

# ON THE FACTORS AFFECTING LOW LEVELS OF ADOPTION OF ICTS IN SCHOOLS

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## Abstract

Success stories abound on the use of Information and Communication Technologies (ICTs) as a tool to complement learning, particularly in the developed world; these success stories rarely happen in schools in the developing countries characterized by low levels of adoption of ICTs. Questions on why this success stories rarely happen and whether ICTs provide students with access to benefits ICTs offer to complement teaching and learning in schools motivated this study whose purpose is to examine the factors affecting the perceptions of teachers on the low level of adoption of ICTs in developing countries as an attempt to contribute towards a solution. This study was achieved through the content analysis of technology adoption theories as well as a survey of 52 teachers from Isiphingo town, Umlazi District of KwaZulu-Natal, South Africa. The assumption supporting this research is the relationship between the teachers' demographics and technology adoptions on one side and their perceptions on the factors affecting adoption of technology on the other side; except that this paper looks at technology adoption from these perspectives: perceived usefulness, perceived ease of use, and adoption of technology. Results from this study indicate that perceived usefulness and perceived ease of use of ICTs have a direct relationship on the low level of adoption of ICTs in schools

## Introduction

The promotion of ICTs in schools in Europe and America is really significant as evidenced by major increase in the number of computers and access to the Internet due to its educational benefits. Norway, for example, moved from a ratio of one computer to approximately 55 students in 1995 to a ratio of one computer to approximately 9 students in 1998 while evidence from Canada show 99% of schools have access to Internet in 1999 [22]. Recent statistics from [19] are even more exciting which shows that one computer is available for every 2 students in Europe when compared to statistics of schools in 2000, when one computer was available to approximately 25 - 90 students in the different countries. Findings by [28] reports that schools in highly developed countries like Canada, Finland, Iceland, New Zealand, Norway and Singapore are well equipped in terms of ICT infrastructure. Finding out these success stories on the use of ICTs in education in the developed world, it is

natural to enquire if this situation is similar in the developing world.

## Problem Statement

The main problem of this study can be summarized by stating that the successes observed in the use of ICTs in education in the developed world are still to filter down to the developing world. Most of the developing countries like South Africa are still facing low levels of adoption of ICT in education. For example, in Rwanda, only one secondary school had a computer in the year 2000. This situation did not really improve over time judging by the results of a survey conducted in 2007 where it was found that slightly above 52% of learners only has access to computers for one hour per week [10]. The situation does not seem to be that much better in Kenya, where a survey conducted in 2006 found that only 30% of schools had dedicated computer laboratories, with a ratio of 150 students to one computer, while access at the primary school level is very low at 1:250 [16]. In South Africa, more than 2/3 of the schools were without computers in 2003 [8] and only about 1/3 of schools in China, Hong Kong and Hungary had Internet access in 1999 [27]. In a reports by [28], indicators from developing countries like South Africa, Latvia, Slovenia showed that primary and lower secondary schools have little or no access to ICT infrastructures.

## Main Research Question

What are the factors that can explain the perceptions of teachers on the low levels of adoption of ICTs in schools in developing countries?

## Research Sub Questions

- What are the theories that can explain the perceptions of teachers on the low levels of adoption of ICTs in schools in developing countries?
- How can these theories be shaped to a hypothetical model?
- How can the model be tested empirically?

## Aim and Objectives

The aim of this research is to determine the factors affecting the perceptions of teachers on the low levels of adoption of ICTs in schools in developing countries.

This aim would be achieved via the following objectives

- I. To select relevant objectives that can explain the perceptions of teachers on the low levels of adoption of ICTs in schools in developing countries.
- II. To design a hypothetical model of the factors affecting the perceptions of teachers on the low levels of adoption of ICTs in schools in developing countries.
- III. To empirically assess the proposed conceptual framework of the perceptions of teachers on the low levels of adoption of ICTs in schools in developing countries.

## Literature Review

The aim of this section is to present existing literature on technology adoption and the conceptual model developed from the theoretical frameworks. The results of the review conducted in this research are hereby presented below.

