INFORMATION & COMMUNICATIONS TECHNOLOGY IN EDUCATION | RESEARCH ARTICLE

Determinants of information and communication technology integration in teaching-learning process at Aksum University

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Abstract: The purpose of this study was to investigate factors that determine the integration of Information and Communication Technology (ICT) in teaching-learning process in Aksum University. Descriptive survey research design was employed. The size of population was 550 teachers and 5 College deans. Of these, 385 teachers and 5 college deans were selected as samples with the help of stratified random sampling and comprehensive sampling techniques, respectively. Questionnaires and interview were used to collect the data. The result of a one sample t-test shows that teachers’ attitude towards the use of ICT, accessibility of ICT facilities, teachers’ self-efficacy, teachers’ competence, and technology characteristics highly influenced the ICT integration while technical support, the nature of curriculum, administrative support, and ICT policy were less likely to influence ICT utilization. In addition, the result of correlation indicated that ICT integration had positive relationship with all independent variables. With regard to regression, 88.1% of ICT integration was predicted with the combination of teachers’ self-efficacy, attitude, the characteristics of technologies, accessibility of ICT facilities, teachers’ competence, ICT policy and administrative support significant model at F (7, 377) = 400.393, p < 0.05. The results of interview also

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PUBLIC INTEREST STATEMENT

ICT is one of the major tools that enhances the quality of student learning and their learning outcome. ICT-based education system is a holistic approach where a very high level of integrity and moral standard is required by teachers and students. It facilitates the use of active learning methods so that students can learn based on their curiosity. The purpose of this study was to investigate factors that determine ICT utilization in teaching-learning process. Questionnaire and interview were used to gather data. The collected data were analyzed with both quantitative and qualitative data analysis techniques. The result of this study indicated that the integration of ICT in teaching-learning practices depends on teachers’ self-efficacy their attitude towards ICT, the characteristics of technologies, accessibility of ICT facilities, teachers’ competence, and ICT policy, and administrative support. Finally, appropriate recommendations have been forwarded at the end.
indicated that inadequate administrative and technical support, restrictive nature of curriculum, lack of sufficient time, shortage of electric power, and concrete models to integrate technologies hinder from using ICT in teaching-learning process. Therefore, it is possible to conclude that personal and institutional factors can determine ICT integration in teaching-learning practices.

**Subjects:** Internet & Multimedia - Computing & IT; Management of IT; Information & Communication Technology (ICT); Communication Technology; Nutrition; Internet & Multimedia

**Keywords:** ICT; integration; teaching-learning process; Aksum University

1. Introduction

1.1. Background of the study

Much of the reforms have been observed in the world over the period of time which has been experiencing substantial socio-cultural transitions and economic restructuring due to information technology and globalization (Mehboob et al., 2012). These changes increased concern for countries not only to be more adaptive to the changes but also design and develop innovative tools, equipment, processes, systems, structures, policies, and resources to remain compatible with the changing world. It also viewed that educational systems around the world are under increasing pressure to use ICT (Yuen et al., 2008). With the fast development of science and technology in the era of globalization, higher education play an essential role in reflecting learning environments and enhances lifelong learning processes. In this regard, ICT can create a powerful learning environment that transforms the teaching-learning process in which students deal with knowledge in an active, self-directed and constructive way (Volman & Van Eck, 2001).

The effective integration of ICT in the curricula with the intent of positively influencing teaching and learning has been in a state of development over the past 20 years (Dockstader, 1999). This can be realized through changing the way people access, gather, analyze, present, transmit, and simulate information. Technology should be used as a tool to support educational objectives such as skills for searching and assessing information, cooperation, communication, and problem solving which are important for the preparation of children for the knowledge society (Drent & Meelissen, 2008; Voogt, 2003). Learning methods using ICTs provide many opportunities for constructivist learning through their provision and support for resource-based, student-centered settings, and by enabling learning to be related to context and practice (Barron, 1998). Teachers generate meaningful learning experiences for their students using ICT to the flexibility of content and delivery.

In addition, ICT can enhance teaching and learning through its dynamic and interactive approach which provides real opportunities for individualized instruction. In fact, innovative use of ICT can facilitate student-centered learning (Drent, 2005). It has also the potential to accelerate, enrich skills, motivate, and engage students in learning, strengthens teaching as well as provides opportunities for connection between the school and the world (Davis & Tearle, 1999). Hence, every teacher should use technologies to enhance students learning so that it can encourage thinking, decision-making, problem-solving, and reasoning (Grabe & Grabe, 2001). The use of ICT as a tool of everyday life enhances the quality of students learning. Along with a shift of curricula from content-centered to competence-based, the mode of curricula delivery has now shifted from teacher-centered to student-centered supported with ICT (Sharma et al., 2011).

Nowadays, ICT is not the only option but also an undeniable necessity because it is considered as an important step in changing educational system (Aqhakhani, 2009). ICT provides different opportunities, which are now creating competitive edges for themselves through the choices they
are offering students. Law et al. (2008) also believed that the acquisition of ICT skills includes the ability to become lifelong learners within the context of collaborative inquiry and the ability to work and learn from experts and colleagues in a connected global community. ICT has radically changed the traditional method of information delivery and usage patterns in the domain as well as offering contemporary learning experience for teachers and students (Webb & Cox, 2004). Unless other simultaneous innovations have been brought in pedagogy, curriculum and assessment, the time and effort expended on implementing these devices produce few improvements in educational outcomes (Cross & Adam, 2007). Thus, ICT necessarily can improve student learning outcomes if it is integrated meaningfully with the education system (Herzig, 2004; Lim & Ching, 2004; Wang, 2001).

One of the most vital contributions of ICT in the field of education is easy access to Learning. The application of ICT in education creates a new kind of learning in such a way that learning is not carried out through face to face but it is possible in environments than classroom, so that the information can be easily shared with other learners (Asnafi & Hamidi, 2005). This implies that ICT increases the flexibility of delivery of education so that learners can access knowledge at anytime and anywhere. Nwosu and Ogboro (2012) and Lowther et al. (2008) also stated that ICT helps to expand access to education, strengthen the relevance of education to the workplace, and enhance educational quality by creating an active process connected to real life. This flexibility has heightened the availability of just-in-time learning and provide learning opportunities for many learners who were constrained by other commitments (Young, 2002).

