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EXPLORING SECONDARY SCHOOL TEACHERS' PEDAGOGICAL BELIEFS AND THE INTEGRATION OF ICT IN THE CONTEXT OF A DEVELOPING COUNTRY: A TECHNOLOGY ACCEPTANCE MODEL PERSPECTIVE

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Abstract:
Information, and communication technologies (ICTs) have become rudimentary in communication and information sharing world over. Even more so for teachers because technologies have the potential to transform their practice and help their students learn. This study extends the technology acceptance model to establish how teachers' pedagogical beliefs (PB) directly or indirectly influence ICT acceptance among secondary school teachers in Kenya. The research instruments were a survey (n = 234) whose quantitative data were analysed drawing on Ajzen's (1985) technology acceptance model (TAM) to identify the challenges and the perceptions of challenge for teachers in using technology in the classroom. The findings from this study suggest that teacher's accounts of appreciation and dissonances with the integration of technology in teaching mirrored similar issues in literature. However, the findings also revealed some nuanced shifts on teacher perceptions and attitudes to technology integration. Implications for policy and practice are discussed, and the development of a new teachers' technology acceptance model is presented. This study fills the gap in the literature regarding knowledge of technology adoption practice from the points of view of teachers.

Keywords: information and communication technology (ICT), pedagogical beliefs, secondary school teachers, technology acceptance model, regression analysis

1. Introduction

In the modern global economy, ICTs are fundamental in communication and information sharing and have become an essential feature of people's lives (Rafique, 2014). This is even more so for teachers because technology has the potential to empower them and improve learning by widening access to education (Hennessy et al., 2010). Research has

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found that teachers who integrate technologies into their teaching can improve lesson delivery, stimulate learners, prepare them for the future of learning and get them ready for the 21st technology-based workforce and beyond (Gordon, 2011; Lemke, 2010). Furthermore, teachers who are innovative, confident, and ready to allow their learners the freedom of learning through discovery inspire them to realise the advantages of technology to achieve age-old dreams through individualisation of teaching (Cuban, 2012).

Several studies have examined the factors that influence teachers' resolve to integrate ICT in secondary schools, yet comparatively few of those have appraised teachers' pedagogical beliefs as significant. When teachers' pedagogical beliefs have been considered, researchers had mostly centred on pre-service teachers (Gyamfi, 2016). Some studies have argued for the need to examine teachers' pedagogical beliefs among in-service teachers in secondary schools (Kipsoi, Chang'ach & Sang, 2012; Odera, 2011; Piper et al., 2015). Failure to examine teachers' pedagogical beliefs would lead to limited understanding of the factors related to teachers' motivations to incorporate ICT in classroom teaching. This study, hence, aimed to investigate secondary school teachers' pedagogical beliefs within the Technology Acceptance Model (TAM) – a framework that frames an individual's attitude and perception to integrate a particular technology (Davis, Bagozzi & Warshaw, 1989). This study has the capacity to engender further insights into how secondary school teachers' pedagogical beliefs influence the way they perceive ICT integration in teaching, and by so doing, supplement the literature by authenticating the TAM in the Kenyan context and give forth important study implications and practice of ICT integration evolution.

1.1 Teachers' Pedagogical Beliefs and ICT Integration

A burgeoning body of literature have categorised teachers' pedagogical beliefs into traditional (behaviourist) aligned beliefs and constructivist aligned beliefs (Hammond et al., 2011; Konig, 2012; Lehtinen, Nieminen & Viiri, 2016; Tondeur, 2020) especially with regards to how these beliefs impact the way they integrate technology in their instructional methods indicating that the effective incorporation of ICT into classroom teaching relies upon the kind of pedagogical point of view embraced by the teachers (Prestridge, 2012; Teo, 2014). Although scholars like Lim, Chai and Churchill (2011) are in dissonance with this view, others like Jimoyiannis (2012) confirm that teachers whose way of thinking is aligned to constructivist beliefs and learner-centred strategies are likely to incorporate ICT in their classroom instruction productively. For instance, Lim et al. (2014) denotes that instructors who apply constructivist way of teaching use digital devices frequently in a more superior way as opposed to those who do not. Conversely, teachers who embrace behaviourist (traditional) pedagogical beliefs are more conventional and less likely to utilise ICT for pedagogical reasons further suggesting that behaviourist beliefs negatively affect the adoption of ICT in teaching (Hermans et al., 2008; Prestridge, 2012) to an extend that teachers aligned to behaviourist pedagogical

beliefs, notwithstanding when offered ICT-rich class, may keep on utilising ICT devices available to practice didactic way of teaching (Lim & Chai, 2008). For instance, while Tondeur (2020) allays fears that some instructors may hold constructivist pedagogical beliefs yet at the same time disregard to take the advantage of ICT devices due to lack of necessary technical skills in utilising the innovation and the restrictions of their socio-cultural settings, Omwenga (2003) found that teachers held constructivist beliefs yet were unable to use the computers for pedagogical purposes because of various constraints related to lack of adequate time to design lessons, insufficient specialised help, absence of authority backing and lack of access to computers with dependable internet. Similarly, other studies have identified external pressures related to curriculum and assessment plans (Ertmer et al., 2012; Liu, 2011).