### A. Theories

Several theories and models have been proposed in studying ICT adoption. These theories and models focus on people's intention to adopt and use ICT [13], [25]. Adoption theories proposed to explain acceptance or rejection of technologies include the Theory of Reasoned Action (TRA) [3], [11]; Theory of Planned Behavior (TPB) [3], [15]; Technology Acceptance Model (TAM) [6-7], [15] and Diffusion of Innovation Theory [1], [23]. The main assumption of these theories is that they are suitable to determine the perceptions of teachers on the low levels of adoption of ICTs in schools in developing countries. This assumption relies on the fact that technology adoption theories can provide insights into people's intention to engage in a behavior change to adopt and use ICT [13]. It also examines the individual and the choices an individual makes to accept or reject a particular innovation, but also the extent to which that innovation is integrated into the appropriate context [25].

**Theory of Reasoned Action (TRA):** The theory of Reasoned Action TRA posits that a person's actual behaviour can be determined by his/her behavioural intention along with his/her beliefs that he has for that behaviour [3], [11],

[14], [24]. It is possible that the perceptions of teachers on the low levels of ICTs in schools in developing could emanate from their behavioral intention and their beliefs about ICTs.

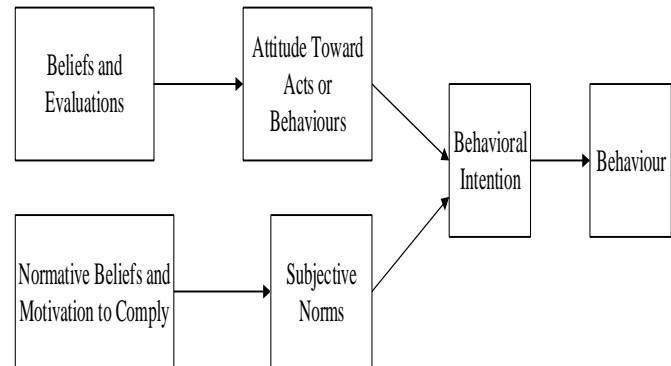


Figure 1. Theory of Reasoned Actions [14]

**Theory of Planned Behaviour (TPB):** Theory of Planned Behavior posits that specific salient beliefs influence behavioral intentions and subsequent behavior [2]. In comparison to TRA, TPB is basically an extension of the Theory of Reasoned Action (TRA) that includes measures of control belief and perceived behavioural control (PBC) defined as "one's perceptions of his/her ability to act out a given behavior easily" [3-4], [15]. TPB also found significant relationships between attitude, subjective norm, perceived behavioural control and behavioral intention [24]. It is possible that the perceptions of teachers could emanate from their own salient beliefs about ICTs which influences their behavioural intentions and subsequent behaviour about ICT use.

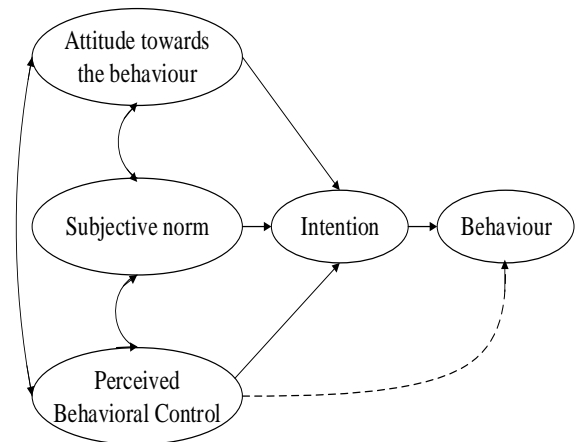


Figure 2. Theory of Planned Behaviour [2]

**Technology Acceptance Model (TAM):** Technology Acceptance Model (TAM) is an information systems theory that can explain user behaviour towards ICTs [5-7], [18]. It

is influenced by TRA and TPB [7] and focuses on the adoption and use of ICT. According to TAM, two theoretical constructs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) both affect the intention to use or the acceptability of an information system [14], [18], [21], [26]. This model could be helpful to understand and explain the perceptions of teachers on their possible attitude towards the acceptance or rejection of an innovation in schools in developing countries.