Numerous research have been conducted to assess the determinants of ICT integration in the teaching-learning processes (Norton et al., 2000). Based on the findings of various studies, personal, technological and institutional factors highly influence the integration of ICT in teaching-learning process. Teachers’ attitudes and beliefs towards technology influence their acceptance of the usefulness of technology and its integration into teaching (Hew & Brush, 2007; Huang & Liaw, 2005). When teachers’ attitudes are positive toward the use of ICT, they can easily provide useful insight about the integration of ICT into teaching and learning processes. Related to this, teachers’ competence is also the major predictor of integrating ICT in teaching activity (Berner, 2003; Summers, 1990). Research has shown that teachers’ competence with computer technology is a key factor of effective use of ICT (Knezek & Christensen, 2002; Peralta & Costa, 2007). In line with this, teachers’ self-efficacy influences the use of ICT in teaching practices (Liaw et al., 2007). Although some studies showed that teachers’ experience as unrelated to ICT integration in teaching (Niederhauser & Stoddart, 2001), many studies proved that teaching experience highly influences the integration of technologies in teaching (Giordano, 2007).

Moreover, access to ICT facilities is necessary condition to the integration of ICT in education (Plomp et al., 2009; Yildirim, 2007). Effective integration of ICT into teaching depends on the availability and accessibility of access to computers, updated software and hardware. In the same way, Yilmaz (2011) also believed that providing teachers with technical support with regard to repairing contribute for the integration of ICT in teaching-learning process. Without technical support, teachers become frustrated to use ICT (Tong & Triniada, 2005). Also researches have shown that various levels of administrative support and technology leadership influence successful integration of ICT in teaching (Anderson & Dexter, 2005). This aspect of leadership will help administrators to share tasks with subordinates while focusing on the integration of technology in teaching activities. Similarly, the characteristics of technology determine the use of ICT in teaching. Evidence suggests that innovation attributes: relative advantage, compatibility, complexity, trial ability, and observability as perceived by individuals influence ICT integration in teaching (Rogers, 2003). With regard to curriculum, Stockdill and Morehouse (1992) also identified content characteristics as factors influencing ICT integration into teaching (Figure 1).
1.2. Statement of the problem

There has been an increasing interest given to the integration of ICT to support teaching-learning process. ICT enhanced learning environment facilitates active, collaborative, creative and evaluative learning compared to the traditional methods. With the help of ICT, teaching environment has been changed from teacher-centered instruction to student-centered instruction (Castro Sanchez & Aleman, 2011). Accordingly, ICT may function as a facilitator of active learning and higher-order thinking (Alexander, 1999) and foster co-operative learning and reflection about the content (Susman, 1998). ICT acts as a modern approach which is supporting the role of educational system, improving the quality of teaching, diversifying teaching methods, providing automatic continuous learning, shortening the education time, considering individual talents and coping with collective education problems (Esmaili et al., 2004). This can be achieved through increasing learner motivation and engagement, facilitating the acquisition of basic skills, and enhancing teacher training methods (Wadi & Sonia, 2002). ICTs also motivate learners through videos, television, and multimedia computer software that combine text, sound, and images which can be used to provide challenging and authentic content that will engage students in learning process. In supporting this idea, the use of technological approaches in teaching-learning has a positive effect on education, motivating students, promoting learning and changing classroom interaction (Picchio, 2001). Hence, teaching and learning no longer depend exclusively on printed materials.

Though ICT plays an important role in improving the quality of student learning, different barriers affected its integration with education system. Most educational institutions in most countries are in the early phase of ICT adoption characterized by patchy-uncoordinated provision and some enhancement of the learning process and development of e-learning, but no profound improvements in teaching-learning process (Balanskat et al., 2006). Similarly, Chigona and Chigona (2010) also found inadequate training, lack of access to computer laboratories, lack of technical support, and inadequate technology discouraging teachers from using ICT in teaching. According to the findings of Birhanu (2014) and Kwacha (2007) shortage of electric power supply, shortage of appropriate classrooms, insufficient facilities, lack of qualified ICT personnel, and management attitude are the main challenges that hindered the successful integration of ICT in teaching-learning process. Similarly, teachers’ attitude and resistance to change found as asignificant barrier to integrate ICT in education system (Becta, 2004). In addition, lack of teacher collaboration and pedagogical support and experience among teachers (Ertmer & Otterndt-Leftwich, 2010), shortage of time to master new software (Almekhlaifi & Almeqadi, 2010), insufficient skills for managing teaching materials (Frederick et al., 2006), limited knowledge, and experience in ICT (Honan, 2008; Hutchison & Reinking, 2011; Newhouse, 2002), lack of motivation and financial support (Liu & Szabo, 2009), lack of recognition and presence of large class sizes (Tezci, 2011b), and lack of specific ideas to integrate technology with instruction (Al-batainah et al., 2008) are another challenges teachers faced while they use ICT.
Moreover, lack of appropriate administrative support and ICT infrastructure (Lim, 2007), absence of appropriate course content and instructional programs, appropriate hardware, software, and materials (Yildirim, 2007) are the major challenges that hindered to use ICT for instructional purpose. Empirica (2006) and Toprakç (2006) also found that lack of computers and adequate materials are the most common barriers that affect the successful integration of ICT in teaching practices as reported by teachers who were serving in higher education institutions. The use of ICT in teaching requires competent teachers to retain knowledge for a longer time (Mewcha & Ayele, 2015). According to UNDP (2001), the majority of teachers in developing countries are not competent to use instructional technology in teaching-learning practices. In addition to these, the integration of ICTs in education systems may face various challenges with respect to attitude, policy, planning, infrastructure, learning content and language, capacity building, and financing (Fisseha, 2011).

Although ICT facilitates teaching-learning process, it is not yet properly integrated into the education system due to the limitations associated with it. While many studies had been conducted in different areas, study has not been conducted about the practices of ICT in Aksum University. Thus, this study investigated factors determining ICT utilization in teaching-learning process.

1.3. Research questions

1. What are the factors that factors determine ICT integration in teaching-learning process in Aksum University?

2. Are there significant relationships between the list of factors and ICT integration in teaching-learning practice in Aksum University?

