Conceptualizing a Model for ICT Implementation in Teacher Education Programme in Nigeria

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Abstract
ICT implementation for teaching and learning has been a research topic for many research studies, but there is no generalize process to implement ICT in teacher education. This study aims to examine the variables that influence teacher educator's intention to implement ICT in classroom. Using Ely's condition of change (1990) as the framework, a research model was developed to include attitude and ICT use. It is reasonable to expect attitude to be associated with ICT use. In addition, the study investigated the influence of dissatisfaction with status quo, time, knowledge and skill, resources, reward and incentive, participation, commitment, leadership on teachers' intention to implement ICT. With data gathered from (N = 302) participants using a survey questionnaire, structural equation modelling (SEM) analysis revealed that the proposed model in this study has a good fit, and empirical support for four of nine hypotheses. Teachers' attitude was found to have a direct significant influence on ICT implementation. Other factors were found to have an indirect influence on ICT and were not statistically significant to influence ICT. Practical implications were addressed either to guide practitioners in designing an implementation model for teacher education program or assist researchers in their future study.

Keywords: ICT implementation, Teacher education programme, Structural equation modelling

Introduction

Information and Communication Technology (ICT) in education's major essential component is in complementing and enriching traditional educational system in education delivery and instructional materials (Olabode, Oyewole & Oke, 2013). ICTs provide an array of powerful tools that may help in transforming the present isolated, teacher-centred and text-bound classrooms into rich, student-focused, interactive knowledge environments. In the new teaching and learning environment of ICT use, the role of the teacher changes from knowledge transmitter to that of learning facilitator, knowledge guide, knowledge navigator and co-learner with the student. The new role does not diminish the importance of the teacher but requires new knowledge and skills (UNESCO,2002). Quality education is dependent on the development of high quality teachers (Haddad & Jurich, 2006) for teachers are indispensable within the teaching and learning process.

In teacher training colleges much of the good practices are in teaching ICT as a subject, but less as learning tools for ICT practices and effective teaching strategies using ICT. There is a lack of clearly stated ICT applications since teachers lack the basic understanding of the precise method ICT can enhance teaching and learning. The knowledge and skills teachers receive at training have a great impact on their transitive future use of pedagogical ICTs when they enter job markets as qualified teachers (Kihoza et.al. 2016). Teachers will teach in the same way they were taught. Teachers need to develop knowledge and skills on current ICT facilities in order to gain the experience necessary to understand the potentials of dynamic technologies in education

Mooij and Smeets (2006) posits that the lack of interest that has been displayed by teachers in most countries may be due to the misconception of the concept "integration" which is due to the insufficient knowledge they possess. A further inhibiting factor would seem to be the lack of or inadequate teacher training. It is through the training of teachers that the objectives of ICT implementation can be clarified. Furthermore, the attitude of the school management in supporting the process is also viewed as influential to teachers' use of computers. The attitude of the school management may not directly affect the teachers' perception of ICT, but may indirectly influence teachers' perception of the quality and quantity of ICT resources that the school needs. Kuhn (1996) calls for a "paradigm shift", a change in theory and methods, when old theories and methods will not solve new problems. A paradigm shift in view of the learning process, coupled with applications of the new information technologies, may play an important role in bringing educational systems into alignment with the knowledge-based, information-rich society. The shift also demands new knowledge and skills in the work force (UNESCO 2002).

Fullan (2001) research on educational change helps to identify seven major stakeholder in the change process as the dean, teaching staff, senior administrators, student teachers, school teachers/ICT coordinators in schools/principals, government agencies and business and industry. With the introduction of ICTs in teacher education programs, the seven groups of stakeholders listed are clearly distinguishable as their role is in the formative evaluation and dissemination of initiatives for ICT teacher education. The deans provide leadership and lecturers or academic staff of teacher education programs implement the change. All innovations

are expected to succeed. What characteristics and/or attributes of the innovation could be used in the introduction of the change process to encourage its adoption by teacher educators? Therefore the question is where do leaders and those who implement change start in introducing ICT in teacher education? This study therefore focuses on Ely's educational change model to help answer the research questions.

