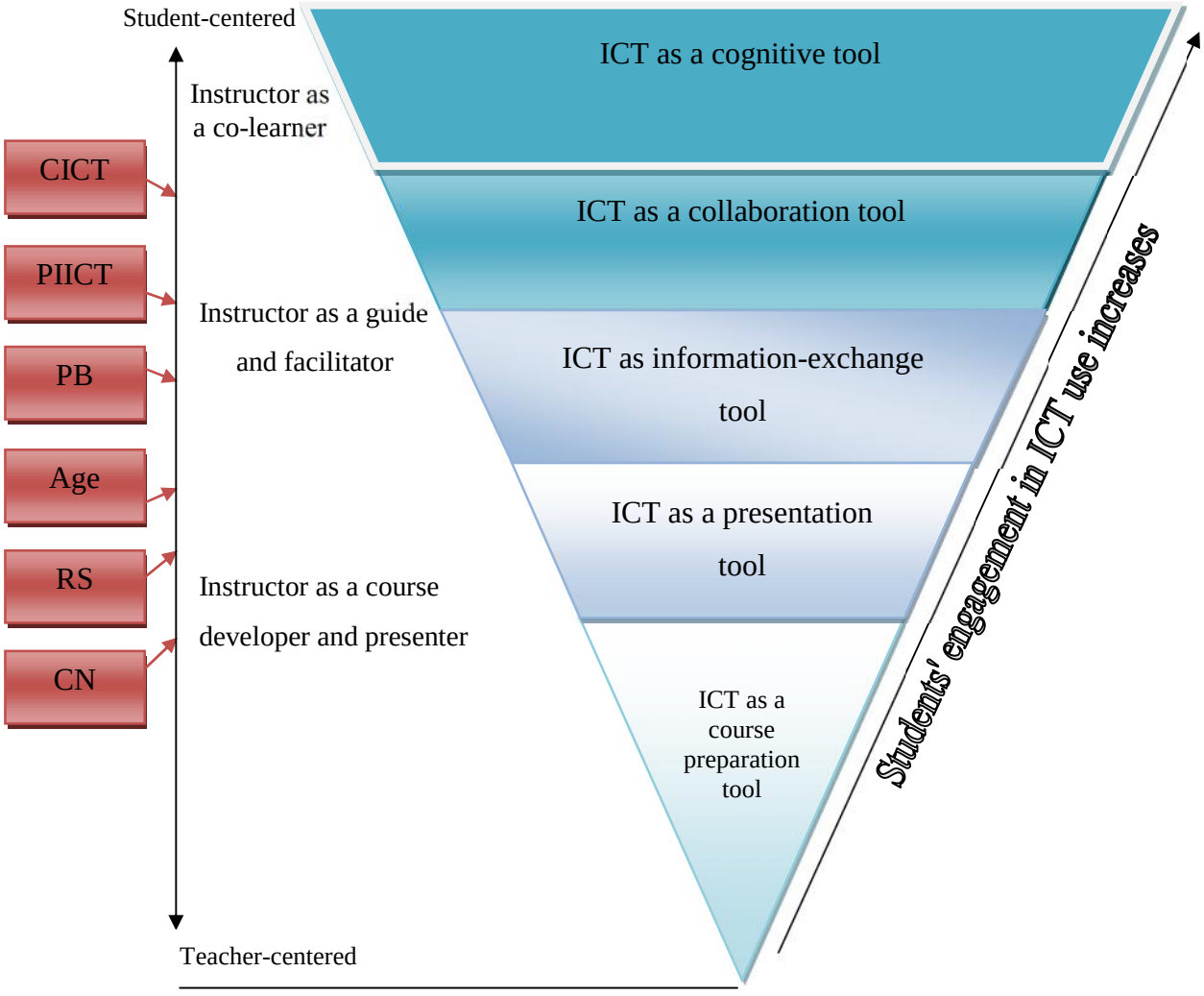

Figure 12: The ICTU model

The PICT model which was developed based on the qualitative data and the regression model which was developed based on the quantitative data can combine resulting in a new model called the ICTU model. The third and the major contribution of this research project is,

therefore, development of the ICTU model which describes how instructors use ICT in the teaching-learning process and also explains why instructors use ICT the way they use it. The inverted cone represents variance in patterns of ICT use while the brown-colored rectangles represent predictor variables that explain variance in instructors' pattern of ICT use. The ICTU model is a refined model which is developed based on the findings of this research project.

This model depicts that effective use of ICT in the teaching-learning process depends on instructors' age, competence in ICT use, pedagogical beliefs, personal innovativeness in the domain of ICT, perceived readiness of students, and perceived nature of the courses they teach. It was explained in the previous chapters that only age negatively correlates with innovative use of ICT while the remaining five variables positively correlate with innovative use of ICT.