3. Which factors significantly predict ICT integration in teaching-learning process in Aksum University?

4. What are the challenges that hinder the successful integration of ICT in teaching-learning practices in Aksum University?

1.4. Significance of the study

Since this study focuses on the practices of ICT, the university’s management, college deans, and teachers get additional propositions on how technology can be used in different levels to improve teaching-learning process. ICT helps to reach target groups with limited access to conventional education and training and can transform the learning environment thus help improving the quality of education. ICT converges traditionally separated educational technologies—books, writing, telephone, photography, and databases. In consequence, it bridges forms of knowledge and intersect places of learning—home, school, work, and community. The findings of this study provide important recommendations on how to make ICT infrastructure accessible so that the connection of educational institutions and curricula to the emerging networks resources.

1.5. Delimitation of the study

Although it is important to study the status of ICT integration in Ethiopian higher education institutions, this study was geographically delimited to Aksum University due to time and resource constraints. Thus, the findings of this study cannot be generalized for other universities, which were not considered in this study. Concerning the variables, it focuses on teachers’ attitude, self-efficacy, competency, technical support, administrative support, accessibility of ICT facilities, the nature of the curriculum, ICT policy, and the characteristics of technologies. Additionally, challenges that hinder the successful integration of ICT in teaching were treated. However, participants’ personal backgrounds such as gender, educational qualification, ethnicity, work experience, age, marital status, religion, etc. will not be the concern of this study.
1.6. Limitations of the study

- This study aimed to assess teachers’ perception on the determinant of ICT integration in teaching-learning process in Aksum University at a particular point of time. But, it is unknown that whether their perception is currently changing unless systematic longitudinal study was conducted.

- The study was geographically restricted to the specific areas of Aksum University, the result of this study cannot be generalized to other universities which were not included in the current study. This happened due to shortage of time and resources that are necessary to conduct the study.

- Since the data gathering techniques were self-administered questionnaire and interview, the accuracy of the data was limited to the subjective perception of respondents. Because of these, the researcher may be obliged to make artificial decision.

2. Research methodology

2.1. Research design

Research design is the blue print that describes the conditions and procedures for collecting and analyzing data (McMillan & Schumacher, 2010). Since this study involved large number of samples to gather data concerning ICT utilization in the teaching-learning process, descriptive survey research design was found suitable. Descriptive survey design can be used when collecting information about people’s attitudes, opinions, habits or a variety of education or social issues. According to Nkpa (1997), descriptive studies are concerned with either describing or interpreting existing relationships, attitudes, practices, processes and trends or comparing variables. Therefore, the researcher followed this design as a guide to investigate the determinants of ICT integration in the teaching learning process at Aksum University.

2.2. Population, sample and sampling techniques

There are three Campuses in Aksum University which contain seven colleges and three schools. In these colleges/schools, there are a total of 1011 teachers were considered as the target population of the study. For the purpose of this study, College of social sciences, engineering and technology, business and economics, natural sciences, and school of education and behavioral sciences were selected among others which consisted of 550 teachers and five college deans were considered as the population of the study. For manageable reason, the researcher selected 385 samples out of 550 teachers using stratified random sampling technique. That is, 70% of teachers were taken from each college based on the size of its population using proportionate stratified sampling technique, the number of teachers across the colleges are significantly varied. Then, these respondents were selected using simple random sampling, mainly lottery methods with the assumption to give equal chance for all teachers to be selected as samples. With regard to college deans, the researcher included all 5 deans in the sample using comprehensive sampling technique due to the manageability of their numbers. Because, the researcher expected that college deans have better knowhow about ICT supported instruction as compared to others.

2.3. Data collection instruments

For the purpose of gathering data, questionnaire and semi-structured interview were employed. The logic behind using the questionnaire as a survey instrument is more efficient instrument to get large amount of primary data from large number of sample with limited amount of time and resources. In line with this, large amount of information can be collected from a large number of people over a short period of time in a cost effective way (Popper, 1959). Thus, the researcher developed a total of 85 close-ended questions for teachers to assess ICT integration in teaching-learning process containing five points of Likert type items. The scale of each item required participants to express their views ranging from ‘very low’ represented by a score of ‘1’ to very high designated by a score of ‘5’.
Finally, semi-structured interview was used to gather data in order to compare the data obtained through the questionnaire. Face-to-face interview was conducted using field note to jot down, which solicited information via interaction between the researcher and the respondents. It has been proven that in order to receive proper, specific, valid, and reliable data, attention must be paid to the triangulation of samples (Cohen et al., 2000).

2.4. Pilot test
For the purpose of this study, pilot test was conducted on 50 teachers were found outside the main sample of the study. The distribution of samples for pilot test followed the same procedures as did in the main sample. Although there are different methods that are used to measure the reliability of tests, the researcher used Cronbach alpha to measure the internal consistency of items with each of the dimension. The reliability coefficients of the instruments with Cronbach Alpha ($\alpha$) = (0.82, 0.75, 0.84, 0.77, 0.91, 0.85, 0.87, 0.79, and 0.89) for items concerning teachers’ attitude, self-efficacy, competency, technical support, administrative support, accessibility of ICT facilities, curriculum, ICT policy, and the characteristics of technologies, respectively. That is, items with the value of Cronbach Alpha ($\alpha$) = 0.75 is above the lower limit of acceptability to judge the instrument as reliable for the study (Oroodho, 2009). These results indicated high reliability of instruments due to high level of reliability of coefficients.

2.5. Data gathering procedures
Before starting to gather data, the researcher asked permission from the university to get their consent. Based on the permission given, the researcher has distributed the questionnaire to the sample teachers in person using lottery method. The respondents have given 3 days to complete the questionnaire, and then the researcher has collected the questionnaire from each respondent physically. After the questionnaire has returned to the researcher, the interview was conducted on five college deans through face to face approach inside the university using 35–40 minutes with each interviewee.

2.6. Data analysis techniques
Both quantitative and qualitative data analysis techniques used since it employed questionnaire and semi-structured interviews as data gathering tools. The quantitative data gathered through the questionnaire were analyzed with the help of both descriptive and inferential statistical techniques. That is, one sample t test, Pearson product moment correlation, and multiple regression were mainly employed to analyze the quantitative data.