Numerous studies report different factors that influence teachers' use ICTs in their instructional methods (Amelina, 2017; Ha & Lee, 2019; Kim et al., 2013; Liu, 2011), but invariably, approached this matter from the teachers' professional development point of view. However, albeit teachers' professional development is an important part of improved teaching and learning (Cordingley et al., 2015; Lim et al., 2014; McAleavy et al., 2018), teachers' pedagogical beliefs play a pertinent part in the effective integration of ICT in teaching and learning. As student-centred (constructivist) learning approaches take precedence over traditional (behaviourist) teacher-centred approaches (Ha & Lee, 2019; Lim et al., 2014; Mtika & Gates, 2010), any successful integration of ICT for pedagogical purposes should consider teachers' pedagogical beliefs. Moreover, understanding teachers' pedagogical beliefs can support effective student-centred learning using ICT and how teachers are expected to perceive technologies as tools used for the purpose of encouraging learners to seek for deeper understanding (Amelina, 2017; Kim et al., 2013). Notably, trying to change teachers' beliefs about technology incorporation in instructional methods can be a tall order (Khader, 2012; Lim & Chai, 2008) largely because pedagogical beliefs are shaped following learners' long-time school life experiences (Lehtinen, Niemenen & Viiri, 2016). Nonetheless, Muiji and Reynolds (2008) contended that beliefs are dynamic and are bound to change because of practical experiences that teachers undergo.

Education is closely associated to social changes and choice of pedagogy is frequently influenced by social conduct, anticipations, and values (Crompton, 2013). This means that pedagogy is anticipated to transform because of the adjustments in the public arena, and ICT has been one of the agents of change. Each evolving technology has shaped education in some ways. That is not to contend that technology determines education in totality, but instead that there is a commonly beneficial union between significant ICT impacts on the way of life and the modern educational suppositions and practices (Sharples & Pea, 2014). Accordingly, the establishment of ICTs has conceivably caused interruption in behaviourist pedagogies that have conceivably advanced learner-centred methodologies (Leadbeater, 2008). Furthermore, as technology has developed and turned out to be progressively pervasive, pedagogies of learning have likewise

developed to be more student-focused (Crompton, 2013) and have become an epistemological revolution changing what is known through versatile technologies (Lankshear & Knobel, 2010; Traxler, 2010).

Theoretically, change in pedagogy is ideal but in practice, opportunities offered by advanced technologies to eliminate traditional pedagogies are not adopted (Zheng & Huang, 2014) more so in developing countries (Kipsoi et al. 2012). Instead, the presentation of technology in teaching have principally been utilised to duplicate the traditional behaviourist practices but in a polished way (Exter et al., 2014; Davies & Merchant, 2009; Sangra et al., 2010). This means that the 21st century ICTs are being used with 20th century teaching methods together with instructional techniques and classroom management procedures which have not been transformed notably (Khlaif & Farid, 2018; Magid, 2015). Literature further indicate that poor teaching approaches adopted by teachers led to students' attainment of poor grades with instructors sometimes creating a teaching style founded on their expected beliefs on what constitutes good teaching, individual preferences, and their capabilities (Hennessy et al., 2010b), practised at the cost of the learners' needs (Miima, Ondigi & Mavisi, 2013).

Although the literature reviewed herein each illuminate cogent arguments for ICT integration in teaching and notwithstanding a rich exploration into ICT integration in education (Amelina, 2017; Ha & Lee, 2019; Liu, 2011), deficient attention has been accorded to teachers' pedagogical beliefs as a locus for teacher preparation (Hennessy et al., 2010b; Sentence et al. 2012), a requisite to improved teaching and learning using ICT in Kenya (Omwenga, 2003; Prestridge, 2012; Teo, 2014), and guarantee reliable teacher professional operations (Rusznyak & Walton, 2011). Transforming these discussions into the domain of teachers' pedagogical beliefs divulges a lacuna in the knowledge at their convergence, and it is this lacuna that this research seeks to utilise by applying the TAM framework (Ajzen, 1985; Davis, Bagozzi & Warshaw, 1989) to investigate the teachers in order to supplement new knowledge.

1.2 Technology Acceptance Model (TAM)

The current research embraced the TAM model as the conceptual framework for interpreting data about secondary school teachers' adoption of ICT for classroom teaching in Kenya. The TAM model was proposed by Davis in 1986 to investigate behaviours of using ICTs (Davis, 1986; Davis et al., 1989; Nadri et al., 2018; Wong, 2015). The TAM is a valuable theoretical device for acknowledging how teachers' ICT acceptance status levels influences its integration in teaching (Adams et al., 2014; Aypay et al., 2012; Venkatesh & Bala, 2008). This model has since pursued serious developmental process throughout the time becoming a modern reference model (Pynoo et al., 2012; Teo, 2011). Recent empirical studies showed that both Perceived Ease of Use (PEU) and Perceived Usefulness (PU) influenced users' attitudes (ATT) towards Actual Usage (AU) of ICT (Teo & Milutinovic, 2015; Teo et al., 2016). TAM is validated as a theoretical framework utilised to elucidate and clarify user behaviour (Legris et al., 2003), and

explains how PEU and PU variables determine perception, attitude towards the device, intention to use it and its actual usage.

The model hypothesises that, when users are given a technology, numerous variables influence their underlying acknowledgment yet two essential determinants, PU and PEU largely determine their sustained acceptance and integration (Adams et al., 2014; Aypay et al., 2012; Davis, 1989; Teo & Milutinovic, 2015). When an ICT device is viewed as being useful (improving work execution) and easy to utilise, it culminates in users' positive attitude towards ICT integration (Davis, 1989). This implies that the integration of technology by the teachers in the current research will be dictated jointly by the benefits of ICT (PU) and easy endeavours required to utilise it PEU (Chang, Yan & Tseng, 2012). PU impact ATT towards usage and Behavioural Intention BI to utilise an ICT device (Teo, 2009). ATT is the evaluative impact of the person in behaving in a certain manner (Teo, 2010; 2011) and is recognised as a variable that influences future behaviour. Both PU and ATT influence BI that thusly influences the AU. In TAM therefore, "*the actual use of ICT is influenced directly or indirectly by the user's BI, ATT, PU and PEU*" (George and Ogunniyi, 2016, p. 152).

