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Attribution Theory and Perceived Reliability of Cellphones for Teaching and Learning

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***Abstract*—**The use of information and communication technologies such as computers, mobile phones and the Internet is becoming prevalent in today's world; and it is facilitating access to a vast amount of data, services and applications for the improvement of people's lives. However, this prevalence of ICTs is hampered by the problem of low income levels in developing countries to the point where people cannot timeously replace or repair their ICT devices when damaged or lost; and this problem serves as a motivation for this study whose aim is to examine the perceptions of teachers on the reliability of cellphones when used for teaching and learning purposes. The research objectives unfolding this aim are of two types: Objectives on the selection and design of theories and models, and objectives on the empirical testing of these theories and models. The first type of objectives is achieved using content analysis in an extensive literature survey: and the second type of objectives is achieved through a survey of high school teachers from the ILembe and UMgungundlovu districts in the KwaZulu-Natal province of South Africa. Data collected from this questionnaire based survey is analysed in SPSS using descriptive statistics and Pearson correlations after checking the reliability and validity of the questionnaires. The main hypothesis driving this study is that there is a relationship between the demographics and the attribution identity of teachers on one hand, and their perceptions on the reliability of cellphones on the other hand, as suggested by existing literature; except that attribution identities are considered in this study under three angles: intention, knowledge and ability, and action. The results of this study confirm that the perceptions of teachers on the reliability of cellphones for teaching and learning are affected by the school location of these teachers, and by their perceptions on learners' cellphones usage intentions and actual use.

***Keywords*—**Attribution, Cellphones, E-learning, Reliability.

I. Introduction

THE Handset Replacement Cycle can be defined as the length of time that a device owner keeps his or her handset before purchasing a new one. According to existing literature [1], the United States has the shortest handset replacement cycle in the world, while India and Brazil have the longest. On average, people in the United States replace their handsets after 1 year and 9 months [1]. In the United Kingdom, people replace their handsets after 1 year and 10 months and after 2 years and 3 months for people in Korea [1]. On the other hand, people in India replace their handsets after 7 years and 10 months, and people in Brazil replace their handsets after 6 years and 8 months [1]. According to [1], the main factors influencing handset replacement cycles are related to income levels and communication billing methods.

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A. Problem Statement

The main problem motivating this study is centered on the low income levels of people in developing countries to the point where they cannot timeously replace or repair their handsets when damaged or lost. According to existing literature [2], around 72% of the total population of sub-Saharan African countries lives on less than two dollars a day: The annual per capita income ranges from around $100 in Ethiopia, Uganda, Mozambique, Ghana, Bangladesh, Nigeria, Pakistan, and India. In China, the annual per capita income is around $5,000, and around $7,000 in Brazil and Mexico. In Canada, UK, USA, Switzerland, the annual per capita income are $35,000, $38,000, $45,000 and $55,000 respectively. On the other hand, the costs of an iPhone in Brazil and Mexico, South Africa, USA, Germany and Japan are respectively around $963, $2,000, $200, $187 and $104 respectively [3]. This problem of the difficulties for people to timeously replace their cellphones in developing countries because of their low income levels, when applied to the context of the use of cellphones for teaching and learning, raises the following main research question with its follow-up questions. The aim and objectives of this study will be formulated just after the research questions.

B. Main Research Question

What are the factors that affect the perceptions of teachers on the reliability of cellphones when used for teaching and learning purposes, and which recommendations can be made to improve this reliability?

Research question 1: What are the theories that can explain the perceptions of teachers on the reliability of cellphones when used for teaching and learning purposes?

Research question 2: How can the contributing factors to the perceptions of teachers on the reliability of cellphones when used for teaching and learning purposes be shaped into a hypothetical model?

Research question 3: How can a hypothetical model on the factors affecting the perceptions of teachers on the reliability of cellphones when used for teaching and learning purposes be empirically validated?

Research question 4: Which cellphone maintenance recommendations can be proposed from the knowledge of the factors affecting the perceptions of teachers on the reliability of these devices when used for teaching and learning purposes?