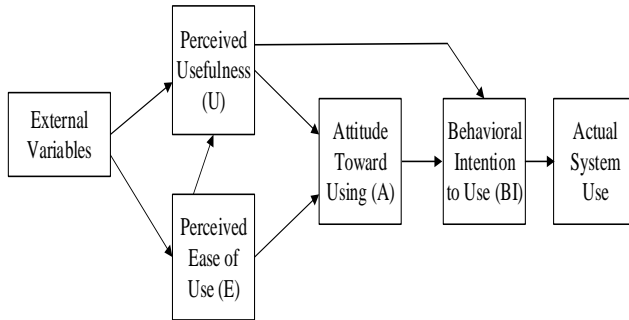


Figure 3. Technology Acceptance Model [7]

**Innovation Diffusion Theory:** Innovation Diffusion theory hypothesizes that the acceptance or rejection of an innovation by an individual depends on his/her prior knowledge of that innovation [18], [20]. It therefore implies that an individual’s technology adoption behavior is determined by his or her perceptions regarding the five attributes of an innovation which includes: relative advantage, complexity, compatibility, observability, trialability, and of the innovation, as well as social norms [23]. This knowledge will influence him/her to adopt or reject the innovation either temporarily or permanently.

### B. A New Conceptual Model

This study proposes a new model of the factors affecting the perceptions of teachers on the low levels of adoption of ICTs in schools in developing countries. The new model is grounded on the perceived usefulness and perceived ease of use constructs from the technology adoption model. It uses the PU and PEOU items as factors that can affect the perceptions of teachers on the low levels of adoption of ICTs in schools. It therefore implies that this model assumes that the perceptions of teachers on the low levels of adoption of ICTs in schools depend on the demographics of these teachers. These perceptions also depend on their perceived usefulness of ICT and on how they perceive ICTs to be easy to use.

Based on the theoretical model in Figure 4, the study will empirically test the following hypotheses to fulfill the third objective of this study.

H1: Demographics of a teacher will have a direct relationship on his or her perceptions on the low levels of adoption of ICTs in schools

H2: Demographics of a teacher will have a direct relationship on his or her perceptions on usefulness of ICTs in schools.

H3: Demographics of a teacher will have a direct relationship on his or her perceptions on ease of use of ICTs in schools.

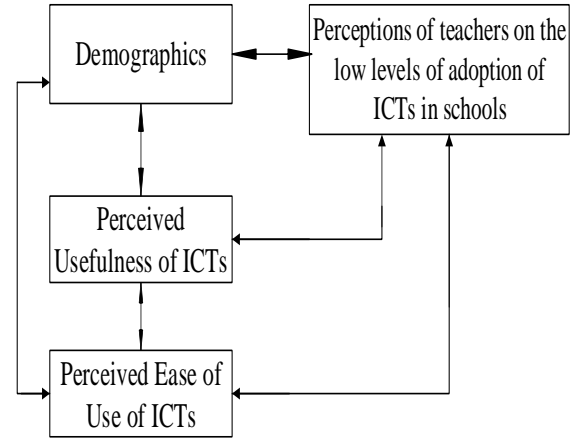


Figure 4. A Conceptual Model

H4: Perceived usefulness of ICTs in schools will have a direct relationship with an educators perceptions on the low levels of adoption of ICTs in schools.

H5: Perceived ease of use of ICTs in schools will have a direct relationship with an educators perceptions on the low levels of adoption of ICTs in schools.

H6: Perceived usefulness of ICTs will have a direct relationship on perceived ease of use of ICTs in schools.

## Research Methodology

This research is grounded within the ICT adoption theoretical frameworks. The role of this framework was respectively to guide the design of the research variables and ICT adoption questionnaire used by this study as described below.

**Research Methods:** Two research methods were used to fulfil the third objectives of this study: quantitative (objective 2 and 3) and qualitative (objective 1 and 3) research approach. Content analysis of literature was performed to obtain existing literature on technology adoption theories and models as described in the section 2 above. Empirical testing of the proposed model was achieved through a survey of teachers from the Isiphingo town, Umlazi District, KwaZulu-Natal, South Africa. The Isiphingo town has a

total of 412 educators [9]. The sample of this research was constructed using stratified (by rural schools versus urban schools and big schools versus small schools) random sampling as described in the sample size calculation method proposed by [17] as shown by the equation below with the following parameters:  $Z = 1.96$ ,  $P = 0.05$ ,  $d = 0.055$ , and  $N = 412$  which gives a sample size of 52