9.2.4. Limitations of the Study and Suggestions for Future Research

The data that have been reported in the current study are mainly based on the perceptions of the instructors through self-reporting. While perceptions and self-report data are not always unrealistic, they may be decorated by vested interest and bias, and may not reflect existing conditions. This study suggests that investigating the influence of different factors on instructors' patterns of ICT use by employing different data collection methods like classroom observation of the actual pedagogical use of ICT in classroom and by involving students as participants would help to describe instructors' actual behavior when they use ICT in the teaching-learning process.

It is difficult to assert that the findings of this study are generalizable to other contexts. The investigator suggests that replicating the same research in different settings invigorates our understanding of factors that affect instructors' patterns of ICT use. The investigator also suggests that conducting further research in the area to identify causal relationship between the explanatory variables identified in this study and instructors' patterns of ICT use revitalizes our understanding of the relationship between the predictor variables and the dependent variable.

One of the common contributions of research findings is inspiring new questions that lead to further research endeavors. In this study, instructor-perceived readiness of students to use ICT has emerged as a variable with significant impact on instructors' patterns of ICT use in the teaching-learning process. This finding sparks the need for further study on students' readiness to use ICT by using students themselves as one source of data. The results of such a study may help to design and implement strategies aimed at influencing instructors to engage their students in ICT use in the teaching-learning process.

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APPENDICES

Appendix A. Instructors' Interview Consent Form

Dear instructor,

You are being asked to participate in an interview regarding the use of ICT into your teaching at the University. I am a doctoral student at Addis Ababa University in the department of Curriculum and Teachers Professional Development Studies. I would like you to participate in an interview regarding the use of ICT into your teaching at the University. The title of my research project is "Factors influencing instructors' pattern of ICT use: A mixed methods research". I would like your permission to study your perspective about the conditions in using ICT in the teaching-learning process during this interview as part of my doctoral research. The goal of the interview is to study instructors' perceived barriers and enabling factors in using ICT in their teaching. The estimated time for the interview is approximately 45-50 minutes. The interview session will be digitally recorded and later transcribed. All of the participants will remain anonymous and pseudonyms may be used for your name in the research. You may refuse to participate or may withdraw at any time. There are no risks or harms associated with participation in this semi-structured interview.

If you have any questions, need further information or at a later time wish to withdraw from this study, please contact at the number: 0911461526. Thank you very much for considering this request. Your participation is very valuable and could help improve the experiences of faculty and future students.

Sincerely,

Genene Abebe

Consent Form

I, _____ (please print) give my consent to participate in the interview on ICT use in the teaching-learning process and have Genene Abebe digitally record the session.

Signature _____ Date _____

email address _____

Appendix B: Consent form for the Vice President for Academic Affairs

Dear Vice President of the University,

You are being asked to participate in an interview regarding the use of ICT in the teaching-learning process at the university. I am a doctoral student at Addis Ababa University in the department of Curriculum and Teachers Professional Development Studies. I would like you to participate in an interview regarding the use of ICT into your teaching at the University. The title of my research project is "Factors influencing instructors' pattern of ICT use: A mixed methods research". I would like your permission to study your perspective about the conditions in using ICT in the teaching-learning process during this interview as part of my doctoral research. The goal of the interview is to study instructors' perceived barriers and enabling factors in using ICT in their teaching. The estimated time for the interview is approximately 20-25 minutes. The interview session will be digitally recorded and later transcribed. The information you share with me will be secured with confidentiality. You may refuse to participate or may withdraw at any time. There are no risks or harms associated with participation in this semi-structured interview.

If you have any questions, need further information or at a later time wish to withdraw from this study, please contact at the number: 0911461526. Thank you very much for considering this request. Your participation is very valuable and could help improve the experiences of faculty and future students.

Sincerely,

Genene Abebe

Consent Form

I, _____ (please print) give my consent to participate in the interview on ICT use in the teaching-learning process and have Genene Abebe digitally record the session.

Signature _____ Date _____

email address _____

Appendix C: Interview Consent Form for Representative of the ICTDO

Dear ICTDO Representative,

You are being asked to participate in an interview regarding the use of ICT in the teaching-learning process at the university. I am a doctoral student at Addis Ababa University in the department of Curriculum and Teachers Professional Development Studies. I would like you to participate in an interview regarding the use of ICT into your teaching at the University. The title of my research project is "Factors influencing instructors' pattern of ICT use: A mixed methods research". I would like your permission to study your perspective about the conditions in using ICT in the teaching-learning process during this interview as part of my doctoral research. The goal of the interview is to study instructors' perceived barriers and enabling factors in using ICT in their teaching. The estimated time for the interview is approximately 55 minutes to 1 hour. The interview session will be digitally recorded and later transcribed. The information that you share with me will remain secured with confidentiality, and your identity will be kept anonymous. You may refuse to participate or may withdraw at any time. There are no risks or harms associated with participation in this semi-structured interview.