C. Aim and Objectives

The aim of this study is to analyze the factors determining teachers' perceptions on the reliability of cellphones when

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used for teaching and learning purposes, and to make recommendations on how to improve the reliability of these devices when used for this purpose, hoping to contribute towards solving the problem of the difficulties for people to timeously replace their cellphones in developing countries because of their low income levels. The objectives of this study are the following:

a) To select appropriate theories that can explain the perceptions of teachers on the reliability of cellphones for teaching and learning.
b) To design a conceptual model of the factors influencing the perceptions of teachers on the reliability of cellphones for teaching and learning.
c) To empirically test the conceptual model of the perceptions of teachers on the reliability of cellphones for teaching and learning.
d) To make recommendations for the improvement of the reliability of cellphones when used for teaching and learning.

II. Literature Review

The research objectives of this study are now translated into Internet search keywords in order to perform the hereby presented literature overview around the above stated study objectives:

A. Theories

Suitable Theories on Cellphone Perceived Reliability were found from existing literature using the Internet search keywords *"product failure" + "theory"*. This search was then directed to a dissertation [4] that identified some of the theories that are relevant to the understanding of the performance failures of major household electrical appliances. These theories include: the consumer complaint behavior theory, the expectancy disconfirmation theory, and attribution theory.

1. Expectancy Disconfirmation Theory

The expectancy disconfirmation theory explains how consumers arrive at decisions concerning their satisfaction or dissatisfaction with a product. It describes a consumer's response to the discrepancy between his or her own prior expectations for a product's performance and the actual performance of the product after using it [5].

2. Consumer Complaints Behavior Theory

This theory explains how consumers respond to dissatisfaction with a product. When a consumer is dissatisfied with a product, he or she may engage in behavioral or non-behavioral responses to resolve his or her dissatisfaction. Behavioral responses include formal complaints directed at product manufacturers and retailers, at public consumer protection agencies, at voluntary organizations, and at courts. These responses also include informal complaints such as boycotting retailers and products, changing brands, and negative word of mouth marketing. Studies have shown that a typically dissatisfied customer will tell eight to ten people about a problem [13]. A non-behavioral response refers to the situation where a dis-satisfied consumer does nothing about the product he or she is dissatisfied with; in other words, he or she does not make any formal or informal complaint about the product.

3. Attribution Theory

Attribution can be defined as the process by which individuals explain the causes of behavior and events [7]. Attribution theory attempts to describe how we explain to others and to ourselves the causes of things that happen to us [8]. Attribution theory is an extension of expectancy theory and it is a theory of perception.

B. Conceptual Models

This study has chosen the attribution theory as its theoretical foundation among the above mentioned theories that can explain the perceptions of teachers on the reliability of cellphones when used for teaching and learning purposes. An interesting paper was found from existing literature using the keyword "models based on attribution theory" where attribution theory models are sub-divided into normative models and descriptive models.

1. Normative Models

These models describe what people can do in a variety of situations. The most obvious example among the normative models is Kelley's model of Co-variation and Configuration [9]. This model is an attempt to establish whether a given behavior of a person should be attributed to the internal personality or character of that person instead of it being attributed to the situation at hand. A behavior can be attributed to the internal characteristics of a person when such a behavior is consistent, distinctive, and nonconsensual, i.e., when such a behavior is exhibited by that person over a long period of time. A given behavior can be attributed to external circumstances when such a behavior is distinctive and is not exhibited by a person over a long period of time.

Attribution to	Distinctiveness	Consensus	Consistency
Stimulus	High	High	High
Person	Low	Low	High
Circumstance	High	Low	Low

Fig. 1 Co-variation and Configuration model

2. Descriptive Models

These models describe what people actually do or their actual behavior in a variety of situations. Examples of such models include the correspondence Inference model, the fundamental attribution error model, and the self serving bias model.

The fundamental attribution error model [10] states that individuals have a tendency to attribute a given behavior to a person's disposition or personality, and to neglect the presence of situational factors influencing the person's behavior. The self serving bias model states that people take credit for

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positive outcomes of events and deny blame for negative outcomes of events [11]. The correspondence inference model explains that people make conclusions or inferences about another person's personality or disposition after observing how that person has intentionally and knowingly committed an action, and based on the effects of his or her actions [12]. According to [6], the correspondent inference theory has proven to be very useful as a rational baseline model that can be used to measure attributions.