Before analyzing the data, data cleaning was carried out to check whether the data met the assumptions of the analysis techniques in relation to the adequacy of sample size, missing values, outliers, multicollinearity, normality, and linearity across dependent and independent variables through visual inspection and inter-correlation analysis methods. After testing the assumption of each analysis technique, the actual data analysis was done.

Specifically, One sample t- test used to assess factors that influence ICT integration in teaching-learning process (RQ #1). Pearson product moment correlation also employed to determine whether or not there are significant relationships between the list of factors and ICT integration in teaching-learning process (RQ #2). In addition, Multiple regression was used to analyze factors significantly predict ICT integration in student learning (RQ #3). Finally, the qualitative data gathered using interview were analyzed through narration (RQ #4).

3. Results and discussion

3.1. Teachers’ response about the determinants of ICT integration in teaching
There are different factors, which determine the integration of ICT in teaching-learning process. As depicted in Table 1, the results of a one sample t-test indicated that the mean scores of teachers’ attitude towards the use of ICT (3.59) was significantly higher than the expected mean value (3) at
Table 1. A one sample t-test about the factors of ICT integration in teaching-learning process

| Factors of ICT Integration | N  | Mean | SD  | Mean difference | t-value | df  | Sig(2-tailed) |
|---------------------------|----|------|-----|-----------------|---------|-----|---------------|
| Attitude towards ICT      | 385| 3.590| .402| .59065          | 28.799  | 384 | .000          |
| Accessibility of ICT      | 385| 3.290| .402| .29039          | 14.140  | 384 | .000          |
| Teachers' self-efficacy   | 385| 3.773| .380| .77299          | 39.893  | 384 | .000          |
| Teachers' competence      | 385| 3.101| .411| -.00877         | 12.165  | 384 | .000          |
| Technical support         | 385| 2.316| .404| -.68312         | -33.165 | 384 | .000          |
| Nature of curriculum      | 385| 2.161| .625| -.83122         | -26.308 | 384 | .000          |
| Administrative support    | 385| 2.643| .263| -.35609         | -26.508 | 384 | .000          |
| ICT Policy                | 385| 2.444| .488| -.55584         | -22.344 | 384 | .000          |
| Characteristics of ICT    | 385| 3.458| .467| .45844          | 19.226  | 384 | .000          |
(t = 28.799, df = 384, p < 0.05). This result indicate that teachers had positive attitude to use ICT for teaching-learning practices. In the same way, the findings of Almusalam (2001) and Lawton and Gerschner (1982) proved that teachers' attitudes have been found as the major factor to determine the use of new technologies in instructional settings. This implies that if teachers' attitudes are positive towards educational technology, they can easily integrate ICT into their practice. Accordingly, teachers with positive attitude towards instructional technologies can foster its integration in the classroom (Van Braak et al., 2004). However, teachers with negative attitude toward technologies were less likely to use it than those with positive attitudes (Harrison & Rainer, 1992) Table 2 and 3.

Table 1 also indicated that the mean scores of teachers' response about the accessibility of ICT (3.29) was higher than the expected mean value (3) at (t = 14.140, df = 384, p < 0.05). This suggests that ICT facilities (Interactive whiteboards, computers, projectors, Internet, Photocopy machines, scanner and printers, CD-ROM drives, laptop and I-pad to the class are accessible for teaching-learning activities. In this regard, the findings of Cowie and Jones (2005) indicated that the accessibility of ICT facilities encourage teachers to utilize in teaching practices. Similarly, ICT infrastructure can be one of the factors that influence the use of technology among teachers (Krysa, 1998; Shiue, 2007; Yildirim, 2007). Richardson (2000) also reported that many teachers integrated technology into their teaching and learning process. Therefore, effective uses of technologies in teaching-learning practices depend on the availability of sufficient hardware and software. In addition to this, the results of a one sample t-test revealed that the mean scores of teachers’ self-efficacy to apply ICT for the purpose of teaching-learning activities (3.77) was higher than the expected mean value (3) at (t = 39.893, df = 384, p < 0.05). This result showed that teachers were confident to apply ICT in teaching-learning process. The results of this study was consistent with the previous research findings in that the effective and efficient use of ICT in teaching practices depend on teachers' level of self-efficacy (Knezek & Christensen, 2002). In line with this, teachers unable to use ICT to support the teaching-learning practices due to lack of confidence (Balanskat et al., 2007; Jones, 2004).

With regard to teachers' competence, the results of a one sample t-test indicated that the mean scores of teachers’ competence to use ICT (3.101) was higher than the expected mean value (3) at (t = 12.165, df = 384, p < 0.05). This implies that teachers were competent in integrating ICT in teaching-learning process. This result was similar with the findings of Berner (2003) and Summers (1990) considered teachers’ competence as the major factor determining ICT utilization in teaching. In addition, teachers with didactic competences as significant factors of effective and efficient utilization of ICT in teaching-learning practices (Pelgrum, 2001). Moreover, Table 1 shows that the mean scores of teachers' response about the characteristics of ICT (3.45) was higher than the expected mean value (3) at (t = 19.226, df = 384, p < 0.05). This result indicate that teachers used

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\begin{array}{|l|l|l|l|}
\hline
\text{Independent variables} & \text{ICT integration in teaching} & \text{N} & \text{Pearson Correlation(r)} & \text{Sig. (2-tailed)} \\
\hline
\text{Attitude towards ICT} & 385 & 0.712 & 0.00 \\
\text{Accessibility of ICT} & 385 & 0.584 & 0.00 \\
\text{Teachers' self-efficacy} & 385 & 0.783 & 0.00 \\
\text{Teachers' competence} & 385 & 0.553 & 0.00 \\
\text{Technical support} & 385 & 0.303 & 0.00 \\
\text{Nature of curriculum} & 385 & 0.243 & 0.00 \\
\text{Administrative support} & 385 & 0.420 & 0.00 \\
\text{ICT Policy} & 385 & 0.451 & 0.00 \\
\text{Characteristics of ICT} & 385 & 0.603 & 0.00 \\
\hline
\end{array}
\]
Table 3. Step wise (statistical) regression on the factors determining ICT integration in teaching