**Research Variables and Data Collection:** The research variables for this study can be found on Figure 4. Data for each of these variables were collected using a Likert scale of 8 items for perceived ease of use of ICTs and perceived factors affecting the low levels of adoption of ICTs in developing countries. It also used a Likert scale of 7 items for perceived usefulness of ICTs except for the demographic variable which had 7 categorical items. The scale for the perceived ease of use of ICTs and the perceived usefulness of ICTs was adapted from the instrument and scales developed and validated for TAM by [6] and the scale for the variable on the perceptions of teachers on the low levels of adoption of ICTs in schools in developing countries was adapted from the questionnaire developed by [12].

## Research Results

This section presents the results of this study under the assumption that the perceptions of teachers on the low levels of adoptions of ICTs in schools in developing countries depend on the perceived usefulness of ICTs and Perceived ease of use of ICTs.

### A. Data Reliability and Validity

Results from Table 1 shows that the data collected from the teachers who participated in this survey for each of the respective research variable shows that it passed the reliability and validity test (Cronbach’s Alpha ( $\alpha$ ) value  $> 0.745$ ).

**Table 1. Reliability Table for the Research Variables**

Research Variable	No of items	Cronbach’s Alpha ( $\alpha$ )
Perceived Usefulness of ICTs	7	0.949
Perceived Ease of Use of ICTs	6	0.745
Perceptions of teachers on the Low levels of adoptions of ICTs in schools in developing countries	8	0.779

### B. Descriptive Statistics

This section will present descriptive statistics on the demographics of the surveyed teachers as well as their perceptions the ease of use of ICTs, their perceptions on the usefulness of ICTs and their perceptions on the low levels of adoptions of ICTs in schools.

**Demographics:** Table 2 gives an idea of the demographic profile of the teachers who participated in this research. Results from these demographic statistics indicate that a simple majority of teachers are female (55.8%) and of African origin (53.8%) whose qualifications are almost evenly spread. Half of the teachers surveyed used the computer on a daily basis (50%).

**Table 2. Demographics of Surveyed Teachers**

A	Items	Percentage
<b>Gender</b>	Male	44.2
	Female	55.8
<b>Age Group</b>	Less 30	15.4
	30-40	38.5
	41 – 50	36.5
	Above 50	9.6
<b>Qualification</b>	Diploma	21.2
	Bachelors	26.9
	Honors	26.9
	Masters	25
<b>Computer Usage</b>	None	7.7
	Daily	50
	Weekly	30.8
	Monthly	11.5
<b>Ethnicity</b>	African	53.8
	Indian	19.2
	Colored	13.5
	White	13.5
<b>Teaching Experience</b>	0 - 5	28.8
	6 - 10	25
	11 - 15	32.7
	16 - 20	9.6
	Above 20	3.8

**Perceived Usefulness of ICTs:** Table 3 gives an overview of the state of the perceived usefulness of ICTs by teachers who participated in this study. Interesting results from Table

3 indicates that majority of teachers perceive ICTs to be useful for adoption in schools as (mean of > 3.52 out of 5).

**Perceived Ease of Use of ICTs:** Table 4 gives an overview of the state of the perceived ease of use of ICTs when adopted in schools. Interesting results from Table 4 indicates: perceived ease of use of ICTs for items C3 (mean of 3.50 out of 5) and C6 (mean of 3.10 out of 5) are very high. Moreover, the perceived ease of use of ICTs for the remaining items for the teachers who participated in this study are very low as (mean of < 2.98 out of 5).