In this study, PEU is characterised by the extent a teacher acknowledges that adopting ICT would be free of effort, while PU is the extent to which a teacher believes that integrating ICT will ameliorate their teaching strategies. Subsequently, considering the model, actual ICT integration by teachers in schools will be dictated by the teachers' PEU of the ICT, their PU and their ATT of the ICT (Chang, Yan & Tseng, 2012; Teo, 2009), including other contextual external variables added to the model in this case teachers' Pedagogical Beliefs (PB).

Notably, there have been somewhere in the range of few investigations in the Kenyan higher education setting (Macharia & Nyakwende, 2010), unfortunately though, most of them have been conducted in universities and for the most part centred around learners from varying disciplines. For instance, (Kinyanjui, 2019) has recently embraced the TAM as a framework to do an extensive review of the scholarly works that necessitates the incorporation of ICT in teaching of tourism in tertiary institutions in Kenya. This restrains its application in the Kenyan secondary school education setting that is the focus of the current study. Given that some studies have proposed for an augmentation of the TAM model (Mwendwa, 2018), there is need, therefore, to expand TAM to cater for the essential variables missing for a sound explanation of teachers' perceptions and attitudes towards technology adoption in class.

2. Development of the Assumptions

This segment introduces the study assumptions, in view of the broadened theoretical TAM (Davis, 1986, 1989). Based on its popularity and parsimony across a broad range of technologies and disciplines, the TAM model was picked to theorise the current study, first, to test its applicability in the Kenyan teachers' teaching using ICT context and

secondly, to expand the TAM to mirror the Kenyan circumstance, factoring the two significant determinants of socio-cultural and institutional elements. Since Davis proposed the first TAM model, it has been tried and approved in numerous educational settings (Iddriss, 2012; Liu et al., 2010; Mtebe & Raisano, 2014; Ngai et al., 2007; Teo, 2009). Nevertheless, a pursuit of databases, for example, Computers and Education, the Education Resources Information Centre (ERIC), the African Journal of Information and Communication Technology (AJIC), and many more revealed that the TAM model is yet to be tried and approved in the Kenyan secondary school teachers' ICT integration setting. Following this revelation, the current research will contribute to knowledge in evaluating for the relevance of TAM in the Kenyan secondary school teachers' ICT integration context. Considering the reviewed literature and hypothetical factors of the TAM, the current research makes the following assumptions:

2.1 Pedagogical Beliefs (PB)

Teachers' pedagogical beliefs significantly affect the utilisation of technology in teaching (Prestridge, 2010). In other words, teachers bring their pre-existing beliefs regarding knowledge structures, their perceptions of pedagogy into teaching, which determines how they interpret and implement teaching (Scott, 2008). The integration of technology in teaching requires teachers' acknowledgement of what role technology has in teaching and how/why, it is applied (Li, 2014). This necessitates a detailed scrutiny of teachers' epistemological beliefs, which play an essential part in determining their reasoning and decisions on the type of information to be taught and the teaching methods to be applied (Lee & Tsai, 2012).

The significance of instructors' pedagogical beliefs in the context of ICT incorporation in teaching is acknowledged (Ertmer, 2005; Gyamfi, 2017; Sipilä, 2010; Tondeur et al., 2016). Teachers who embrace constructivist beliefs and practice student-centred strategies are bound to see the importance of incorporating ICT in classroom instruction (Chen, 2014; Jimoyiannis, et al., 2007). Similarly, teachers whose pedagogical applications are aligned to learner-centred teaching approaches are most likely to adopt ICT in teaching with ease (Gyamfi, 2017; Sipilä, 2010; Tondeur et al., 2016. Hence, the degree to which ICT will be successfully incorporated into teaching relies upon the sort of pedagogical viewpoint embraced by teachers (Sipila, 2010; Tondeur et al., 2016). Consequently, it is hypothesised that:

H1: A secondary school teacher whose pedagogical applications are aligned to learner-centred teaching strategies is bound to see the usefulness of integrating ICT in teaching.

H2: A secondary school teacher whose pedagogical applications are aligned to learner-centred teaching approaches is most likely to adopt ICT in teaching with ease.

2.2 Perceived Ease of Use (PEU)

PEU in the present research refers to the level at which an individual teacher accepts that embracing ICT in teaching would require a little effort (Davis, 1989). In other words, if the ICT instrument is easy to use, then the barriers are overcome. PEU is viewed as the essential factor that determines teachers' attitude towards acknowledgment of technology because teachers are inclined to adopt ICT products that are simple to handle (Buabeng-Andoh, 2012; Cox, 2000; Isiyaku et al., 2018). When all other factors are constant, a teacher is probably going to contemplate a technology devise valuable when its operation is straightforward (Liu et al., 2010). Thus, the succeeding assumptions are postulated:

Hypothesis: 3: How simple a teacher considers the ICT to use will determine the teacher's view of its usefulness.

Hypothesis: 4: PEU will positively affect a teacher's attitude towards using technology in teaching.