| Model | Dependent variable | Independent variables | Unstandardized Coefficients | Standardized Coefficients |
|-------|--------------------|-----------------------|----------------------------|---------------------------|
|       |                    | R Square              | B                          | Std. Error | Beta | T-value | Sig. |
| 7     | ICT integration in teaching | .881 | .168 | .056 | 2.981 | .003 |
|       | Constant           |                       |                            |            |      |         |      |
|       | Teachers’ self-efficacy | .071 | .018 | .131 | 4.001 | .000 |
|       | Attitude towards ICT | .161 | .009 | .362 | 18.537 | .000 |
|       | Characteristics of ICT | .097 | .011 | .183 | 8.738 | .000 |
|       | Accessibility of ICT | .186 | .017 | .225 | 10.679 | .000 |
|       | Teachers’ competence | .159 | .012 | .277 | 13.242 | .000 |
|       | ICT Policy         | .134 | .014 | .249 | 9.579 | .000 |
|       | Administrative support | .095 | .012 | .205 | 8.144 | .000 |
ICT for educational purpose based on its simplicity, compatibility, practicability, relevance, and observability. In line with this, the integration of ICT in teaching-learning practices depend on the relative advantage, compatibility, visibility, ease of use, results demonstrability and trial ability (Jebele & Reeve, 2003). This result suggests that teachers will use ICT for teaching practices if they perceived it as important.

On the other hand, technical support, the nature of curriculum, administrative support, and ICT policy were less likely found to determine ICT utilization in teaching activities. Specifically, the result of a one sample t-test indicates that the mean scores of teachers’ response about technical support (2.31), the nature of curriculum (2.16), administrative support (2.64) and ICT policy (2.44) were lower than the expected mean value (3) at (t = −33.163, df = 384, p < 0.05), (t = −26.308, df = 384, p < 0.05), (t = −26.508, df = 384, p < 0.05) and (t = −22.344, df = 348, p < 0.05) respectively. Concerning technical support, Korte and Husing (2007) confirmed that lack of technical support discourages teachers from integrating technology in teaching practices. Moreover, administrative support was found as the challenges to use ICT in the teaching-learning process. In the same way, Lim (2007) also believed that teachers are unable to integrate technologies for teaching-learning purpose due to lack of appropriate administrative support. With regard to ICT policy, the result of this study is similar with the findings of Yusuf (2005) that the national policy for information technology gives little emphasis to integrate ICT in the education system. This shows that technical support, the nature of curriculum, administrative support, and ICT policy less likely to influence to integrate instructional technologies.

### 3.2. The relationship between the list of factors and ICT integration in teaching

As indicated in the table above, there had positive relationship between independent variables and ICT integration in teaching-learning process. It is evident that the results of Pearson’s product moment of correlation indicate that the use of ICT in teaching had high positive coefficients of correlations with teachers’ self-efficacy (r =.78) and attitude towards ICT (r =.71) while moderate positive correlation had with the characteristics of technologies (r =.60), accessibility of ICT facilities (r =.58) and teachers’ competences to use ICT (r =.55) at p < 0.05. In addition to this, ICT integration had low positive coefficient of correlation with the nature of curriculum (r = .25), technical support (r = .30), administrative support (r = .42) and organizational policy (r =.45) at p < 0.05.

These suggest that factors related to teachers’ attitude, self-efficacy, competence, accessibility, and characteristics of ICT, ICT policy, the nature of curriculum as well as administrative and technical support had positive relationships with the integration of ICT in teaching-learning process.

Based on the findings of this study, all the variables had positive relationship with ICT integration in teaching-learning practices. Specifically, the findings revealed positive correlation between teachers’ competence and technology integration in teaching practices (r =.55). This result is consistent with the work of Sorgo et al. (2010) who found positive correlation between ICT utilization and teachers’ competence. They concluded that teachers’ competence positively related to ICT integration in teaching. In addition to this, teachers’ attitude had positive relationship (r = .71) with regard to the use of ICT. This result is consistent with the previous research findings which showed that teachers’ actual ICT use related to their attitude (Keengwe & Onchwari, 2008; Lau & Sim, 2008). This finding also confirmed with Eugene (2006) and Woodrow (1992) that the attitudes of teachers towards technology greatly influence their adoption and integration of computers into their teaching. Teachers’ attitude plays an important role in the teaching-learning process that utilizes ICT. This indicates that positive attitudes often encourage less technologically capable teachers to learn the skills necessary for the use of technology-based activities in the classroom.

With regard to self-efficacy, teachers’ level of self-confidence had positive relation (r = .78) with ICT integration in the teaching-learning process. This result was consistent with the findings of Yuen and Mo (2008) who revealed that ICT utilization depends on perceived teachers’ level of self-efficacy. Also, innovative teachers linked the perception of confidence in using ICT with the loss of
fear of damaging the technologies. Although, some teachers may have positive attitudes to the technology, but abstain from using it in teaching due to low self-efficacy, tendency to consider them not qualified to teach with technology.

Similarly, access to technology has positive relationship \( (r = .58) \) with ICT integration. The finding of this study is consistent with Yildirim (2007) who found that access to ICT facilities one of the effective ways to teachers’ pedagogical use of ICT in teaching. Furthermore, 814 faculty members in higher education in Turkey showed that majority of the respondents reported having access to computers and the Internet. 82.5% and 81.2% of faculty members had access to computers and internet respectively (Usluel et al., 2008). Technical support is also another factor which have positive relationship \( (r = .30) \) with the integration of ICT in teaching-learning practices. In this respect, ICT support in schools influences teachers to apply ICT in classrooms without wasting time troubleshooting hardware and software problems (Korte & Husing, 2007). For this reason, it is essential to provide guidance, support, and services as parts of the technology applications (Haslaman et al., 2008). In the integration of the ICT, technical support is needed for technology use throughout the curriculum because the lack of it may create difficulties and result in diminished support for the curriculum (Resta, 2002).