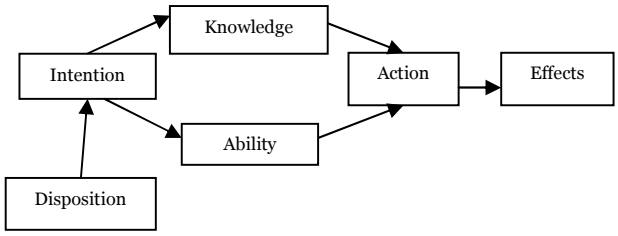


Fig. 2 Jones and Davies model of correspondent inferences

C. New Conceptual Model

The current research proposes a new model of the factors influencing the perceptions' of teachers on the reliability of cellphones when used for teaching and learning purposes. The new conceptual model uses the constructs of intention, knowledge/ability, and action from the Jones and Davies correspondence inference model as possible factors that affect the perception of teachers on the reliability of cellphones when used for teaching and learning. In other words, this model hypothesizes that the perceptions of teachers on the reliability of cellphones for teaching and learning depend on demographics of these teachers. They also depend on their perceptions on the intentions of learners in using these cellphones, as well as on their perceptions on the knowledge/ and ability of these learners in using such devices. This model finally hypothesizes that the perceptions of teachers on the reliability of cellphones for teaching and learning depends on their perceptions on how learners actually use cellphones (See Fig. 3).

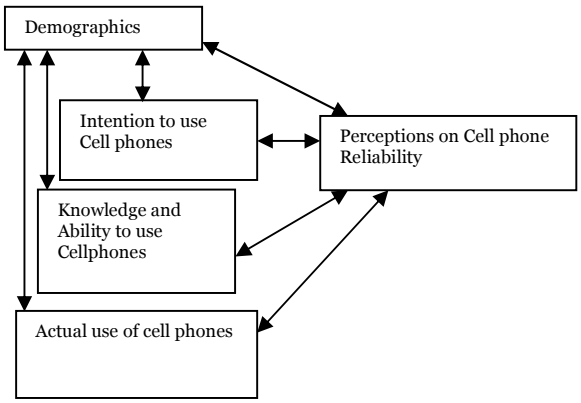


Fig. 3 Conceptual Model

The conceptual model illustrated in Fig. 3 represents the following research hypotheses to be empirically validated by the third objective of this study.

Ha0: There is a direct relationship between the demographics of a teacher, and his or her perceptions on the reliability of cellphones when used for teaching and learning purposes.

Hb0: There is a direct relationship between the demographics of a teacher, and his or her perceptions on learners' intentions in the use of cellphones.

Hc0: There is a direct relationship between the demographics of a teacher, and his or her perceptions on the learners' knowledge and ability of learners in the use of cellphones.

Hd0: There is a direct relationship between the demographics of a teacher, and his or her perceptions on the actual use of cellphones by learners.

He0: There is a direct relationship between a teacher's perceptions on learners' intentions in the use cellphones, and his or her perceptions on the reliability of cellphones when used for teaching and learning purposes

Hf0: There is a direct relationship between a teacher's perceptions on learners' knowledge and ability in the use of cellphones, and his or her perceptions on the reliability of cellphones when used for teaching and learning purposes.

Hg0: There is a direct relationship between a teacher's perceptions on the actual use of cellphones by learners, and his or her perceptions on the reliability of the cellphones when used for teaching and learning purposes.

Figure 3 constructs will from now on guide the structure of this paper starting with the next section on empirical studies on the relationship between attribution and perceived reliability of cellphones.

D. Empirical Studies

Few studies [4], [13]-[23] were found on the relationship between attribution and perceived reliability of ICT devices. All these studies were carried out using questionnaire based surveys, but for different countries: South Africa [4], Malaysia [13], England [14], United Kingdom [15], India [16], China [17], Japan [18]-[19], Nigeria [20], Czech Republic [21], Singapore and Philippines [22], and Korea [23].

1. Demographics

According to [13], the lifespan of mobile phones in urban areas is shorter than the lifespan of mobile phones in rural areas; and [14] also found that women had shorter lifetime expectations for mobile phones compared to men. Moreover, according to [14], older people expect their cellphones to last longer than younger people do, and men more frequently replace their mobile phones compared to women [15].

2. Knowledge and Ability

According to [4], electronic devices fail because the person using them does not know how to use them, or does not follow the prescribed instructions for using them.

3. Actual Use

Findings from [4] indicate that an electronic device fails because the person using the device mistreats or abuses it.