**Table 3. Perceived Usefulness of ICTs**

B	S1	S2	S3	S4	S5	Mean	SD
B1	10	15	19	19	37	3.58	1.377
B2	4	15	23	23	35	3.69	1.213
B3	8	13	27	23	29	3.52	1.26
B4	6	15	21	19	38	3.69	1.292
B5	6	13	23	25	33	3.65	1.235
B6	4	17	25	19	35	3.63	1.237
B7	8	13	23	17	38	3.65	1.327
Ave	7	14	23	21	35		

**Table 4. Perceived Ease of Use of ICTs**

C	S1	S2	S3	S4	S5	Mean	SD
C1	37	23	12	19	10	2.42	1.405
C2	23	19	19	21	17	2.90	1.432
C3	8	12	25	35	21	3.50	1.18
C4	21	25	19	23	12	2.79	1.333
C5	17	17	29	23	13	2.98	1.291
C6	13	23	23	21	19	3.10	1.332
Ave	20	20	21	24	15		

**Perceptions of Teachers on the Low levels of Adoptions of ICTs in schools:** The overview of descriptive statistics from Table 5 shows the general consensus of the perceptions of teachers on the low levels of adoptions ICTs in schools who participated in this study. Results from Table 5 indicates ICT adoption in schools is still generally low (mean of > 3.1 out of 5) except for items D1 (mean of 2.96 out of 5).

### C. Correlations

According to Table 6, results from the Pearson’s correlation analysis of variables not involving demographics shows that perceived usefulness of ICTs are associated with perceptions of teachers on the low levels of adoptions of ICTs In schools (significant at 99% (p=0.000)); and there is an association between the perceived ease of use of ICTs and the perceptions of teachers on the low levels of adoptions of ICTs In schools (significant at 99% (p=0.025)).

**Table 5. Perceptions of Teachers on the Low Levels of Adoptions of ICTs in Schools**

D	S1	S2	S3	S4	S5	Mean	SD
D1	21	17	21	25	15	2.96	1.386
D2	10	12	35	37	8	3.21	1.073
D3	13	8	27	29	23	3.40	1.302
D4	12	23	21	31	13	3.12	1.247
D5	10	15	23	35	17	3.35	1.219
D6	8	15	37	23	17	3.27	1.157
D7	10	13	29	23	25	3.40	1.272
D8	4	21	19	31	25	3.52	1.196
Ave	11	15.5	26.5	29.25	17.88		

**Table 6. Pearson’s Correlations not Involving Demographics**

		B	C	D
B	Pearson Correlation	1	.152	<b>.532**</b>
	Sig. (2-tailed)		.282	.000
	N	52	52	52
C	Pearson Correlation	.152	1	<b>.311*</b>
	Sig. (2-tailed)	.282		.025
	N	52	52	52
D	Pearson Correlation	<b>.532**</b>	<b>.311*</b>	1
	Sig. (2-tailed)	.000	.025	
	N	52	52	52

Also, Table 7 gives an overview of the Pearson’s correlation analysis of variables which involves demographics. Results from Table 7 shows that highest level of qualification of teachers surveyed are associated with the perceived usefulness of ICTs in schools (significant at 99% (p=0.000)); and there is an association between the computer usage of teachers surveyed and the perceived ease of use of ICTs in schools (significant at 99% (p=0.023)).

Pearson’s correlation test results presented in Table 6 and Table 7 whose outputs are summarized in Figure 5 with interpretation combined with the initial hypotheses leads to the following results.

R1: There is no direct relationship between the demographics of a teacher, with his or her perceptions on the low levels of adoption of ICTs in schools.

R2: There is a direct relationship between the qualifications of a teacher with his or her perceived usefulness of ICTs in schools.

R3: There is a direct relationship between the teachers' computer usage and his or her perceived ease of use of ICTs in schools.

R4: There is a direct relationship between the teachers perceived usefulness of ICTs in schools, with his or her perceptions on the low levels of adoption of ICTs in schools.

R5: There is a direct relationship between the teachers perceived ease of use of ICTs in schools, with his or her perceptions on the low levels of adoption of ICTs in schools.

R6: There is no direct relationship between the teachers' usefulness of ICTs in schools and his or her perceived ease of use of ICTs in schools.