With regard to the characteristics of technologies, the findings of the current study suggest that ICT integration into teaching practices has positively correlated \( (r = .60) \) with the features of the technologies based on its practicability, compatibility, observability, simplicity, and relative advantage for teaching preparation tasks. Similarly, the work of Dillon and Morris (1996) confirmed that relative advantage, complexity, observability, and the image will have a more widespread and rapid rate of technology integration. Therefore, if teachers perceive that an innovation has an advantage over the existing technology, compatible with their social needs, ease to use as well as can be trialed before use, it is more likely integrate in teaching practices. There is also a positive relationship between technology utilization and the nature of the curriculum \( (r = .24) \). This result was consistent with the work of Hue and AbJalil (2013) in which the nature of course content is a crucial in determining the integration of technology and have positive relationship with ICT integration in teaching.

Finally, positive correlation \( (r = .42) \) also observed between administrative support and ICT utilization in teaching-learning process. The finding of this study is consistent with the previous studies about the importance of transformational leadership could help improve the integration of ICT into teaching and learning processes (Afshari et al., 2009). This aspect of leadership will help to share tasks with subordinates while focusing on the adoption and integration of technology.

Therefore, it is possible to conclude that positive relationship exists between independent variables and integration of ICT in teaching-learning practices.

### 3.3. The contribution of independent factors on integration of ICT in teaching-learning process

The result of stepwise regression revealed that 88.1% of ICT integration was determined by the combination of seven predictor variables of this study. The model using a stepwise regression method revealed that there was a significant model; \( F (7, 377) = 400.393, p < 0.05 \). The values of coefficient of determinations are \( .131, .362, .183, .225, .277, .249, \) and \( .205 \) at \( p < 0.05 \) for teachers’ self-efficacy, attitude towards ICT, the characteristics of technologies, accessibility of ICT facilities, teachers’ competence, ICT policy and administrative support, respectively.

This result is consistent with the previous studies that different factors appeared to influence the integration of ICT into teaching practices. Specifically, teachers’ attitude towards ICT (Clausen, 2007; Garland & Noyes, 2004), teachers’ competence (Lim & Choi, 2008; Rosenfeld & Martinez-Pons, 2005), technology characteristics (Yi et al., 2006), self-efficacy (Yuen & Ma, 2008), access to ICT facilities (Yildirim, 2007), administrative support (Yee, 2000) and ICT policy (Yusuf, 2005) are
found most significant factors in predicting ICT integration in teaching-learning process. While the 
$\text{t}$-values of predictor variables remained more than 4.00 showing significant relatedness and 
predicting qualities of the coefficients. In nutshell, regression analysis indicates that the rest 
11.9% of the ICT utilization predicted by other factors, which were found outside this regression. 
However, factors related to technical support and the nature of the curriculum were excluded from 
the regression equation because of its little contribution to predict ICT integration in teaching 
learning practices which is similar to the findings of Goktas et al. (2009) due to inadequate number 
of ICT-related courses.

3.4. The challenges of ICT integration in teaching-learning process

Respondents believed that there is no trained personnel to maintain and repair the available ICT 
facilities which may cause delay in service provision. In this regard, the perspectives of respon-
dents were quite similar with the idea of Resta (2002) and Dexter et al. (2003) in that lack of 
technical support may create difficulties to support teaching practices with the help of technolo-
gies. Without good technical support in the classroom, teachers cannot be expected to overcome 
the barriers preventing them from using ICT (Lewis, 2003). According to respondents, restrictive 
curricula and restricted organizational structure, large class size, inadequate administrative sup-
port, rigid school syllabi and shortage of electric power supply were the major factors hindered the 
successful integration of ICT in teaching. The results seem similar to the findings of the previous 
studies that technical support and inadequacy of ICT infrastructure were factors discouraging 
teachers from using ICT (Baylor & Ritchie, 2002; Chigona & Chigona, 2010; Cowie & Jones, 2005; 
Samuel & Bakar, 2006).

Respondents also added that shortage of time, the presence of outdated ICT facilities and inade-
quacy of management support as the major factors deter the integration of technologies in teaching 
practices. In the same way, Slaouti and Barton (2007) shared the ideas of respondents in that lack of 
access, time pressures, lack of mentors and opportunities for training have effect on teachers’ use of 
ICT in teaching and learning process. A significant number of researchers identified time limitations 
and the difficulty in scheduling enough computer time for classes as a barrier to teachers’ use of ICT in 
their teaching (Becta, 2004; Beggs, 2000; Sicilia, 2005). As the quality of ICT leadership improves, so 
does the percentage of teachers integrating ICT in teaching activities (Lai & Pratt, 2004).

4. Conclusion and recommendations

4.1. Conclusion

Based on the findings of the current study, it is possible to conclude that integration of ICT in 
teaching practices largely determined by teachers’ self-efficacy, attitude towards ICT, the char-
acteristics of technologies, accessibility of ICT facilities, teachers’ competence, ICT policy and 
administrative support. However, technical support and the nature of the curriculum were 
excluded from the regression equation because of their little contribution to predict ICT integration 
in teaching practices. In addition, inadequate technical support, favorable classroom, inadequate 
administrative support, shortage of electric power supply, lack of concrete models to use technol-
ogy and low teacher motivation were hindered the successful integration of ICT in teaching.

4.2. Recommendations

- Aksum University needs to employ sufficient technical assistance with the necessary ICT skill 
  and knowledge to help teachers during classroom interaction.

- Aksum University management needs to motivate teachers through different incentives to use 
  ICT as instructional tools in the teaching-learning process.

- Aksum University needs to provide in-service training for teachers to develop their knowledge 
  of ITC so as to use in teaching-learning process effectively.
• Aksum University needs to arrange classrooms equipped with the necessary ICT infrastructures to promote learning opportunities with the help of instructional technologies.

• The Ministry of Sciences and Higher Education needs to review the current ICT policy in order to encourage teachers to use ICT for instructional purposes.

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Appendices

Questionnaire for Teachers

General Directions

This questionnaire is designed to assess the determinants of ICT integration in teaching learning process in Aksum University. The researcher kindly requests you to fill the questionnaire honestly and thoroughly depending on the given instruction. Your responses will be kept confidential and will only be used for academic purpose. In addition, the researcher would like to inform you that there is no right or wrong answer for each items rather the answers reflect your perceptions. Finally, the researcher would like to express his appreciation for the time and effort you took to fill the questionnaire.

Thank you in advance for your cooperation!!