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Theoretical Framework: Ely's Condition of Change

The theoretical framework for this study is the condition of change developed by Donald P. Ely in 1990. Ely (1990) points to conditions of successful change, being the first to emphasize the environmental conditions that promote change in his pioneering study of change libraries, used the term conditions of change to refer to a set of factors to describe the environment. Ely's (1990; p. 299) study has been refined over the years, and broadened to cover "the implementation of educational technology in a variety of education-related context". Ely's approach recognizes that the characteristics of the innovation are not the only factors influencing its adoption, his research suggest that the environment in which the innovation is to be introduced can play an equally important role in determining a change effort's success.

One type of change is innovation, "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995; p. 11). Because acceptance or adoption of an innovation usually demands some type of change, innovation infers change (Ely, 1978). This process of change occurs when an individual or institution adopts and implements an innovation. Implementation models describing an effective processes of change indicate that the most important stage is the stage in which those involved in the implementation process understand the need for this change (Cook et al. 2007), but even after understanding the need for the change, differences may exist between various interested parties in their perception of the goals of the change, in their personal and organizational interests, and in their attitudes toward the desired nature of the change, a sense of urgency is thus created among them, regarding the change as essential for improving and advancing the organizational system (Hargreaves and Goodson 2006).

Ely states that though the eight conditions are ordered numerically, he argues that it is not a sequential system but a list of conditions that should be considered. Ely further states that "The setting in which these conditions are used is the ultimate determinant of their utility. Care should be taken to allow for cultural and personality variables" (Ely, 1990, p 300). Depending on the "local condition" of the environment, some conditions may play more prominent roles having a greater affect than others on the change process. Another argument against the attempt to impose sequence or rank in order of importance is the fact that some conditions overlap and all are interconnected and related to one another to varying degrees. This in turn also explains why when one condition is absent the overall probability of success is weakened. Ely's studies have identified eight of these conditions and validated them across various educational and cultural settings. (1) There must be dissatisfaction with the status quo; For change to be voluntarily embraced participants must perceive the status quo to be less comfortable, things could be better, that something needs to change, measuring dissatisfaction with the status quo can provide much more than just a number; is the source of disaffection internal frustration with textbooks full of out-dated information or is the frustration external, such as pressure from the state, parents? There is a need

to know if the current situation is unsatisfactory to the participants; that is, if everyone is happy with how things are, change is less likely to be successful.

(2) The people who will ultimately implement any innovation must possess sufficient knowledge and skills to do the job; Ely (1990) notes "people may believe that changes are in order, but without the specific knowledge and skills to bring about the change the individual is helpless" (p.300). Relevant support and training is a critical factor in the success of innovation. Support could be in tutorial assistance, formal education, and more commonly, faculty development programs and workshops.

(3) The things that are needed to make the innovation work should be easily accessible. Resources are broadly defined as those tools and other relevant materials that are accessible to assist learners to acquire learning objectives (Ely, 1990). This condition relates to the general infrastructure of the organization and how well that infrastructure can support the innovation. Such as computers, classroom remodelling, personnel salaries and teacher training, it also covers things so small that they may be over looked. If resources are unavailable, acquisition of learning objectives will be impeded.

(4) Implementers must have time to learn, adapt, integrate and reflect on what they are doing; Time is a separate condition for success because it is vitally important to the process of change (Ely, 1990). Teachers who are expected to change what they do and how they do it must be given time to play, use, and create (Szabo, 2002). This involves a long period of time to follow the process of innovation as well as time at each step of the process to explore and adapt the technology to the needs of the classroom. Adequate time and compensated time be made available for users to become educated and skilled in how to use the innovation.

(5) Rewards or incentives (must) exist for participants; The existence of incentives that motivate users to employ the innovation, or rewards provided by the organization for those who do use the innovation (Ely 1990, 1999). External rewards are provided to intended users as means to motivate them to employ the innovation. Strategies for developing incentives reside in allowing users to see successful implementation efforts ("observability"), outcomes, savings in time through automation ("relative advantage") and enabling access to resources (Rogers, 1995). Ensuring that financial incentives (bonuses), professional opportunities, and intrinsic rewards such as social praise, achievement certificates are a product of implementation. A critical part of Ely's condition of rewards and incentives is the removal of disincentives.

(6) Participation in the change process must be expected and encouraged; The key to making a technology plan work is buy-in. As Ely (1990) puts it, participation is expected and encouraged, shared decision making, communication among all parties involved and representation where individual participation is difficult. Buying-in to the process with one's time, effort and ideas in this way contributes to a sense of ownership in the innovation. It makes it difficult for participants to advocate rejection, meaning the involvement of key stakeholders in decisions that relate to the planning and design of the innovation.