2.3 Perceived Usefulness (PU)

PU is the level to which one thinks that using a device would improve the results (Davis, 1989). In the current study, PU denotes the extent to which a teacher accepts that technology may benefit their work. PU further suggests that when a teacher finds a technology effortless to use, he/she will view it as being valuable (Yuen & Ma, 2008). Therefore, technology utilisation in teaching would be viewed to be valuable, when a teacher believes that its usage will support him/her in performing the professional duties with ease (Fathema, Shannon & Ross, 2015). Hence, the following assumptions are postulated:

Hypothesis 5: Teachers' PU of ICT has a notable positive impact on their attitude towards ICT utilisation.

Hypothesis 6: PU will positively affect teachers' utilisation of technology in teaching.

2.4 Attitude towards Use (ATT)

Attitude is defined as an inclination to react positively or negatively to something or an individual (Ajzen & Fishbein, 2000). Attitude towards ICTs is characterised by the extent to which one likes or dislikes an ICT system. Various investigations have found that the effective use of technology relies upon teachers' attitudes towards ICT (Fathema, Shannon & Ross, 2015; Teo, Fan & Du, 2015). For instance, Hsu et al. (2009) discovered existence of a notable association between attitudes towards computers and their actual usage.

In the present study, an attitude is revealed when teachers respond either positively or negatively towards the incorporation of ICT in their instructional strategies. Yuen and Ma (2008) in their study revealed that instructors with positive attitudes towards ICT feel progressively good about utilising it in teaching. Conversely, those

teachers with negative attitudes fail to incorporate it (Yang, et. al, 2017). As Teo (2008) found, teachers' attitudes and their intention to utilise computers in classroom teaching were significant as opposed to their PEU and PU. Hence, attitude has been theorised as an immediate antecedent of technology use.

Hypothesis 7: Teachers' positive attitudes (ATT) towards using ICT will positively affect their actual ICT use.

2.5 Actual System Use (AU)

Actual system Use (AU) is the result of all TAM model variables. In the current research, Actual System Use is the extent to which teachers aim to actualise their usage after they have determined the degree of its usefulness. The effective utilisation of any type of innovation provided by the schools relies upon the readiness of the users to utilise it. In the current investigation, actual ICT usage was quantified by secondary school teachers' frequency of use in classrooms. Notably, this research did not examine further the behavioural intention to use variable given that the study centres on the ICT utilisation behaviour of secondary school teachers. In view of the way that numerous earlier investigations have stretched out and approved the TAM to suit their unique situations (Liu et al., 2010; Tarhini, Hone & Liu, 2013; Teo & Milutinovic, 2015) the present research broadened the TAM by joining the Pedagogical Beliefs external variable to the four original TAM variables (PEU, PU, ATT & AU) as indicated in the figure below. Hence, the expanded model with the augmentation of secondary school teachers' pedagogical beliefs as an external variable is presented in Figure 1 below.