Part I: Factors determining ICT integration in teaching learning process

This section is designed to gather information about the overall satisfaction of respondents with their job. Please, respond to all items by encircling a scale that represents your opinions. 1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree and 5 = strongly agree.

| No. | Items concerning the determinants of ICT integration in teaching | Responses |
|-----|------------------------------------------------------------------|-----------|
|     | Teachers’ attitude about the value of ICT                        | 1 2 3 4 5 |
| 2.1 | ICT can improve teaching-learning process                        | 1 2 3 4 5 |
| 2.2 | ICT improves students’ academic achievement                      | 1 2 3 4 5 |
| 2.3 | ICT are fast and saves time                                      | 1 2 3 4 5 |
| 2.4 | ICT tends to increase students learning motivations and commitment| 1 2 3 4 5 |
| 2.5 | ICT can increases accuracy and efficiency                        | 1 2 3 4 5 |
| 2.6 | ICT helps to assess students’ learning through tests/quizzes     | 1 2 3 4 5 |
| 2.7 | ICT enhance active learning methods and eliminate passive learning| 1 2 3 4 5 |

(Continued)
(Continued)

| No. | Items concerning the determinants of ICT integration in teaching | Responses |
|-----|---------------------------------------------------------------|-----------|
|     |                                                               | 1 | 2 | 3 | 4 | 5 |
| 2.8 | ICT enable students feel more autonomous in their learning   | 1 | 2 | 3 | 4 | 5 |
| 2.9 | ICT helps students to engage in practical learning           | 1 | 2 | 3 | 4 | 5 |
| 2.10| ICT enhance students’ critical thinking skills               | 1 | 2 | 3 | 4 | 5 |
| 2.11| ICT helps to access and store information                     | 1 | 2 | 3 | 4 | 5 |
| 2.12| ICT enhance teacher and student interaction as well as among students | 1 | 2 | 3 | 4 | 5 |
| 2.13| ICT facilitate learning with disabilities (cognitive, physical, behavioral) | 1 | 2 | 3 | 4 | 5 |
| 2.14| ICT helps to organize and prepare a lesson                   | 1 | 2 | 3 | 4 | 5 |
| 2.15| ICT helps to design and produce learning resources            | 1 | 2 | 3 | 4 | 5 |

**Accessibility of ICT facilities**

| No. | Items | Responses |
|-----|-------|-----------|
| 2.16| Interactive whiteboard | 1 | 2 | 3 | 4 | 5 |
| 2.17| Computer | 1 | 2 | 3 | 4 | 5 |
| 2.18| Overhead projector | 1 | 2 | 3 | 4 | 5 |
| 2.19| Internet facilities | 1 | 2 | 3 | 4 | 5 |
| 2.20| Digital video camera/Digital audio camera | 1 | 2 | 3 | 4 | 5 |
| 2.21| Digital photo cameras (including editing software) | 1 | 2 | 3 | 4 | 5 |
| 2.22| Photocopy machines, scanner and printers | 1 | 2 | 3 | 4 | 5 |
| 2.23| CD-ROM/DVD drives | 1 | 2 | 3 | 4 | 5 |
| 2.24| Personal digital devices such as phones, laptop and i-pad to the class | 1 | 2 | 3 | 4 | 5 |
| 2.25| Wireless technology/satellite services | 1 | 2 | 3 | 4 | 5 |

**Teachers’ self-efficacy in using ICT**

| No. | Items | Responses |
|-----|-------|-----------|
| 2.26| Interactive whiteboard | 1 | 2 | 3 | 4 | 5 |
| 2.27| Computer | 1 | 2 | 3 | 4 | 5 |
| 2.28| Overhead projector | 1 | 2 | 3 | 4 | 5 |
| 2.29| Internet facilities | 1 | 2 | 3 | 4 | 5 |
| 2.30| Digital video camera/Digital audio camera | 1 | 2 | 3 | 4 | 5 |
| No. | Items concerning the determinants of ICT integration in teaching | Responses |
|-----|---------------------------------------------------------------|------------|
| 2.31 | Digital photo cameras (including editing software)            | 1 2 3 4 5 |
| 2.32 | Photocopy machines, scanner and printers                      | 1 2 3 4 5 |
| 2.33 | CD-ROM/DVD drives                                             | 1 2 3 4 5 |
| 2.34 | Personal digital devices such as phones, laptop and i-pad to the class | 1 2 3 4 5 |
| 2.35 | Wireless technology/satellite services                        | 1 2 3 4 5 |

**Teachers’ competences about ICT application**

| No. | Items concerning the determinants of ICT integration in teaching | Responses |
|-----|---------------------------------------------------------------|------------|
| 2.36 | Produce a text using a word processing program               | 1 2 3 4 5 |
| 2.37 | Use internet/emails to communicate with others               | 1 2 3 4 5 |
| 2.38 | Edit text online containing internet links and images        | 1 2 3 4 5 |
| 2.39 | Create a database                                           | 1 2 3 4 5 |
| 2.40 | Use a spreadsheet (e.g., Excel)                              | 1 2 3 4 5 |
| 2.41 | Recording or calculating assessment, marks and grades        | 1 2 3 4 5 |
| 2.42 | Create a presentation with simple animation functions       | 1 2 3 4 5 |
| 2.43 | Create a presentation with video or audio clips             | 1 2 3 4 5 |
| 2.44 | Participate in a discussion forum on the internet            | 1 2 3 4 5 |
| 2.45 | Create and maintain blogs or web sites                       | 1 2 3 4 5 |
| 2.46 | Participate in social networks (Facebook, Twitter, Instagram)| 1 2 3 4 5 |
| 2.47 | Download and install software on a computer                  | 1 2 3 4 5 |
| 2.48 | Upload curriculum resources from websites for students to use | 1 2 3 4 5 |
| 2.49 | Using overhead projector in teaching and learning.          | 1 2 3 4 5 |
| 2.50 | Prepare materials to use with an interactive whiteboard    | 1 2 3 4 5 |
| 2.51 | Writing texts, articles, power points etc, smart boards, you tube, internet | 1 2 3 4 5 |