If you have any questions, need further information or at a later time wish to withdraw from this study, please contact at the number: 0911461526. Thank you very much for considering this request. Your participation is very valuable and could help improve the experiences of faculty and future students.

Sincerely,

Genene Abebe

Consent Form

I, _____ (please print) give my consent to participate in the interview on ICT use in the teaching-learning process and have Genene Abebe digitally record the session.

Signature _____ Date _____

email address _____

Appendix D. Observation and interview protocols

Observation protocol

1. What ICT facilities are there in the university?
2. Do students and instructors use the available ICT in the university?
3. Is there ICT staff that provides technical support?

Interview protocols

A. For instructors

1. Do you use ICT in your teaching? If yes, how? If no, why?
2. If yes, what do you do with the technology?
3. Do you think that the use of technology improves students' learning?
4. What do you think affects the way instructors use ICT in the teaching-learning process?
5. Do you receive any support from the university administration in using ICT? How do they support you?
6. Do the ICT staff members give you technical support when you need?

B. For ICTDO representative

1. Do you have ICT policy for the university?
2. Do you give technical support for instructors in ICT use? What support do you provide?
3. Do you give training to instructors about ICT use?

C. For the academic vice president

1. Do you give support for students and instructors in using ICT? What support do you give?
2. What are your expectations from the use of ICT in the teaching-learning process?
3. What mechanisms do you use to enforce instructors to use ICT in their teaching?
4. What follow-up mechanisms do you have to check whether instructors use ICT in their teaching or not?

Appendix E: Cover letter for the questionnaire

Dear Instructor:

I am a PhD student at Addis Ababa University in the department of Curriculum and Teacher Professional Development Studies. This survey is part of the doctoral research work that I am conducting. I am inviting you to participate in this research project by completing the attached survey. This research project is entitled: "Factors influencing instructors' pattern of ICT use: A mixed methods research". The project has been approved by the department of Curriculum and Teacher Professional Development Studies. The purpose of this survey is to identify factors that have association with instructors' pattern of ICT use in the teaching-learning process at higher education level.

The survey will take approximately 30 minutes to complete. There is no known risk related with participating in this research project. In order to ensure that all information will remain confidential, you are not required to include your name. If you are willing to participate in this project, please answer all questions as honestly as possible and return the completed questionnaires promptly either to me or to your department head. Participation is strictly voluntary and you are free to withdraw from this study at any time without obligation. If you require additional information or have questions, please contact me at the number: 0911461526. Thank you in advance for your time and support. By continuing with this survey, you have provided consent.

Sincerely,

Genene Abebe

Appendix F-Questionnaire

Instruction I: Please indicate your response to the following questions by putting tick mark (✓) in the appropriate boxes

1. Age in years a.[20-25) b. [25-30) c.[30-35) d.[35-40) e. 40 and above
2. Teaching experience a. [0-1) year b. [1-2) years c. [2-3) years d. [3-4) years e. 4 and above
3. Experience in using ICT a. [0-1) year b. [1-2) years c. [2-3) years d. [3-4) years e. 4 and above
4. At which level do you teach? a. completely at undergraduate level b. mostly at undergraduate level

   c. almost equally at graduate and undergraduate level d. mostly at graduate level e. completely at graduate level

Instruction II: Please indicate how much you agree or disagree with the following statements by putting a tick mark (✓). Make sure to respond to every statement.

Item no.	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	I like to experiment with new ICT					
2	If I heard about a new ICT, I would look for ways to experiment with it.					
3	Among my peers, I am usually the first to try out new ICT					
4	In general, I am hesitant to try out new ICT.					

Instruction III: Please indicate your current attitude towards ICT regarding each of the following statements. Make sure to respond to every statement by putting a tick mark (✓).

Item no.	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	ICT such as computer provides opportunity for improving students' performance					
2	The efficiency of the learning process is increased through the use of ICT					
3	ICT such as computer increases the level of creativity of students					
4	ICT used as a learning tool increases student motivation					
5	Modern education highly demands the use of ICT in the learning process					
6	I have had more negative than positive experiences with ICT such as computers					
7	I use ICT such as computers on a regular basis					
8	I am convinced that I will never be able to use ICT such as computers properly					
9	ICT such as computers make me nervous					
10	I use ICT such as computer because I think I can save time on routine tasks					

Instruction IV: Please indicate how much you agree or disagree with the following statements by putting a tick mark (✓). Make sure to respond to every statement.