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4. Perceptions on Cellphone Reliability

The following lifespans of cellphones are reported by different studies: less than one year [13], [15], one to two years [14], [16], [22], two to three years [17]-[18], three to four years [22]-[23], and more than four years [19]-[21].

E. Research Gap

All the studies [19]-[23] reviewed in this paper on the reliability of cellphones are on the general use of cell phones; and none of them applies to the teaching and learning context.

III. Research Design

The objectives of this research were reached using approaches both from qualitative (objectives 1, 2, and 4) and quantitative (objective 3) research methods.

1. Content Analysis in the form of a literature review:

The methodology used by research objectives 1, 2, and 4 consist of the analysis of content obtained from existing literature on the perceptions of cellphone reliability.

2. Survey of High School Teachers:

The new conceptual model proposed by this study was empirically tested through a survey of teachers selected from high schools in the ILembe and UMgungundlovu municipality districts of the KwaZulu-Natal province of the republic of South Africa.

A. Population and Sampling

The population of this survey is made up of 236 high school teachers. The sample size of this survey was calculated using (1) [24], where Z is the level of confidence, P is the proportion, d is the precision or acceptable margin of error, and N is the Population size. The value of the sample size (n) was estimated using the following parameters: Z = 1.96, P = 0.05, d = 0.044 and N = 236; which gives a sample size of 67 teachers.

$$n' = \frac{NZ^2P(1-P)}{d^2(N-1)+Z^2P(1-P)} \quad (1)$$

IV. Research Variables and Data Collection

The research variables for this study are illustrated in Fig. 3. Data for was collected using a Likert scale of 7 items for intention and actual use variables, 8 items for knowledge and ability variable and 10 items for cellphone reliability variable. The demographic variable had 10 categorical items and some of the demographic items include the teachers' highest level of qualification, their school location, and their frequency of computer usage. The scale for both the intention and actual use variables was adapted from [26], the scale for knowledge and ability variables was adapted from [27], and the scale for cellphone reliability was adapted from the list of cellphone hardware and software characterization as proposed by [25].

V. Results

This section presents the results of this study under the basic assumption that the perception of teachers on the reliability of cellphones for teaching and learning depend on their perceptions on the intent

A. Data Validity and Reliability

Results from Table I shows that the data collected by this questionnaire based survey is reliable (all Likert-scale based research variables have a Cronbach's alpha (α) greater than 0.7).

TABLE I
Reliability Table for Research Variables

Research Variable	No of items	Cronbach's Alpha (α)
Intention to use cellphones	7	0.843
Knowledge and Ability to use cellphones	8	0.883
Actual Use of cellphones	7	0.891
Perception on the reliability of cellphones	10	0.899

B. Descriptive Statistics

This section will present the descriptive statistics on the demographics of the teachers' perceptions on the intentions of learners to use cellphones, teachers' perceptions on the knowledge and ability of learners to use cellphones, teachers' perceptions on the actual use of cellphones by learners, and teachers' perceptions on the reliability of cellphones for teaching and learning.

1. Demographics

Descriptive statistics on the demographics of the educators are evenly distributed across genders, age, and school location. The majority of teachers are of African origins, followed by a non-negligible group size of teachers of Indian origins. The main subjects taught are science and technology, and mathematics, and almost all the teachers were chosen from high schools. It is also interesting to note that the majority of teachers reported that they use computers daily (see Table II).

2. Intention to Use Cellphones

The majority of teachers who participated in this study believe that the intentions of learners towards the use of cellphones are noble. However, they do not believe that learners intend to use their cellphones with care

TABLE II
Intention to Use Cellphones

B	S1	S2	S3	S4	S5	Mean	SD
B1	16	13	18	21	31	3.37	1.465
B2	19	9	13	9	49	3.60	1.615
B3	21	9	4	7	57	3.73	1.684
B4	16	9	7	9	57	3.84	1.582
B5	21	3	4	15	56	3.84	1.620
B6	15	31	10	26	16	2.99	1.365
B7	13	9	28	22	26	3.40	1.338
Avg.	17.25	12.57	12.0	15.57	41.70		

3. Knowledge and Ability to Use Cellphones

Majority of the teachers believe that learners have the

knowledge and ability to use their cellphones except for using their cellphones for editing files and performing basic arithmetic calculations.