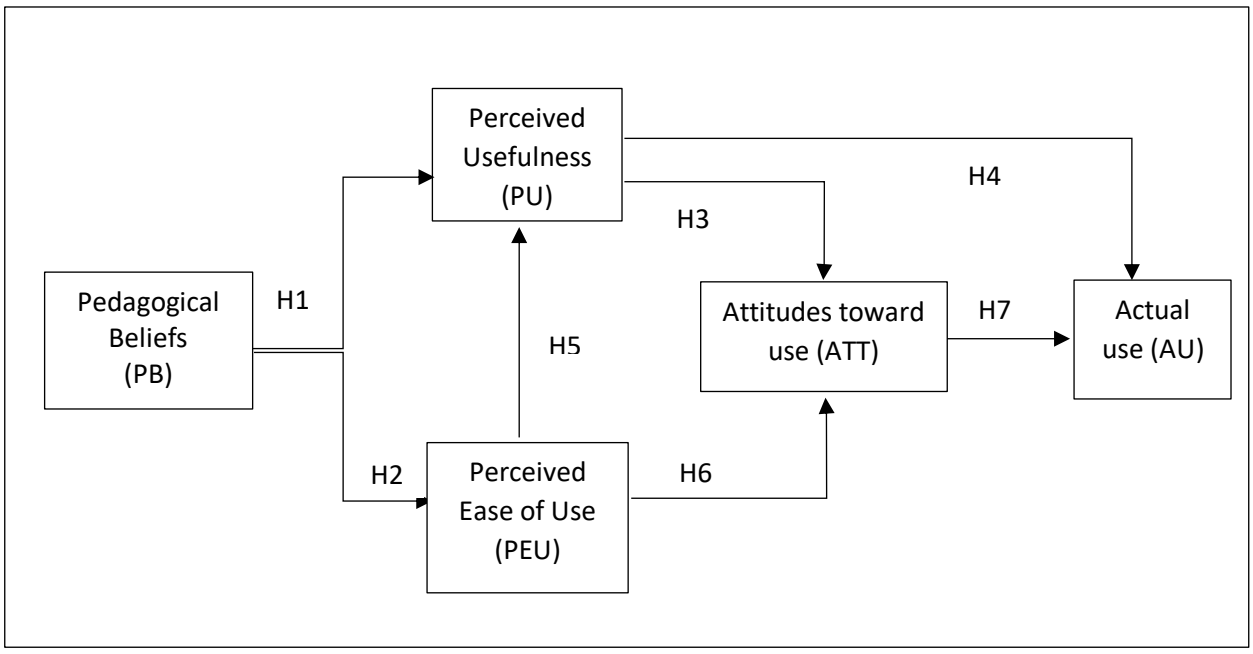

Figure 1: Research Model for teachers' ICT Integration

3. Methodology

3.1 The Development of the Survey

For the construction of a sound questionnaire, the crucial information needed to be extracted from the data was considered (Anderson, 2004). In this study, the questionnaire was tailored to the context of the study itself. The questionnaire attempted to scrutinise secondary school teachers' attitudes towards ICT adoption and their pedagogical beliefs. Neuman (2003) concurs by asserting that a good survey questionnaire enables the investigator to resolve research questions. The questionnaire design was influenced by the TAM variables. According to Bryman (2016), a Likert scale can measure attitudes associated with a particular area in a multiple way. When constructing the Likert scale, the researcher ensured that the items were statements and not questions and they all related to the same object. The researcher also ensured that the items used in the scale were interrelated. The utilisation of the Likert scale is popular in educational research because of its high legitimacy, it is easy to administer, has a high level of legitimacy and dependability, gives single marks from set of things, permits ranking of the respondents, and is simple to develop. (Delamont, 2012; Harpe, 2015; Schumacher, 2014).

This study's questionnaire was divided into two sections. Section one comprised questions intended to collect demographic profiles of the respondents. The second section aimed at obtaining teachers' responses regarding the variables used in this research, that is teachers' pedagogical beliefs, PEU, PU, attitude towards use and actual ICT utilisation. The researcher sought to ensure all questions included in the Likert scale emerged from the same underlying concept. The respondents answered the questionnaire items to the level they agreed to each attribute scored.

Table 1: Measurement Scales (Items, Reliability and Sources)

Scales	Total Items	Reliability (a)	Adapted From
Pedagogical Beliefs (PB)	6	0.808	Becker & Ravitz, 1999
Perceived Ease of Use (PEU)	6	0.817	Davis, 1989, Venkatesh & Davis, 2000
Perceived Usefulness (PU)	6	0.718	Davis, 1989, Venkatesh et al., 2003
Attitude towards Using	6	0.889	Fathema et al., 2015
Actual Use (AU)	6	0.761	Davis, 1989, Venkatesh et al., 2003

Note: All items including the ones for AU were measured on a 5-point Likert Scale, 1 being "strongly disagree" to 5 being "strongly agree".

The initial TAM variables are integrated and engaged in the current study by utilising quantification verified by past studies, with terminology cautiously adjusted to fit the setting of the present research (Cheok & Wong, 2015; Fathema, Shannon & Ross, 2015; Yuen & Ma, 2008). Divided in two sections, the first section asks teachers to provide their demographic information. Teachers were asked to indicate their age range, gender, language of instruction, teaching experience, their position in school, their school location, and level of education, teaching subject, and hours spent on computer. The

second part of the questionnaire asked the teachers to offer thoughts on 53 assertions regarding the five TAM variables indicated in Table 1. These survey item questions have been adjusted from different distributed sources that are reliable and legitimate.

3.2 The Context of the Research

An investigator has a duty to identify ideal site(s) that would yield rich information before initiating data collection (Delamont, 2012). Eight secondary schools in Kenya were selected as the setting of this research because they had earlier taken part in the Computer for Schools pilot scheme with the aim of introducing computers in teaching (Farrell, 2007). These schools are at the forefront of ICT integration and intended to display exceptional practices in the utilisation of technology in classroom instruction. These schools constituted a national benchmark that all other schools in the country attempted to achieve. Given that there are over 3000 secondary schools in Kenya, it was important to explain the criteria used to select only eight schools for the integrity and validity of the study reasons. In choosing the eight schools the following questions were considered: Does the school generally have technology resources? Does the School administration give dynamic support to technology implementation? Do teachers in the school exhibit a higher usage of ICT in teaching? Does the school have a computer laboratory? Is the School willing take part in the research? Hence, the eight Schools involved in the current study had ideal conditions for technology integration compared to other schools in Kenya. This propelled them to fill in as "basic cases" to represent the rest of the schools.

3.3 Research Population and Sampling Strategy

A questionnaire was delivered by hand to the 260 secondary school teachers from 8 purposively selected schools out of which 234 (90%) responded with 26 (10%) failing to respond. Of those who responded, 115 (49 %) were male and 119 (51%) females. In the current research, purposive sampling was embraced as the fundamental sampling technique to get to knowledgeable participants with rich information about the research topic (Cohen, Manion & Morrison, 2011; Vasileiou et al., 2018). Teachers were picked to take part in this research based on being computer users when teaching in their lessons. The teachers who were not actively using computers to teach were not eligible for inclusion.

The completed questionnaires were collected in person from respondents at agreed times. This was aimed at realising a high response rate. The response rates were arguably high possibly because seven of the eight schools were paid a visit by the researcher in person. The researchers' face-to-face meeting with the schools' Principals and interaction with majority of the teachers may have created a rapport between the teachers and the researcher, and the participants returned the gesture as a show of politeness and civility. Taking part in this research was discretionary and no incentive was offered. The respondents gave consent by signing forms after having read about the

purpose of this research, their rights to decline the invitation to participate in the research and the choice for their withdrawal from the study at any time.

3.4 Data Analysis and Findings

The assumptions were measured using SPSS 24 software. Those surveyed were 234 out of 260 translating to a response rate of 90%. Notably, the majority of those who responded were aged between 18 and 30 (75%). Over three quarters of the respondents had a qualification of a university degree. All participating teachers were integrating ICT in teaching and were employed by the Teachers' Service Commission (TSC) of Kenya. Descriptive analyses were conducted to report the mean and standard deviations of the teachers' perceptions and pedagogical beliefs about ICT integration in teaching. Pearson correlation analyses aided in weighing the strength TAM constructs associations, while multiple regression analysis was used to test the assumptions.