No.	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	I believe that expanding on students' ideas is an effective way to build a course.					
2	I prefer to cluster students' desks or use tables so they can work together.					
3	I base student grades primarily on homework, quizzes, and tests.					
4	To be sure that I teach students all necessary content and skills, I follow a module					
5	I involve students in evaluating their own work and setting their own goals					
6	I believe students learn best when there is a fixed schedule					
7	I make it a priority in my classroom to give students time to work together.					
8	For assessment purposes, I am interested in what students can do independently					
9	I prefer to assess students informally through observations and conferences					
10	I often create thematic units based on the students' interests and ideas					

Instruction V: Please indicate your current ICT competence level (your knowledge and skill in using ICT such as computer) regarding each of the following statements by putting a tick mark (✓). Make sure to respond to every statement.

Item no.	Item	No competence	Little competence	Moderate competence	High competence	Very high competence
1	Install new software on a computer					
2	Use LCD projector for presentation					
3	Use the Internet for communication					
4	Use the world wide web to access different types of information					
5	Operate a word processing program like Microsoft word					
6	Operate a spread sheet program like Microsoft excel					
7	Operate presentation software like Microsoft PowerPoint					
8	Operate a database program like access					
9	Create and organize computer files and folders					
10	Fix minor computer problems					

Instruction VI: Please indicate how much you agree or disagree with the following statements by putting a tick mark (✓). Make sure to respond to every statement.

Item no.	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	Students have time to use ICT					
2	Students have sufficient skill to use ICT					
3	Students have interest to use ICT to do independent or group work					
4	Students have access to ICT resources in the university					

Instruction VII: Please indicate whether the course that you teach requires ICT use or does not require ICT use by putting a tick mark (✓). Make sure to respond to every statement.

Item no.	Item	Does not require use of ICT	Rarely requires use of ICT	Sometimes requires use of ICT	Usually requires use of ICT	Always requires use of ICT
1	The course that I teach					

Instruction VIII: Please indicate how much you agree or disagree with the following statements by putting a tick mark (✓). Make sure to respond to every statement.

Item no.	Item	Strongly disagree	Disagree	Neutral	agree	Strongly agree
1.	The University has provided me a training opportunity on how to use ICT such as computers					
2.	ICT technicians and other support groups provide support and immediate maintenance to the ICT tools when they are requested					
3.	ICT technicians and other support groups provide latest ICT tools (hardware and software)					
4.	The university administrators provide incentives for instructors who use ICT in the teaching-learning process					
5.	The university administrators provide continuous professional development opportunities in teaching and technology use					
6.	The university administrators share the university's vision in expanding and using ICT for the teaching-learning process					
7.	The university administrators give priority to the expansion of ICT infrastructure in the classroom as well as in the university compounds					
8.	There are sufficient computers and other ICT tools for instructors to use them					
9.	There is optimum Internet connection in the university					
10.	I have access to computers and other ICT tools and services like Internet that are needed in the teaching-learning process					

Instruction IX: Circle what correctly describes you. Make sure to respond to every statement.

1. Which of the following describes your dominant style of teaching in an ICT-enhanced learning environment?
   a. Mostly you prepare well-structured course material using ICT and provide it to students to read it or you present it using traditional media like chalkboard
   b. Mostly you use PowerPoint slides and present your lecture note or you show some demonstrations using electronic media like TV and LCD projector
   c. Mostly you support students by breaking down the task, performing part of the task or otherwise providing support so that students can complete the rest of the task using ICT without further assistance
   d. Mostly you provide suitable ICT resource and you give tasks for students to solve problems or to exchange ideas about a given issue without further assistance
   e. Mostly you provide encouragement, prompts, reminders, etc; students take full responsibility to identify and solve a given problem or to do a given task using ICT
2. What is your major role in the teaching-learning process in an ICT-enhanced learning environment?
   a. As a course developer (use ICT to develop a course material and provide it to the students to read it and to do learning tasks)
   b. As a presenter (deliver a lesson using ICT tool or show to students how they can do learning tasks using ICT)
   c. As a guide (give direction about what and how students do learning tasks using ICT and monitor while students perform tasks accordingly)
   d. As a facilitator (provide ICT and other resources as well as learning tasks to the students and engage them in different learning activities)
   e. As a co-learner (become part of the learning community in the classroom having a give-and-take relationship with the students using ICT to represent views)
3. To what extent do you and your students use ICT in the teaching-learning process?
   a. You do not use ICT except for minor works like course development, and you don't require your students to do learning tasks using ICT
   b. You use ICT that is available in your university, but you give little or no tasks for your students to do learning tasks using ICT
   c. You and your students use the available ICT to exchange information
   d. Even though you use ICT, you give more time for students to use the available ICT to do learning tasks in group
   e. You encourage your students to use available ICT outside the classroom to do project works or assignments
4. What major task do you usually perform with ICT in the teaching-learning process as compared to the others? (Choose only one alternative that best describes you)
   a. Preparing, enriching or updating course materials using Internet sources
   b. Using simulation, PowerPoint slide, video, etc to make presentation
   c. Exchanging course materials, assignments and project works with students
   d. Forming online discussion groups with students to exchange ideas or engaging students in cooperative learning using ICT
   e. Engaging students in ICT use to gather information from different sources, to organize and analyze it and to make their own meanings from the information and to share to other what they have learnt