TABLE III
KNOWLEDGE AND ABILITY TO USE CELLPHONES

C	S1	S2	S3	S4	S5	Mean	SD
C1	25	24	6	18	26	2.97	1.595
C2	29	13	16	25	15	2.82	1.476
C3	24	10	22	19	24	3.09	1.495
C4	9	13	13	19	44	3.78	1.380
C5	9	1	7	13	66	4.30	1.252
C6	12	1	10	15	60	4.12	1.365
C7	9	0	3	12	76	4.46	1.185
C8	9	6	9	21	54	4.07	1.306
Avg.	12.60	8.50	10.25	17.75	45.63		

4. Actual Use of Cellphones

The majority of teachers who participated in this study believe that the actual use of cellphones by learners is decent, except for the handling of the cellphones with care (see Table V).

5. Perceptions on Cellphones Reliability

Majority of the teachers believe that cellphones used by learners generally last between one to two years (see Table VI).

TABLE IV
DEMOGRAPHICS

A	Demographics	Percentage
A1	Male	50.7
	Female	49.3
A2	Urban	49.3
	Rural	50.7
A3	Less 30	38.8
	30-40	40.3
	41-50	7.5
	Above 50	13.4
A4	Grade R-3	0
	Grade 4-6	1.5
	Grade 7-9	11.9
	Grade 10-12	86.6
A5	1-20	1.5
	21-40	43.3
	41-60	37.3
	Above 61	17.0
A6	Diploma	11.9
	Bachelors	67.2
	Honors	20.9
A7	Languages	13.4
	Mathematics	25.4
	Science &Technology	38.8
	Social Sciences	22.4
A8	None	9.0
	Daily	79.1
	Monthly	11.9
A9	African	73.1
	Indian	25.4
	White	1.5
A10	0-5Years	41.8
	5-10Years	40.3
	10-20Years	6.0
	Above 20Years	11.9

TABLE V
ACTUAL USE OF CELLPHONES

D	S1	S2	S3	S4	S5	Mean	SD
D1	13	9	12	15	50	3.81	1.480
D2	7	10	9	15	57	4.06	1.336
D3	12	9	6	9	63	4.04	1.471
D4	7	1	6	9	75	4.45	1.171
D5	4	6	6	13	69	4.39	1.128
D6	19	16	16	24	24	3.16	1.463
D7	9	12	21	31	26	3.55	1.259
Avg.	10.14	9.00	10.85	16.60	52.00		

TABLE VI
PERCEPTIONS ON CELLPHONE RELIABILITY

E	S1	S2	S3	S4	S5	Mean	SD
E1	25	44	16	3	10	2.28	1.191
E2	25	34	22	9	9	2.42	1.220
E3	24	34	26	6	9	2.42	1.183
E4	29	31	25	6	7	2.30	1.181
E5	13	40	24	9	13	2.69	1.221
E6	18	31	21	16	13	2.76	1.304
E7	19	29	18	9	24	2.88	1.462
E8	37	31	21	7	3	2.07	1.078
E9	16	24	24	4	31	3.10	1.489
E10	22	22	25	9	21	2.84	1.431
Avg.	22.80	32.00	22.20	7.80	14.00		

C. Correlations

The results from Tables VII and VIII are illustrated by Fig 4. The interpretation of Fig 4 combined with the initial hypotheses gives the following results.

Ha0: There is a direct relationship between the school location of an educator, and his or her perceptions on the reliability of cellphones for teaching and learning.

Hb1: There is no direct relationship between the demographics of an educator, and his or her perceptions on the intentions of learners for the use of cellphones.

Hc1: There is no direct relationship between the demographics of an educator, and his or her perceptions on the knowledge and ability of learners to use cellphones

Hd1: There is no direct relationship between the demographics of an educator, and his or her perceptions on the actual use of cellphones by learners.

He0: There is a direct relationship between an educator's perceptions of the intention of learners to use cellphones, and his or her perceptions on the reliability of cellphones for teaching and learning.

Hf1: There is no direct relationship between an educator's perceptions on the knowledge and ability of learners to use cellphones, and his or her perceptions on the reliability of cellphones for teaching and learning.

Hg0: There is a direct relationship between an educator's perceptions on the actual use of cellphones by learners, and his or her perceptions on the reliability of the cellphones for teaching and learning.