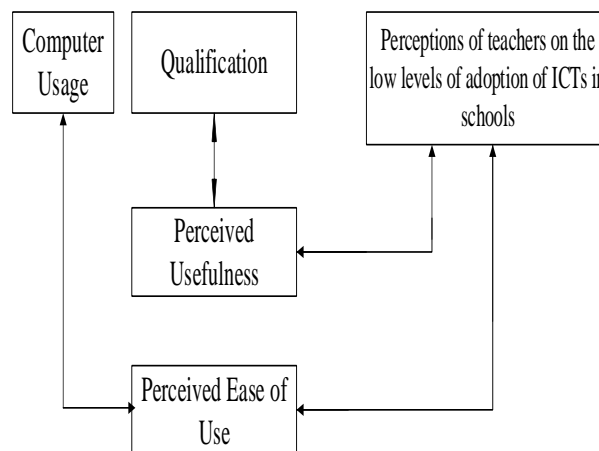


Figure 5. The Validated Model

Table 7. Pearson's Correlations Analysis Involving Demographics

		B	C	D
A1	Pearson Correlation Sig. (2-tailed) N	-0.011	0.54	-0.061
		0.936	0.701	0.666
		52	52	52
A2	Pearson Correlation Sig. (2-tailed) N	-0.060	0.16	0.073
		0.672	0.257	0.605
		52	52	52
A3	Pearson Correlation Sig. (2-tailed) N	<b>.490**</b>	0.130	0.215
		0.000	0.360	0.125
		52	52	52
A4	Pearson Correlation Sig. (2-tailed) N	.034	<b>-.034*</b>	.120
		.812	.023	0.397
		52	52	52
A5	Pearson Correlation Sig. (2-tailed) N	-.218	.136	-.056
		.120	0.338	.695
		52	52	52
A6	Pearson Correlation Sig. (2-tailed) N	-.167	.240	-.063
		.236	.087	0.659
		52	52	52

## Discussion and Conclusion

The key points of this study properly encapsulate the content of this paper on the perceptions of teachers on the low levels of adoption of ICTs in schools in developing countries are as follows:

According to the literature reviewed in this paper [3-4], [11], [14-15], [18], [21], [24], [26], the technology adoption is able to explain the perceptions of teachers on the low levels of adoption of ICTs in schools.

According to the literature reviewed in this paper [6-7], [14], [18], [21], [26], one can hypothesize a model linking the demographics of teachers and their perceptions on the low levels of adoption of ICTs in schools with the following constructs from technology acceptance model: perceived usefulness and perceived ease of use.

According to the results of the survey conducted by this study: perceived usefulness of ICTs and perceived ease of use of ICTs have a direct relationship with the perceptions of teachers on the low levels of adoption of ICTs in schools; teachers computer usage have a direct relationship with his or her perceived ease of use of ICTs in schools; teachers qualification have a direct relationship with his or her perceived ease of use of ICTs in schools.

As a developing country, South Africa should attempt to foster a culture of adoption of ICTs amongst teachers in schools for teaching and learning. Factors identified affecting the adoption of ICTs in schools include the human factor on one hand and technological factor on the other hand. This

include insufficient time to prepare materials using ICTs, poor technical and physical infrastructures, and poor financial resources to support. Therefore, it is important to promote the skills of teachers as regards ICTs and provide adequate resources and motivation to adopt this ICTs.

Ideas for future research on the results of this paper include: further analysis on the impact of computer usage on the ease of use of ICTs, impact of qualifications on the perceived ease of use, and teachers' adoption of ICTs for specific subjects.

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## Biographies

**KAYODE E. OYETADE** was born in 1987, in Ibadan, Nigeria. He completed his West African Senior Secondary School Certificate from Federal Government Ilorin, Kwara State, Nigeria. He obtained his BSc degree in Computer Science from the Federal University of Technology, Abeokuta, Ogun State, Nigeria in 2010. He has completed his Master's Degree in Information Technology (IT) at the Durban University of Technology, Durban, KwaZulu-Natal, South Africa. His research interests are database security, IT education, and emerging technologies.

**SERAPHIN D. EYONO OBONO** was born in 1967, in Yaounde Cameroon. He completed his primary and secondary education in Yaounde with a "Baccalaureat C" (Mathematics and Physics) obtained in 1986. He was then awarded a bursary by the Cameroonian government to pursue his tertiary education in France where he obtained a BSc degree in Computer Science (Nancy I) in 1990, a BSc honors degree in Computer Science (Nancy I) in 1991, a MSc degree in Computer Science (Rouen) in 1992, and a PhD in Computer Science (Rouen) in 1995. He is currently an associate professor in Information Technology (IT) at Durban University of Technology, Durban, South Africa. His research interests are: pattern matching and ICT for development.