Appendix G. Results of factor analysis of PICT

Correlation Matrix for the items of ICTU

		item1	item2	item3	item4
Correlation	item1	1.000	.405	.576	.522
	item2	.405	1.000	.365	.696
	item3	.576	.365	1.000	.744
	item4	.522	.696	.744	1.000

KMO and Bartlett's Test for ICTU

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.613
Bartlett's Test of Sphericity	Approx. Chi-Square	24.226
	df	6
	Sig.	.000

Communalities of the ICTU factors

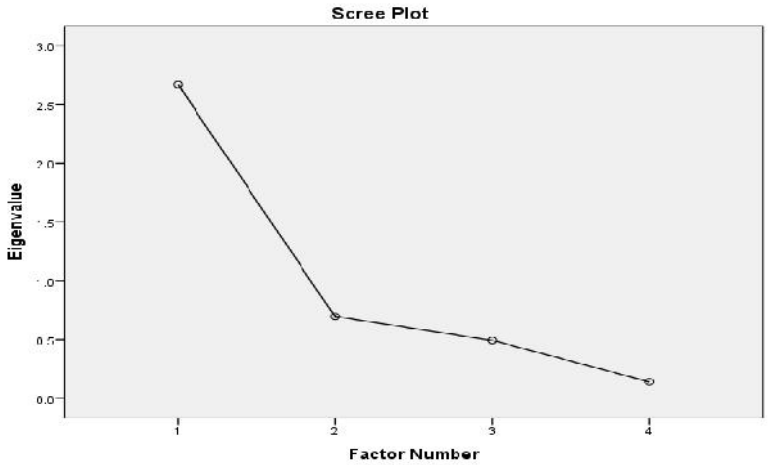
	Initial	Extraction
item1	.375	.390
item2	.555	.399
item3	.654	.571
item4	.762	.952

Extraction Method: Principal Axis Factoring.

Eigenvalues of the ICTU factors

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.670	66.760	66.760	2.312	57.804	57.804
2	.696	17.405	84.166			
3	.492	12.309	96.474			
4	.141	3.526	100.000			

Extraction Method: Principal Axis Factoring.



The Scree plot for ICTU

Appendix H. Results of factor analysis of CF

KMO and Bartlett's Test for CF

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.585
Bartlett's Test of Sphericity	Approx. Chi-Square	111.705
	df	45
	Sig.	.000

Communalities of the CF factors

	Initial	Extraction
item1	.890	.514
item2	.819	.510
item3	.899	.833
item4	.967	.879
item5	.807	.300
item6	.801	.291
item7	.897	.714
item8	.873	.624
item9	.878	.715
item10	.949	.992

Extraction Method: Principal Axis Factoring

The Eugenvalues for the CF factors

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.211	52.112	52.112	4.895	48.953	48.953	3.267	32.674	32.674
2	1.715	17.148	69.260	1.476	14.756	63.709	3.103	31.035	63.709
3	1.128	11.278	80.537						
4	.783	7.834	88.371						
5	.525	5.253	93.625						
6	.325	3.247	96.872						
7	.193	1.934	98.805						
8	.055	.549	99.355						
9	.047	.473	99.828						
10	.017	.172	100.000						

Extraction Method: Principal Axis Factoring.

Appendix I. Results for factor analysis of RS

Correlation Matrix for items of RS

		item1	item2	item3	item4
Correlation	item1	1.000	.591	.588	.681
	item2	.591	1.000	.396	.547
	item3	.588	.396	1.000	.612
	item4	.681	.547	.612	1.000

KMO and Bartlett's Test for RS

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.793
Bartlett's Test of Sphericity	Approx. Chi-Square	379.968
	df	6
	Sig.	.000