(7) An unqualified go ahead and vocal support for the innovation by key players and other stakeholders is necessary. Administrators need to show a commitment to the

innovation. Commitment and the perception by users that the powerbrokers of the organization (i.e. principals, heads of units, head of departments), actively support the implementation of the innovation (Ely 1990, 1999). Commitment refers to "visible" support by the upper level leaders or powerbrokers.

(8) Leadership must be evident. Leadership refers to the level of ownership and support given by the leaders who will manage the daily activities of those using the innovation (Ely, 1999, 1990). The enthusiasm of these leaders directly affects the motivation of the users of the innovation. Immediate supervisors must provide support and encouragement, answer questions, address concerns, and serve as role models.
Ely advocates these guidelines as "suggestions for successful implementation" but not 'formula or rules' (Ely, 1990, p.303) and that they cannot all be realistically achieved for all innovations in all environments. The works which are wholly directed to the investigation of Ely's framework and the relative importance of Ely's conditions with regards to modern technology over the years are small (Ellsworth, 1998; Varden, 2002; Hajar Mohd Nor, 2004; Nawawi, 2005). All these studies provided useful insights as to the existence of the conditions in educational settings in different cultures. Earlier studies had investigated the importance of Ely's conditions in implementing innovation (Bauder, 1993; Ravitz, 1999). These studies had also explored the role Ely's conditions play in the implementation of technological innovations, processes innovations, and program innovations. The research studies reveal that Ely's conditions do facilitate implementation. Ensminger and Surry (2008), in their studies using scenario-based questions measured the relative importance of Ely's eight conditions. Their study was the first major attempt to explore the relative importance of the eight conditions prior to the implementation of an innovation. The study became useful and precipitated for the design of an instrument to measure implementation profiles, and also provided the base for the theoretical view that by evaluating the eight conditions before implementation, institutions could develop structured implementation goals to facilitate the needed change.

Ajzen and Fishbein (1977) argued for the need to conduct ICT planning alongside attitudes since attitudes allow us to understand and form an opinion about an individual's behaviour towards an object (i.e. change) and to identify how the individual's behaviour is affected (Albirini, 2006). Just as a person's knowledge affects their attitude towards an object, the knowledge is also affected by the person's attitudes. Furthermore, attitudes have three main components, cognitive, affective, and behavioural. These components indicate that attitudes can be measured in several ways instead of being one-sided. As behaviours are influenced by one's socio-cultural setting, emotions are under the influence of experiences (Tezci, 2010).

Ely's (1975) investigation of conditions for technological change in the environment and the 1989 review of cross-cultural applications of the conditions revealed the presence of these conditions in various cultures. This finding suggested that the presence of the conditions may be generalised to other settings and as such, provided a basis for this study to be adopted for the Nigerian setting. Furthermore, while an individual's knowledge is also affected by attitudes, the individual's experience and knowledge affect their attitudes towards a given object (Tezci, 2010).

Traditional educational practices no longer provide pre-service teachers with the skills necessary to teach students to survive in today's workplace. There is not much in literature on how teachers are conditioned to implement ICT as instructional tools. There is the lack of a clear instructional ICT application focus for the teachers and teacher trainees in teacher education programmes in the face of constantly changing technology as compared to literature on how teachers should be trained in the use of ICT. Without a defined ICT implementation model for instructional application, teachers will lack knowledge, skills, and competencies on current ICT practices. Therefore this study focuses on the number of essential conditions that must be met to successfully implement ICTs into teacher education programmes considering their own conditions, culture, and context. This study proposes nine hypotheses as demonstrated in the research frame work as shown in Figure 2.

Study Aims and Objectives

The purpose of this study is to examine the conditions that have significant influence on teachers' attitude to implement ICT as teaching tools in teacher education programme. This study has the potential to contribute to existing debates on the relevance of suitable conditions using Ely's condition of change as a framework to explain and predict ICT implementation in a teacher education context, findings from this study will allow researchers to assess the validity of these conditions. This study could serve to inform teacher educators and stakeholders on the conditions that directly impact on teachers' intention to implement technology in their teaching. Being guided by the findings of this study, teacher educators could be assisted to implement an ICT model and to use technology in their teaching of student teachers. Two research questions guide this study:

1 To examine teachers perceptions regarding the influence of Ely's conditions for ICT implementation in teacher education colleges?
2. To examine the condition's an implementation model incorporating ICT in teacher education must meet in order to be considered successful?
From the above, the following hypotheses were formulated:
H1: Teachers' attitude towards ICT has no significant positive influence on their behavioural intention to implement ICT.
H2: Dissatisfaction with status quo has no significant positive influence on teachers' attitude towards ICT Implementation.
H3: Time has no significant positive influence on teachers' attitude towards ICT Implementation.
H4: Knowledge and skill has no significant positive influence on teachers' attitude towards ICT Implementation.
H5: Recourses has no significant positive influence on teachers' attitude towards ICT Implementation.
H6: Reward and Incentives has no significant positive influence on teachers' attitude towards ICT Implementation.
H7: Participation has no significant positive influence on teachers' attitude towards ICT Implementation.
H8: Commitment has no significant positive influence on teachers' attitude towards ICT Implementation.
H9: Leadership has no significant positive influence on teachers' attitude towards ICT Implementation.

Method

Participants and Procedure

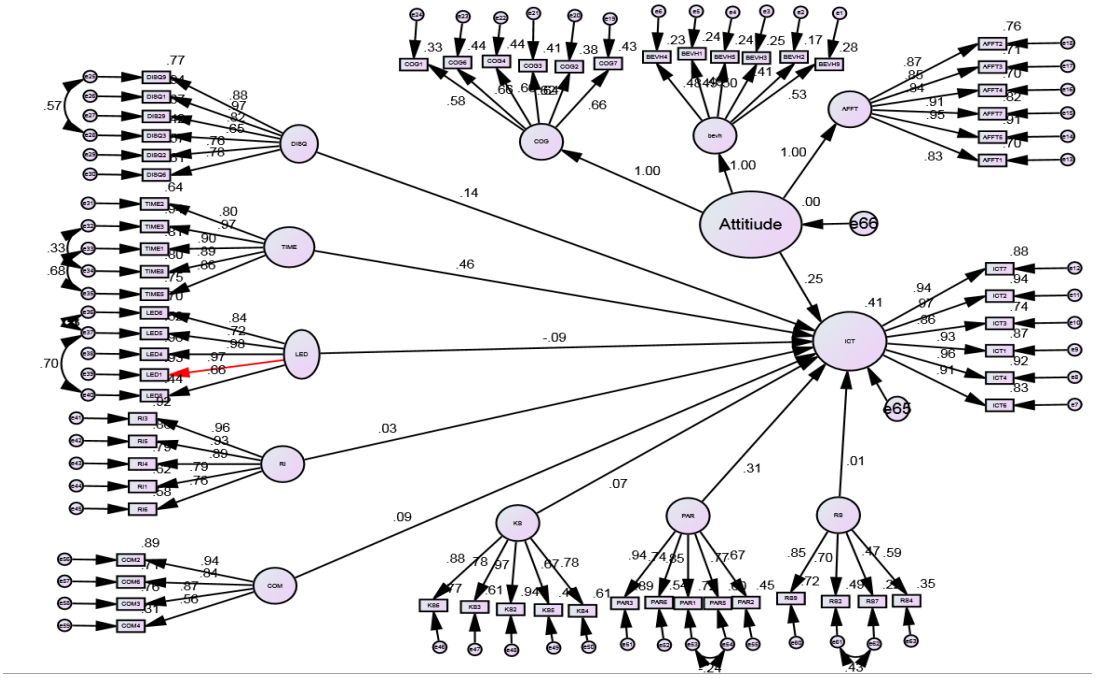
Participants were 302 practicing teachers in a public-funded college of education in Nigeria. They were selected purposefully with the prerequisite that they have been practising teachers for more than 5 years and the majority of their classes are in technology, arts and science contents. Participation was voluntary. Questionnaires were distributed to participants with the purpose of the study and participants' rights to withdraw from the study at any time during or after the completion of the questionnaire were stated. In the instructions, participants were told to contextualize all the items in the questionnaire on ICT implementation for instructional method.