3.5 Descriptive Analysis

The sampled teachers report an above average mean score of 3.65 with a standard deviation ($s = 0.74$) with respect to their perceptions of technology utilisation in classroom instruction. This reflects that the teachers' incorporation of technology in classroom instruction was above moderate level. The teachers recorded skewness (*- 0.83*) and the kurtosis (*- 1.03*) measurements are within the admissible limits for skewness *(- 3 to +3*) and for kurtosis *(- 8 to +8*) (Kline, 2011; Ryu, 2011).

Table 2: Descriptive Statistics

Variable	Mean	Std. Deviation	Median	Skewness	Kurtosis
Pedagogical Beliefs (PB)	3.61	.741	3.61	-0.849	1.025
Perceived Ease of Use (PEU)	3.64	.724	3.60	-1.115	2.018
Perceived Usefulness (PU)	3.65	.883	3.68	-1.168	2.749
Attitude (ATT)	3.85	.794	3.70	-0.873	0.225
Actual Usage (AU)	3.52	.674	3.70	-0.558	0.952

With respect to determinants of ICT integration in classroom teaching, teachers' pedagogical beliefs (PB) scored ($\bar{x}$= 3.61) above the mid value of 3.0. Teachers' attitudes ($\bar{x}$= 3.85) scored highest seconded by perceived usefulness ($\bar{x}$= 3.65) and perceived ease of use ($\bar{x}$= 3.64) denoting that teachers' attitudes and their perceived usefulness to ICT to be significant factors that determined their ICT usage in teaching and learning.

3.6 Pearson Correlation Analysis

Correlation is significant and essential in the elaboration of bivariate associations. As per Pallant (2013), correlation measures demonstrate the strength and the bearing of the association of paired variables. Similarly, Field (2013) report that Pearson correlation coefficient is utilised the moment two factors are associated directly. The current study endeavoured to decide the robustness and bearing of the associations between different

TAM components. The accompanying factors, as portrayed in *Table 3*, were utilised in the correlation analysis.

Table 3: Pearson Correlation Coefficients among TAM Variables

Path	Value	Significance
PB – PEU	.572	.001
PB – PU	.678	.001
PEU – PU	.696	.001
PEU – ATT	.707	.001
PU – ATT	.406	.001
PU – AU	.423	.001
ATT – AU	.852	.001

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

Note: PB – Pedagogical Beliefs, ACC – Accessibility, TRN – Training, SF – System Functionality, SE-ICT Self-Efficacy, SCS – School Culture & Support, TM – Time, PEU – Perceived Ease of Use, PU –Perceived Usefulness, ATT – Attitude, AU – Actual Usage

Table 3 hence indicates Pearson correlation coefficients between the dependent variable (AU) and the four predictor variables (PB, PEU, PU and ATT). All the four correlations were significant at the 5% level. The outcomes demonstrated the presence of solid and significant connections between the predictor factors and the dependent variable. The next section explores regression analysis and the testing of the hypotheses.

3.7 Multi-Regression Analysis

Different authors have explained multiple regression analysis diversely. Hinton and Cramer (2014) for instance define multi-regression analysis as an augmentation of basic or bivariate regression. They suggest that multiple regression aids in selecting the best arrangement of predictors for any model. Regression analysis is generally a meticulous statistical strategy used in building estimation frameworks intended to affirm or discredit postulated variable constructs (Law, Pelgrum & Promp, 2008). This analysis is embraced widely in scholarly works in various disciplines like education, commerce, and psychology (Sharma & Chandel, 2013). According to Hinton and Cramer (2014), regression analysis is either solitary or multiplex. In solitary regression analysis, one dependent factor is identified with one predictor factor whereas in a multiplex regression the dependent variable is regressed against more than one independent variables.

3.8 Testing of Assumptions

Initial tests were carried out to establish that the assumptions of multiple regression analysis were met. Results from the scatter plots connecting the independent variables to the dependent variable demonstrated that the connections all fulfilled the condition of linearity. The presumption of homoscedasticity was measured by plotting the standardized anticipated value against the standardised residuals. Investigation of the scatter graph demonstrated no pattern structure that may have denoted any signs of

heteroscedasticity (Field, 2013). The test result of multicollinearity using the variance inflation factor (VIF) was within the suggested edge estimations of at least one and at most 10 (Field, 2013). Normality was also confirmed with the standardised residuals histogram and typical P-P plot. Therefore, all the assumptions were satisfied.

A progression of multiple regression examination was performed to evaluate the postulations each between predictor factors and the dependant factor. Independent variables that were associated with the dependent variable were utilised. As per the conventional procedure in the Social Sciences studies a statistically noteworthy level of 0.05 (5%) was used as a basis to acknowledge or dismiss an invalid postulation (Creswell, 2012). This means that p-values surpassing 0.05 (5%) score implied that the result was not significant, and the experimental hypothesis had to be dismissed in favour of the null hypothesis while an outcome less than 0.05 score was acknowledged as being noteworthy. This suggested there was just 5% likelihood that the outcome was acquired absolutely by some coincidence further implying that a similar distinction would happen 95% of the time if the test were to be rehashed.

To collate the benefactor of every predictor factor to the prognosis of the dependent factor, Standardized Coefficients (Beta weights) were used to examine the significance of the independent variable and contrast them in regard with their impact on the dependent factor (Pallant, 2013). As suggested by Norusis (2012:249) "*standardised coefficients are realised when both the dependent variable and each of the independent variables have a mean of 0 and a standard deviation of 1*".