Communalities for RS factors

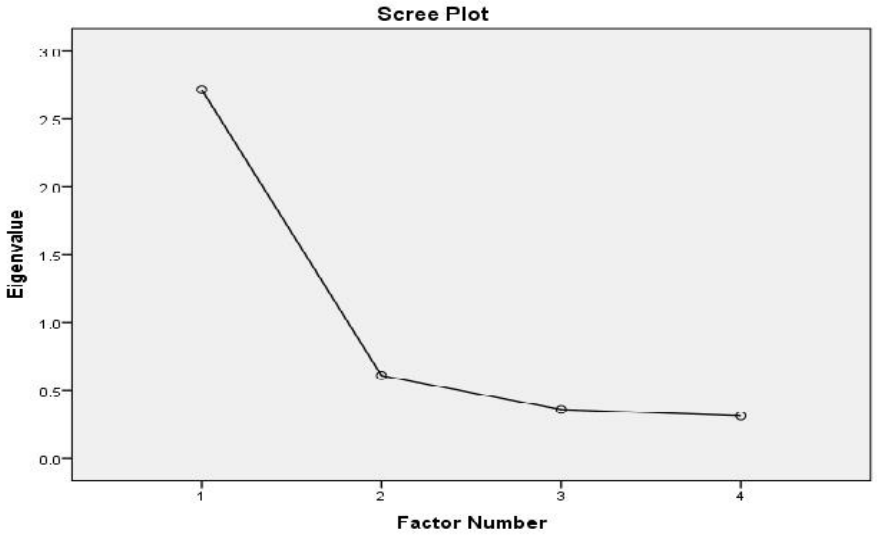
	Initial	Extraction
item1	.569	.723
item2	.388	.422
item3	.429	.473
item4	.558	.701

Extraction Method: Principal Axis Factoring.

Eigenvalues for RS factors

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.716	67.905	67.905	2.320	57.990	57.990
2	.610	15.242	83.148			
3	.360	8.989	92.136			
4	.315	7.864	100.000			

Extraction Method: Principal Axis Factoring.



Scree plot for RS

Appendix J. Output of the Cronbach's alpha Reliability test

Variable	No of Items	Cronbach's alpha value based on the pilot study	Cronbach's alpha value based on the final data	Reported alpha value by the developers
1. PB	7 (10 on the pilot study)	0.71	0.74	-
2. CICT	10	0.91	0.92	0.94
3. CF	10	0.85	0.85	-
4. PICT	4	0.72	0.85	-
5. AICTE	5	0.87	0.90	0.89
6. GAICT	5	0.70	0.75	0.87
7. PIICT	4	0.72	0.71	0.84
8. RS	4	0.93	0.84	-

Appendix K. Number of questionnaires distributed and return rate

College	Total number of active academic staff	Expected sample size (25%)	No. of questionnaires distributed	No. of questionnaires collected
College of Public health and medical sciences	300	75	100	86
College of Social science and law	114	29	45	32
College of Natural Science	116	29	45	31
Institute of teacher professional development	16	4	8	8
College of Business and economics	53	13	15	14
College of Agriculture and veterinary science	112	28	32	30
Jimma Institute of Technology	191	48	55	53
	902	226	300	254

Appendix L. Transcripts of the interview

Transcript1. Partial interview for instructors: Instructors' perception

PH2.	For me ICT is an opportunity. It helped me to disseminate knowledge to my students very. I use LCD projector in smart classroom to present my lecture. I can cover 50 to 60 slides in two hours.
SL1.	ICT helps students in such a way that they can get lots of reference materials from Internet which could have been impossible otherwise. They can get lots of examples from Internet in relation to what they learn in classroom. It helps them to advance their understanding by reading different perspectives from Internet about a single issue. They can interact with their friends through social media and they can learn from each others.
NS1.	ICT is one major factor that made me stay in this University as instructor. It has simplified my work. I can display visuals for my students from Internet which would have been impossible otherwise. There are portions in a course which require you to display models. If you don't use computer, you will find it difficult to teach this part.
BE2.	I have seen both systems. I was teaching using traditional tools like blackboard. Now I sometimes use computer and LCD projector. Experience has thought me that the disadvantage of using ICT overweighs its advantage**.** ICT is contributing for the deterioration of quality of education**.** The other problem that I see is that Students have become PowerPoint dependent**.** They simply copy notes from the PowerPoint slide, they read it, and they sit for exams. They do not refer additional things. Their knowledge is shallow. They have lost interest to read books. Whenever I was using traditional tools like black board, students had chance to listen to what I say, now they don't listen**.** They simply copy notes from the slides. I also noticed that some instructors totally stopped preparing for their lessons since they get everything ready made from Internet. When there is power-cut, these instructors dismiss classes because they are not ready to teach without the technology. Some instructors cover their courses with PowerPoint presentation in few periods and they get engaged in part-time jobs outside the University. I had a chance to see some instructors just reading their slides, which does not help the students. For me, that is not teaching.
AV1.	ICT doesn't simplify instructor's work. It rather requires you to make additional preparation by looking for relevant and up-to-date information that benefits your students. In fact I am not complaining against ICT. ICT helped me to attend free on-line tutorials to upgrade my knowledge and skills which, in turn, helped me to get my students acquainted with latest and up-to-date information.
AV2.	Instructors were misusing the technology by logging into a content provider's website and using PowerPoint slide from the website without any revision or modification. I can see also that currently the disadvantage overweighs the advantage. Traditionally, students had chance to listen to what the instructor says, to analyze what is said, and to ask questions. This is now impossible in smart classrooms.
IPD2.	I am not satisfied with this new learning environment because of the stress it adds on me. I feel that the use of ICT requires additional time for preparation and for fixing some technical problems related to its use.