| No. | Items concerning the determinants of ICT integration in teaching | Responses |
|-----|------------------------------------------------------------------|-----------|
|     |                                                                  | 1 2 3 4 5 |
| 2.52| File management through creating folders, moving files, renaming files | 1 2 3 4 5 |
|     | **Technical Support**                                            |           |
| 2.53| There is technical support staff with the necessary qualification | 1 2 3 4 5 |
| 2.54| Help educators enhance the knowledge of ICT equipment            | 1 2 3 4 5 |
| 2.55| Develop the skill of educators to operate ICT facilities and software | 1 2 3 4 5 |
| 2.56| Maintain and repair ICT facilities to be functional              | 1 2 3 4 5 |
| 2.57| Reduce the risk of ICT through providing technical support for teachers | 1 2 3 4 5 |
| 2.58| Help educators in integrating ICT into teaching learning process | 1 2 3 4 5 |
|     | **The nature of the curriculum**                                 |           |
| 2.59| Teachers are well trained to teach ICT                           | 1 2 3 4 5 |
| 2.60| ICT is taught as a separate subject                             | 1 2 3 4 5 |
| 2.61| ICT is integrated in my courses because I choose to do so        | 1 2 3 4 5 |
| 2.62| ICT is integrated in my because of curriculum requirements      | 1 2 3 4 5 |
| 2.63| Course contents are organized in a way to teach with ICT         | 1 2 3 4 5 |
| 2.64| Course contents are consider teachers’ ICT competences          | 1 2 3 4 5 |
| 2.65| Teachers are responsible to use ICT to deliver the courses      | 1 2 3 4 5 |
|     | **ICT policy**                                                   |           |
| 2.66| There is sound policy in supporting ICT integration in teaching | 1 2 3 4 5 |
| 2.67| A policy used ICT for teaching and learning in specific subjects | 1 2 3 4 5 |

(Continued)
| No.  | Items concerning the determinants of ICT integration in teaching | Responses |
|-----|---------------------------------------------------------------|------------|
| 2.68 | Discussions with teaching staff about ICT use for pedagogical purposes | 1 2 3 4 5 |
| 2.69 | A specific policy to prepare students to use Internet for learning | 1 2 3 4 5 |
| 2.70 | A specific policy about using social networks in teaching and learning | 1 2 3 4 5 |
| 2.71 | A specific policy promote cooperation and collaboration among teacher | 1 2 3 4 5 |
| 2.72 | Design plan to integrate ICT into teaching learning process | 1 2 3 4 5 |
| 2.73 | Implement ICT plan in collaboration with teachers | 1 2 3 4 5 |
| 2.74 | Provide professional development opportunities | 1 2 3 4 5 |
| 2.75 | Make ICT facilities and software accessible for teachers | 1 2 3 4 5 |
| 2.76 | There is financial support for ICT implementation | 1 2 3 4 5 |
| 2.77 | Arrange conducive classroom with the necessary managerial support | 1 2 3 4 5 |
| 2.78 | Offer sufficient electric power supply | 1 2 3 4 5 |
| 2.79 | Motivate teachers to use ICT in teaching learning activities | 1 2 3 4 5 |

**Administrative support**

| No.  | Items concerning the determinants of ICT integration in teaching | Responses |
|-----|---------------------------------------------------------------|------------|
| 2.80 | Simplicity of ICT to use in teaching learning process | 1 2 3 4 5 |
| 2.81 | Compatibility of ICT to integrate into teaching learning activities | 1 2 3 4 5 |
| 2.82 | The relative advantage of ICT to use for teaching purpose | 1 2 3 4 5 |
| 2.83 | The practicability of ICT in teaching learning process | 1 2 3 4 5 |
| 2.84 | The observability of ICT in classroom instruction | 1 2 3 4 5 |
| 2.85 | The attractiveness of ICT while incorporating in teaching | 1 2 3 4 5 |
Part II: Challenges of ICT integration in teaching learning process

This section is designed to gather data about the challenges teachers encountered in integrating ICT in teaching. Please, respond to all items by encircling a scale that represents your opinions. 1 = strongly disagree, 2 = Disagree, 3 = somewhat agree, 4 = agree & 5 = strongly agree.

| No. | Items concerning Challenges of ICT integration in teaching | Responses |
|-----|-----------------------------------------------------------|-----------|
| 3.1 | Insufficient number of computers                         | 1 2 3 4 5 |
| 3.2 | Lack of Internet bandwidth or speed                      | 1 2 3 4 5 |
| 3.3 | Insufficient number of interactive whiteboards           | 1 2 3 4 5 |
| 3.4 | Insufficient number of laptops                           | 1 2 3 4 5 |
| 3.5 | Inappropriate teacher training                           | 1 2 3 4 5 |
| 3.6 | Shortage of technical support for teachers               | 1 2 3 4 5 |
| 3.7 | Insufficient pedagogical support for teachers            | 1 2 3 4 5 |
| 3.8 | Difficulty in linking ICT to the curriculum              | 1 2 3 4 5 |
| 3.9 | Inefficient time to prepare materials through ICT        | 1 2 3 4 5 |
| 3.10| Lack of favorable classroom with the necessary facilities| 1 2 3 4 5 |
| 3.11| Lack of interest on the part of teacher to use teachers  | 1 2 3 4 5 |
| 3.12| Low awareness about the benefit of ICT                   | 1 2 3 4 5 |
| 3.13| Lack of policy to allow teachers to use ICT              | 1 2 3 4 5 |
| 3.14| Lack of administrative support to use ICT                | 1 2 3 4 5 |
| 3.15| Shortage of electric power supply                         | 1 2 3 4 5 |

(1) If there are other challenges that hindered the successful integration of ICT in your University/colleges, please, specify in the space given below.

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Interview Schedule for College Deans

The purpose of this study was to investigate the factors that determine the integration of ICT in teaching learning process at Aksum University.

Key Informant Interviewees- College Deans
(1) Name of KII: _______________
(2) Name of College: _____________
(3) Gender: _____________________
(4) Educational qualification: ______
(5) Work experience: ______________
(6) Date: ______________ Time started: ______ Time Ended: ______
(1) Do you think that ICT is important to improve the quality of teaching learning process in your in university?
(2) How often ICT used in your college for purpose of teaching learning process? Can you give evidences?
(3) What do you think as the major factors that determine the integration of ICT in teaching learning process in your university?
(4) What are the major factors that hinder the successful integration of ICT in teaching learning process in your university?
(5) What do you suggest to improve the utilization of ICT in the university?