Table 4: Multi-regression Table

Variable	Unstandardized Coefficient (β)	Standardized Coefficient (Beta)	t	Significance
PB	.437	.476	5.72	.001
PEU	.722	.659	11.72	.001
PU	.682	.532	9.25	.001
ATT	.692	.814	20.86	.001
Dependent Variable AU				

Note: PB – Pedagogical Beliefs, PEU – Perceived Ease of Use, PU –Perceived Usefulness, ATT – Attitude, AU – Actual Usage

The regression table likewise delineate a β value (an unstandardized coefficient) whose scores are helpful in a projection equation. Nonetheless, using the p values of all four independent variables (PB, PEU, PU and ATT) had an analytical noteworthy effect on the dependent variable (AU). More importantly, the descriptive potentiality of the TAM for solitary variables were analysed utilising the subsequent R square values for the dependent factor.

3.9 Summary of the Hypothesis Testing Results

The teacher's pedagogical beliefs (β = .437, t = 5.72, $p < 0.001$) are found to have a measurably huge impact on the perceived usefulness, confirming H1. PEU of ICT significantly influenced PU (β = .722, t = 11.72, $p < 0.001$) and attitude towards usage (β = .743, t = 9.55, $p < 0.001$) of technology in teaching affirming H3 and H4. PU of ICT positively and significantly affected attitude towards use (β = .682, t = 39.25, $p < 0.001$) and integration of ICT (β = .765, t = 10.29, $p < 0.001$), affirming H5 and H6. Teachers' attitudes towards ICT use have a noteworthy and positive influence on the actual technology usage (β = .692, t = 20.895, $p < 0.001$), which confirms the hypothesis H7. Hence, teachers' pedagogical beliefs (PB) variable was discovered to be statistically significant casual factor of the four original factors (PEU, PU, ATT, & AU.

Table 5 demonstrated the 7 hypotheses tested in the current study using a multiple regression analysis. All anticipated dependencies between 7 model segments are significant at 5% level.

Table 5: Summary of the Hypothesis Testing Results

Hypothesis	Path	Significance	Results
H1	PB – PEU	P < 0.001	Supported
H2	PB – PU	P < 0.001	Supported
H3	PEU – PU	P < 0.001	Supported
H4	PEU – ATT	P < 0.001	Supported
H5	PU – ATT	P < 0.001	Supported
H6	PU – AU	P < 0.001	Supported
H7	ATT - AU	P < 0.001	Supported

Note: N=234, Significance level at 0.05 (5%) confidence level. Dependent Variable AU. PB – Pedagogical Beliefs, PEU – Perceived Ease of Use, PU –Perceived Usefulness, ATT – Attitude, AU – Actual Usage

4. Discussions

The study employed the TAM model to investigate the factors that influence secondary school teachers' perceptions of ICT integration and their actual usage in teaching. The results from the regression analysis support all the seven postulations suggested in the research and revealed that. teachers' pedagogical beliefs (PB), their perceived ease of use, perceived usefulness and their attitudes towards ICT significantly influenced teachers' positive perceptions towards adoption of ICT in teaching. These findings echo literature discourses on the pedagogical rationale (Ertmer & Ottenbreit-Leftwich, 2010; Hawkridge, 1990; Hammond et al., 2011; Paakarri, et al., 2015; Tondeur et al., 2016). However, the pedagogical rationale seldom mirrors the practical utilisation of ICT in most schools in developing countries because ICT is taught as an independent subject. This finding corroborates the idea of Buabeng-Andoh (2015) who discovered that ICT is only instructed as a separate subject and the establishments assumes its utilisation to be in the technology teachers. The teachers reported that technology had the prospective to change

the traditional behaviourist teaching approaches and pedagogical beliefs as reflected in the literature (Chigona et al., 2010).

The findings shone light on some dissonances in teachers' discourse. Notably, there were a minority of the participants, who were opposed to the integration of ICT for pedagogical reasons. These participants argued that they were used to their pedagogy of behaviourist learning where the student is a latent beneficiary of knowledge while the teacher acts as a dynamic producer of information. For instance, a minority of the teachers argued that their main responsibility was to relay their proficiency to the learners; hence, they thought the utilisation of technology was tedious and time wasting. This finding conforms to the common pedagogy of behaviourist learning which is intended for accomplishing right behaviour and rote learning (Shunk, 2012; Skinner, 1938). This category of teachers resisting change are described by Hooper and Potter (2000) as being in the "denial phase" where the person refuses to acknowledge that change is necessary by advancing excuses and justifications with regards to why the change does not influence them. This seemed to suggest that teachers could not manage to integrate technology into teaching on their own. It calls for a purposeful joint effort and collaboration of other stakeholders. In this respect, Evoh (2007) emphasised the involvement of all stakeholders in developing and implementing a school vision to help change teachers' attitudes.

A throwback to the existing empirical literature findings, the findings from the present analysis suggest that technology was effective in changing teachers' pedagogical beliefs from teacher-centred to student-centred. Participants had a general view that students are passive listeners, memorising facts and reproducing data as opposed to when ICT is integrated in pedagogy where students take an active role, are more productive and can construct mental representation of meaning as also reported in the existing literature (Amory, 2014; Anderson, 2010; Smith, 2011). The literature further reflects the key findings contradictions and inconsistencies where regardless of teacher concurrence on the significance of progressively dynamic pedagogies, its actual usage is not across the board (Akyeampong, 2016; Paakarri, et al., 2015). The finding corroborates that of Ang'ondi (2013) who found that teachers would rather do things conventionally than mess with the status quo.