Measures

A multiple-item questionnaire was used, the items focused on all eight conditions as identified by Ely (1990) of five items each on the conditions. Each statement was measured on a five-point Likert scale with 1 strongly disagree to 5 strongly agree. These items were adapted from various published sources (e.g., Nawawi, 2005; Albirini 2006; Braak, Tondeur, and Valcke 2004). The reliability of these items has been well documented. Based on the exploratory factor analysis (EFA) conducted, a five factor loading was extracted with anti- image correlation, diagonal values of 0.5 as well as Kaise- Guttman retention criterion of eigenvalues greater than 1.0. In order to validate the model construct, the criteria are that the AVE should be greater than both the maximum shared variance (MSV), and average shared variance (ASV). The construct reliability (CR) score should be greater than 0.7. Also, average variance explained (AVE) score should be greater than 0.5, and lesser in absolute terms than the CR Score. Going by the output of the reliability test carried out, all these criteria's were met therefore the model is good for the research.

4.3. Data analysis

Data were analysed using structural equation modelling (SEM). SEM is aligned with how hypotheses are expressed conceptually and statistically (Hoyle, 2011) and it is useful for analysing the relationships between latent and observed variables, also the use of SEM produces more precise measurements of the items and constructs in research. In addition, random errors in the observed variables are estimated directly, something that traditional techniques (e.g., multiple regression, MANOVA) cannot do (Teo et al. 2016. In order to obtain reliable results in SEM, researchers recommend a sample size of between 100 and 150 cases (e.g., Kline, 2010). On this basis, the Hoelter's critical N, which refers to the sample size for which one would accept the hypothesis that the proposed research model is correct at the .05 level of significance, was consulted to assess the suitability of the sample size in this study, and, given that the sample size of this study is 302, structural equation modelling was regarded as an appropriate technique for data analysis in this study.
This study proposes nine hypotheses as demonstrated in the research frame work as shown in Figure 1.



4.4 Discussion of the Conceptualized model

The outcome of this empirical study was to establish teachers' perceptions regarding the influence of Ely's conditions for ICT implementation in teacher education colleges and to examine the condition's an implementation model incorporating ICT in teacher education must meet in order to be considered successful. Using the SEM analysis, the maximum likelihoods (ML) output as represented in figure 2 showing the estimate as well as associated significance influence level in the model. The research work is verified based on the outcome within the context of established hypothesized model. The model outcome indicates that ICT R^2 to be .41, which implies that all the eight conditions and attitude total variance contributed to .41 towards ICT implementation in teacher education. In addition the research result shows that three conditions were found to be statistically significant. The model indicates that dissatisfaction with status quo had a significant value of .004 on ICT use as its standard deviation value went up to .136, clearly indicating that the teachers were dissatisfied with their present instructional method for teacher education. Participation, Knowledge and skill on their part contributed .193 coefficient and .484 coefficient respectively towards ICT implementation in teacher education programme making it the highest amongst the conditions as shown in Table 1. This result implies the importance of teachers' adequate knowledge and skill in ICT implementation process. It was also observed that only three conditions and attitude were found to be statistically significant with a p-value < 0.01, with evidence to reject four hypotheses and uphold five hypotheses which states that the conditions had no significant positive influence on teachers' attitude towards ICT Implementation in teacher education programme.

Influence	*Proposed Influence*	*Direct with mediation*	*Direct without mediation*	*Mediation*	*Results*
ATT-ICT	-			Mediation	*H_1 is not supported*

DISQ-ATT-ICT	-	.312 (0.001)	.136 (0.004)	Partial mediation	*H_2 is not supported*
TIME-ATT-ICT	-	-.104 (0.035)	.463 (0.001)	No mediation	*H_3 supported*
KS-ATT-ICT	-	.484 (0.001)	.072 (0.123)	Partial mediation	*H_4 is not supported*
RS-ATT-ICT	-	.020 (0.707)	.008 (0.867)	No mediation	*H_5 supported*
RI-ATT-ICT	-	.031 (0.525)	.029 (0.532)	No mediation	*H_6 supported*
PAR-ATT-ICT	-	.193 (0.001)	.305 (0.001)	Partial mediation	*H_7 is not supported*
COM-ATT-ICT	-	.043 (0.393)	.088 (0.062)	No mediation	*H_8 supported*
LED-ATT-ICT	-	-.005(0.925)	-.092(0.048)	No mediation	*H_9 supported*

Table 1: Fit statistics for SEM for influence between attitude, dissatisfaction with status quo, knowledge and skill and participation