Transcript2. Partial interview for instructors: How ICT was used

PH1.	Usually I use LCD projector in smart classrooms to deliver my lecture note to the students. I sometimes send my lecture notes to the students through e-mail. I also ask students to present a seminar using LCD projector in smart classrooms.
PH2.	I use ICT to download some information from Internet and include it into the note that I give to my students. I usually use ICT for this purpose. I also use LCD projector in smart classroom to disseminate more knowledge in a short period of time.
SL1.	I usually use ICT to download additional things related to my course such as video from YouTube. I also use LCD projector to present my lecture notes to the students.
NS1.	I upload soft copies of the material that I teach so that students can access it**.** They go to library and can easily access the notes from the computers there. I also use ICT to display visuals from Internet for my students to understand abstract concepts.
BE1.	I use ICT in my teaching. For example, I created an online discussion group called "The economics group", where I post an issue for discussion. My students read the issue that I posted online and they reflect what they understand about the issue. Their views about the issue may not be the same and hence they make a dialog. Ultimately, they learn from each other through this process.
AV1.	I send assignments to my students using e-mail and they send what they do using e-mail. We are using e-mail for this purpose. I also use ICT to post a debatable issue so that students read it and reflect their views about the issue or one of them forwards his/her view opposing the views forwarded by the others. Finally we discuss the issue in class and we come to consensus.
IT1.	I use ICT in smart classroom to present my lecture note using LCD projector. I usually use ICT to display pictorial representations. I include animation and other visuals. I also download video from You-tube and present it to the students. I also created a yahoo group where I share ideas with my students about a given topic. Students also do assignments in group and report the results to the class by representing their ideas in graphic form using computer software.
IPD2.	I use ICT to access materials from Internet to enrich and update what I teach.

Transcript3. Partial interview for instructors: Factors that affect use of ICT

PH1.	Training is very important. But it should not be given for the sake of giving. Needs should be assessed.
PH2.	ICT helped me to disseminate knowledge to my students very easily. I use LCD projector in smart classroom to present my lecture. I can cover 50 to 60 slides in two hours. I do not give tasks that require ICT use because I feel that not all students have access to computers and this hampers the full utilization of ICT in the teaching-learning process.
SL1.	There is strong influence of colleagues that discouraged those who are committed to use ICT for effective teaching and learning. Some instructors mock those who consistently used ICT in their teaching. Moreover, students prefer to do assignments from books than from the Internet.
SL2.	Some of us do not have ICT skills and that hindered us from using ICT effectively. We should be given appropriate training. In fact, we do not even have equal access to the technology. I know that almost all of the classes in other colleges have access to the server. In our college, the computers in some smart classrooms are not connected to the server. As a result, we cannot use Internet in these classrooms. ICT technicians' reluctance to fix problems was also affecting our use of ICT in the teaching-learning process. I feel that there should be continuous follow-up to check whether the technology was working or not.
NS1.	We were given only two trainings on ICT use. One is how to access file from the samba file server. The other is about the online grading system that we are going to implement it from now on. The trainings were not based on our needs. They were not timely. Only a small number of pedagogical trainings were given, but they were not given in a way that you can apply them in your teaching. In addition, I feel that students do not have interest to use ICT for their learning. As a result, it seems to me that it is wastage to tell students to do assignments or other course related activities from the Internet. In spite of all these problems, my courses are difficult to teach them without the use of ICT.
NS2.	I think our level of ICT use depends on the level we teach. There is better ICT use at graduate and post graduate level. Instructors can send notes to graduate Students using e-mail since almost all these students have ICT skills and access to ICT in one way or another. In addition, graduate students conduct a research and use computer software to analyze their data and report the results using computer. Moreover, the course we teach also matters. I think mathematical courses do not require the use of ICT.
BE1.	I believe that level of ICT use as compared to the resources we have is less. Top managers believe in report and they do not know what happens on the ground. Even the restriction not to use Face Book and other websites was unnecessarily affecting our works. Our age also matters. I think elder staff members are not responsive to the technology. In addition, experience matters. Those who lack experience in ICT use find it difficult to use it in their teaching.