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TABLE VII
CORRELATIONS INVOLVING DEMOGRAPHICS

		B	C	D	E
A1	Pearson Correlation	.117	.091	.086	.039
	Sig. (2-tailed)	.346	.468	.490	.757
	N	67	67	67	67
A2	Pearson Correlation	.239	.217	-.094	-.291*
	Sig. (2-tailed)	.051	.080	.449	.017
	N	67	67	67	67
A3	Pearson Correlation	-.037	-.018	-.074	.171
	Sig. (2-tailed)	.770	.886	.551	.169
	N	67	67	67	67
A4	Pearson Correlation	-.046	-.201	-.112	.031
	Sig. (2-tailed)	.709	.106	.369	.802
	N	67	67	67	67
A5	Pearson Correlation	.106	-.088	-.030	-.092
	Sig. (2-tailed)	.395	.480	.809	.460
	N	67	67	67	67
A6	Pearson Correlation	-.057	-.134	-.112	-.185
	Sig. (2-tailed)	.645	.285	.365	.134
	N	67	67	67	67
A7	Pearson Correlation	-.089	.032	-.133	-.143
	Sig. (2-tailed)	.474	.800	.285	.249
	N	67	67	67	67
A8	Pearson Correlation	-.049	-.019	-.051	-.069
	Sig. (2-tailed)	.693	.882	.682	.577
	N	67	67	67	67
A9	Pearson Correlation	.041	-.111	-.173	-.214
	Sig. (2-tailed)	.744	.374	.160	.082
	N	67	67	67	67
A10	Pearson Correlation	.055	-.001	.079	-.019
	Sig. (2-tailed)	.658	.994	.526	.882
	N	67	67	67	67

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

TABLE VIII
CORRELATIONS BETWEEN VARIABLES

		B	C	D	E
B	Pearson Correlation	1	.456**	.475**	.271*
	Sig. (2-tailed)		.000	.000	.027
	N	67	67	67	67
C	Pearson Correlation	.456**	1	.630**	.171
	Sig. (2-tailed)	.000		.000	.169
	N	67	67	67	67
D	Pearson Correlation	.475**	.630**	1	.317**
	Sig. (2-tailed)	.000	.000	.000	.009
	N	67	67	67	67
E	Pearson Correlation	.271*	.171	.317**	1
	Sig. (2-tailed)	.027	.169	.009	
	N	67	67	67	67

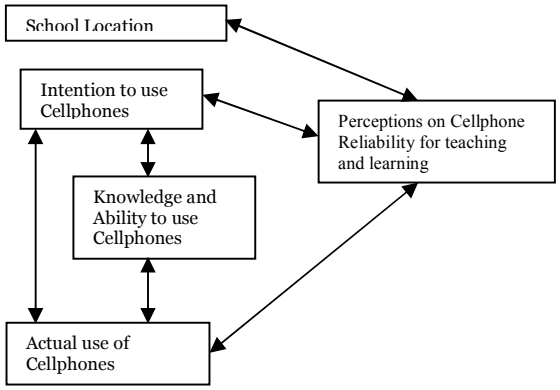


Fig. 4 New Validated Model

VI. DISCUSSION AND CONCLUSION

The following points properly encapsulate the content of this paper on the perceptions of teachers on the reliability of cellphones when used for teaching and learning purposes.

a) According to the literature reviewed in this paper [4], the attribution theory is able to explain the perceptions of teachers on the reliability of cellphones for teaching and learning.
b) According to the literature reviewed in this paper [12], one can hypothesize a model linking teachers' demographics and their perceptions on the reliability of cellphones when used for teaching and learning, with the following constructs from the attribution theory: learners' perceived intentions, their perceived knowledge and ability, and their perceived action.
c) According to the results of the survey conducted by this study, the perceptions of teachers on the reliability of cellphones for teaching and learning are only affected by the school location of these teachers, and by their perceptions on learners' cellphones usage intentions and actual use.
d) One of the interesting findings of the survey conducted by this study is that learners do not use and do not even intend to use their cellphones with care. Therefore, more research should be done on that aspect in order to improve the reliability of cellphones when used for teaching and learning.

Findings from this study are in agreement with existing literature on the fact that the lifespan of cellphones in urban areas is shorter than the lifespan of cellphones in rural areas [13], and on the fact that cellphones fail because people do not use their cellphones with care [4].

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