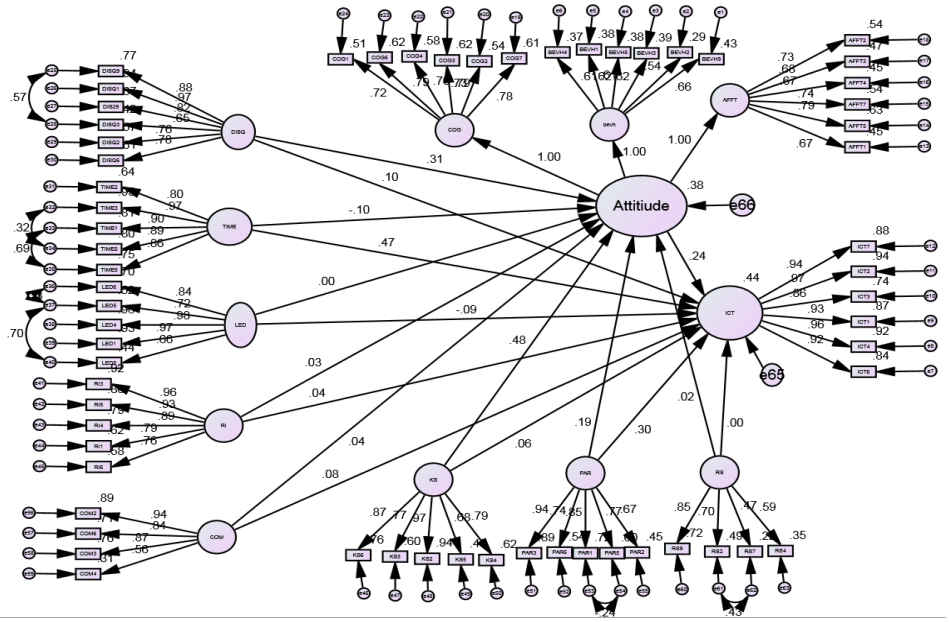


Figure 2. The Influnce of Attitude on ICT use as mediator between Dissatisfaction to status quo,
knowledge and skill and participation in ICT implementation.