BE2.	I have seen both systems. I was teaching using traditional tools like blackboard. Now I sometimes use computer and LCD projector. Experience has thought me that the disadvantage of using ICT overweighs its advantage. ICT is contributing for the deterioration of quality of education. The other problem that I see is that Students have become PowerPoint dependent. They simply copy notes from the PowerPoint slide, they read it, and they sit for exams. They do not refer additional things. Their knowledge is shallow. They have lost interest to read books. Whenever I was using traditional tools like black board, students had chance to listen to what I say, now they don't listen. They simply copy notes from the slides.
AV1.	There was a pedagogical training that was given in the main campus. I started it and I stopped it later because I was expected to go to the main campus every time the training was given. I had transportation problem. They were supposed to arrange transportation or to provide the trainings in our own campus. Generally I can say that there was no follow up about the training. There was no training on how to use ICT in teaching.
AV2.	I have no experience in using ICT. I know that I am expected to use the ICT tools in smart classroom. But I can't access video and audio from Internet. I think LCD projector does not support these formats. When you use ICT, I think what you are expected to do is to bring latest information to your students. I feel that the technology does not simplify teachers' work. A teacher has a lot to do including bringing up-to-date information to the students. My responsibility is to bring latest and up-to-date information and to present it to my students. I feel that I have better information than my students. Using ICT may not make a big difference in my teaching.
IT1.	All students do not have equal access to ICT. It is very difficult to give individual work to the students to do it by using ICT.
IT2.	We have online department group to communicate administrative information with members of the department. We do not post notes on notice board. We communicate through our online group. We use it for office purposes. We have not used this system in the teaching-learning process. We did not think about it. We have no role model whom we follow in this respect.
IPD1.	Effective integration of ICT in the teaching-learning process requires planning which, in turn, requires time. We have lots of duties and responsibilities to carry out. We also do research works for our academic promotion. I think it is difficult to invest time to plan for ICT use. The monitoring and evaluation system is also weak. There is no concerned body that makes classroom observation to see how ICT in smart classroom is used. Instructors are using the ICT tools in smart classrooms in the way they like. I feel that monitoring and evaluation is important to minimize the problems that we see now.
IPD2.	I think that students do not have enough competence to use ICT and this is a barrier to involve students in ICT use.

Appendix M. Permission letters for the adopted scales

Anita Woolley

From: Web Research & Publication <awoolley@cmu.edu>
To: gagiabtd@yahoo.com
Sent: Wednesday, March 27, 2013 7:22 AM
Subject: New Article Request

Dear User,

You have made request for document on Research & Publication website. Details are as follows:

Document Title : Construct validity of a self-report measure of teacher beliefs related to constructivist and behaviorist theories

PDF URL :
http://www.anitawoolley.com/attachments/article/48/Woolley_Benjamin_Woolley_2004_EPM.pdf

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Anita Williams Woolley | Asst. Professor of Organizational Behavior & Theory
Carnegie Mellon University | Tepper School of Business
5000 Forbes Avenue | Pittsburgh, PA 15213
(412) 268-2287 | awoolley@cmu.edu

Ritu Agarwal
To Me
Today at 10:02 AM
You have my permission to use the scale.

Best regards,
Ritu

--
Ritu Agarwal
Professor and Dean's Chair of Information Systems
Director, Center for Health Information and Decision Systems
Robert H. Smith School of Business
4327 Van Munching Hall
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301.405.3121 TEL
301.405.8655 FAX
http://www.rhsmith.umd.edu/chids

http://www.rhsmith.umd.edu
http://www.rhsmith.umd.edu/faculty/ragarwal

Abdulkafi Albirini
To Me
Today at 6:36 AM
Dear Genene,

Yes, I give you the permission to use the scale as long as proper acknowledgement is made.

Best regards

Abdulkafi Albirini, PhD
Assistant Professor of Arabic and Linguistics
Department of Languages, Philosophy and Speech Communication
Utah State University
0720 Old Main Hill
Logan, UT 84322
Phone: 435-797-8630

Johan van Braak
To Me
Today at 2:01 AM
Dear Mrs. Abebe,

Thank you for your interest in my research. Please feel free to use these instruments.

Good luck with your research and I am very interested in the outcomes.

Best regards,
Johan

Prof. dr. Johan van Braak
Department of Educational Studies
Faculty of Psychology and Educational Sciences
Ghent University
Henri Dunantlaan 2 – 9000 Ghent - Belgium

Declaration

I hereby declare that this doctoral dissertation is my original work and has not been presented for a degree in any other university, and that all sources of materials used for the dissertation have been duly acknowledged.

Name of the investigator: Genene Abebe
Signature: Genene A
Date of Submission: 22/04/2015

This doctoral dissertation has been submitted for examination by my approval as the candidate's University advisor

Name of the advisor: Amare Asgedom (PhD)
Signature: AA
Date of Submission: 22/04/2015