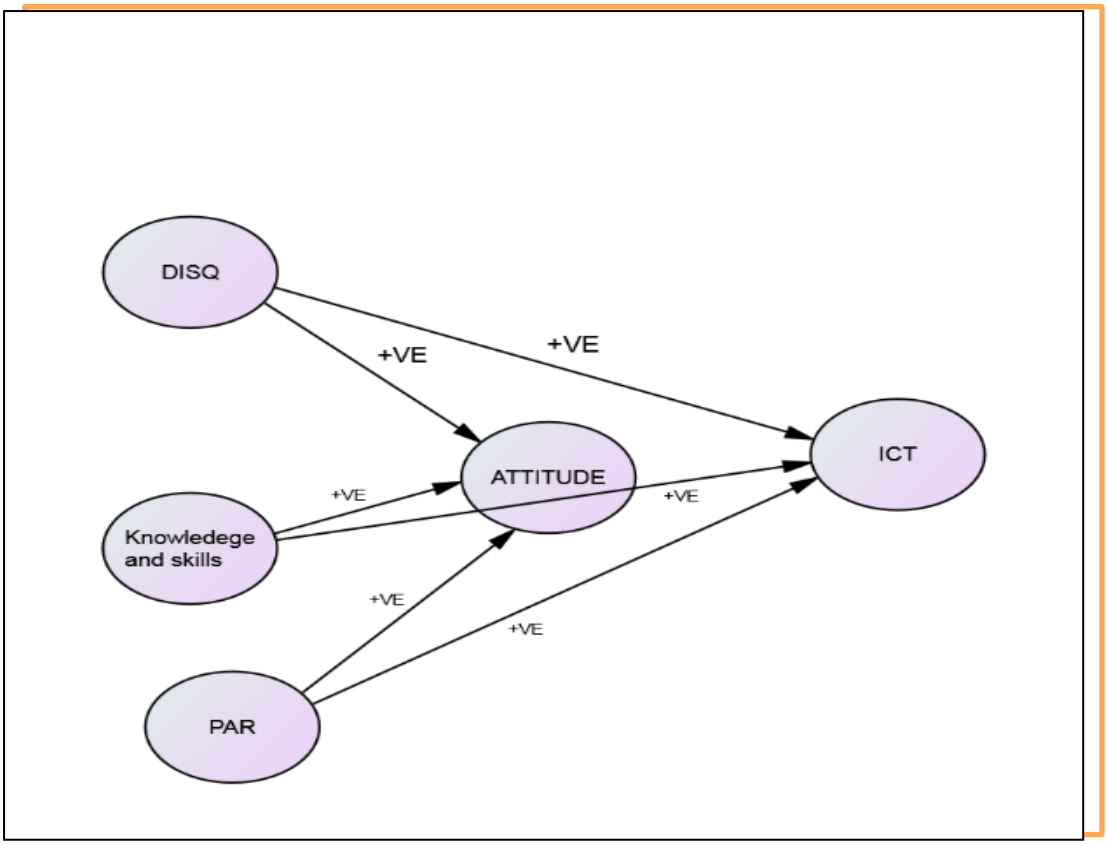


Figure 3: Conceptualized hypothetical model showing a casual influence of attitude on Dissatisfaction to status quo, knowledge and skill, participation also as mediated by attitude towards ICT. (Source: author, 2016)

The result outcome of the model as indicated in table 1 shows that there is a partial difference between the regression path coefficient (β) of dissatisfaction with status quo on direct without mediation and direct with mediation. The coefficient of direct without mediation is .136 while direct with mediation is .312. The difference is as a result of the influence that attitude has ICT. The difference in regression path coefficient was equally observed for knowledge and skill as well as participation that were mediated by attitude. However the difference in regression path coefficient (β) was not significant as attitude had no direct influence on time, resources, reward and incentives, commitment and leadership, because the p-value of 0.532 is greater than the recommended thresholds of p=0.05 therefore, all five hypotheses supported the research study.

Teachers' ICT implementation knowledge and skill, participation and dissatisfaction with status quo in their ICT use for teaching are important conditions for the education system to meet the ICT implementation policy that demand teachers ICT use in teacher education programmes. However, teachers' high educational level has not significantly contributed to their knowledge and skill in ICT use. Teachers do not perceive themselves as advanced users of technology but indicate their willingness to participate in ICT implementation programmes with inputs and ideas towards a successful ICT implementation model.

4.5 Implication

The result of the research study has shown that attitude has an influence on teachers ICT implantation in teacher education. This implied that teachers' attitude towards

ICT has to be given priority by education stakeholders and policy makers in the education change process. The results are in line with Ndibalema (2014) whose study investigated teachers' attitudes towards the use of pedagogical ICT tools in Tanzanian Schools found that teachers who exhibited low familiarity with ICT use as pedagogical tools posed a serious problem.

The Nigerian National Policy on Education (FRN,2013) stressed the urgent need to integrate ICT into teacher education in Nigeria in recognition of its role in advancing knowledge and skills necessary for effective functioning in the modern world. Even as Tinio (2011) posit that effective implementation of ICTs into educational system is a complex, multifaceted process that involves not just technology but also the pedagogy and teachers' competencies among factors. Loveless (1996) identifies teachers as the most important factor to a successful ICT implementation in education. This implies that teachers are the major factor in ICT implementation process, were knowledge and skills are necessary for ICT pedagogy effective use as it has a direct positive influence on technology use of ICT by the teachers. Denoting that implementation of ICT into teacher education programme to a large extend depends on the pedagogical competence and technical skills of the teaching staff.

4.6 Limitations and future research work

The result of this study indicates that the data generated fits and is plausible as this should be. It is worth mentioning that in consideration of the model goodness of fit it can be contestable. The result of this study is limited to the sample collected for this present research in the study area, therefore, it is limited in scope. The research model however sheds light on the importance of all the conditions of change examined in the study. Further research studies can build on this study model to confirm this finding.

5 Conclusion

The research study was built on Ely's 1990 conditions of successful change, being the first to emphasize the environmental conditions that promote change broadened to cover the implementation of educational technology in a variety of education-related context, specifically adopted in the present study as ICT. ICT has the potential for aiding these new educational methods, when used appropriately, different ICTs are said to raise the quality of teaching and learning by transforming the classroom and the way teaching and learning is conducted. The model identified conditions that contributed significantly to a conceptualized model for ICT implementation in teacher education. Based on the outcome of the model, attitude was found to play a major role in mediating the conditions towards ICT.

Teachers remain the most important factor to strengthen the use of ICT in education in any education adoption reform. ICT implementation may appear too expensive, its benefits far outweighs the huge benefits for any nations education process. Base on the research result, this study therefore suggest an adoption of this model for ICT implementation in teacher education programs with participation of teachers for successful ICT strategy.

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