Nevertheless, the findings reported components of a constructivist approach to teaching. The teachers fill in as scaffolders, guiding and supporting learners to develop as opposed to just imparting knowledge (Belland, 2017; Harasim, 2012). In accordance with the present findings, previous studies have demonstrated that teachers with access to technology are inclined to integrate constructivist teaching approaches regularly as opposed to those who have not (Jimoyiannis, 2012; Mereku, et al., 2010; Meyers, et al., 2016).

Factor analysis of statements used in the pedagogical beliefs scale uncovered the presence of six factors which describe various pedagogical instructional styles: teacher as a 'coach', 'advisor', 'delegator', 'facilitator', 'specialist', 'instructor'. The research finding

indicated that the teachers would in general concur with every one of these elements at different levels. This indicates that instructors hold learner-centred, constructivist, pedagogical beliefs when the conditions are favourable. Nevertheless, the same teachers are reluctant in abrogating teacher-centred behaviourist teaching approaches, which as they suggest, makes them to feel at ease and in charge of the learning situations they set up when instructing. This indicates the changed role of the teacher. The findings reveal that the instructors, who will adopt the 'facilitator' and 'delegator' roles, which represent learner-centred constructivist beliefs tend to integrate technology regularly in their professional duties. Conversely, it is demonstrated that the instructors who assume the 'expert', 'master' and 'formal position' roles that represent instructor-centred perspectives, rarely integrate technology in their teaching. These findings match those observed in earlier studies (Amelina, 2017; Cordingley et al., 2015; Ha & Lee, 2019; Kim et al., 2013; Lim et al., 2014; McAleavy et al., 2018; Mtika & Gates, 2010; Tondeur, 2020).
This study revealed that PEU has a positive significant influence on PU. This finding is consistent with those of (Davis, 1989; Solangi, et al., 2018; Teo, Fan & Du, 2015) which suggested that PEU is a prevailing variable in determining PU and actual ICT usage (AU). This suggests that both PEU and PU of ICT significantly influence teachers' ICT adoption in Kenya. However, this finding is inconsistent with Gyamfi (2017) who found that PEU was not a noteworthy determinant of PU. This study also revealed that PU has a noteworthy optimistic impact on teachers' actual utilisation of technology in teaching ($\beta = .543$, $P < 001$). This discovery is consistent with (Adams et al., 2014; Teo, 2009) who revealed that when technology is introduced to teachers, they make a worth judgment concerning the innovation's usefulness in empowering them to accomplish their improved professional duties. This infers the more valuable the teachers think ICT is, the more probable they will utilise it (Adams et al., 2014).

The study confirmed that attitude ($\beta = .692$, $p < 0.001$) was the most significant predictor of technology integration. Conversely, a local study by (Ang'ondi, 2013; Hennessey et al., 2010) found that teachers in Kenya developed negative attitude towards ICT integration due to limited access to computers and the internet. However, over time, teachers' attitudes towards technology integration have gotten progressively positive and their confidence in the utilisation of technology has expanded. This is most likely because of the way that ICT is continually penetrating each part of regular day-to-day life – including teaching – with various helpful and facilitating applications. Teachers' experiences with these applications assist them with understanding that technology could leverage their professional duties too. The findings further contrast with other noticeable TAM scholarly investigations (Davis & Venkatesh, 1996; Teo & Schalk, 2009), which established that users' attitude towards technology usage bear insignificant effect on actual utilisation of ICT. This finding is further inconsistent with that of Davis and Venkatesh (1996), which inferred the attitude variable from the first failed to wholly arbitrate connection of PEU, PU and behavioural intention (BI) to adopt.

The research outcome broadly bolstered the suggested model with slight amendments and affirmed the important impact of pedagogical beliefs (PB). Findings from the current research bolster existing research findings relating to the solid connections among PU, PEU and ATT about teachers' ICT utilisation. In accordance with earlier discoveries, PEU of ICT essentially influenced PU of ICT (Teo, 2010) and PU significantly influenced teachers' attitudes (ATT) towards ICT utilisation. Moreover, this research revealed huge impacts of PEU (Lee, Hsieh & Chen 2013) on teachers' ATT toward ICT assimilation in their instructional methods. The significant influence of ATT on actual ICT usage (Farahat, 2012; Wang & Wang, 2009) is likewise supported. The current study's findings validated Davis' (1989) assertion about ICT integration in teaching. Davis' (1989') findings suggest that teachers assess how easy or troublesome it is to integrate ICT and weigh its usefulness in their profession. On the off chance that they discover it is easy to utilise and useful innovation for teaching, they build up optimism towards it, which, determines their actual utilisation (AU) of ICT. Consequently, original TAM variables significantly influenced AU of ICT in classroom instruction. Likewise, the teachers' pedagogical beliefs (PB) variable directly or indirectly impacted teachers' ATT towards ICT and their AU of ICT. These underpin the validity of the suggested augmentation of first TAM in elucidating teachers' perceptions of ICT integration in teaching.

5. Conclusions

Studies in the discipline of ICT acceptance model predominantly originates from the developed nations and mirrors its education philosophies. The present research, with a concentration in teaching in Kenya, a non-Western social academic setting, presents a new viewpoint to the scholarly works about technology utilisation from the teachers' perspectives. Henceforth, the discoveries will enable investigators to examine the legitimacy and vigour of the model across varying philosophies. This study has confirmed the findings of the literature, which set forward the requirement for ratifying the TAM in various social settings, to fortify its cultural legitimacy (Kwok & Yang, 2017; Teo, 2010). The study has along these lines, added to the scholarly work by ratifying the TAM in the Kenyan teaching setting.

Utilising the TAM as a hypothetical framework, the current study aimed to investigate variables affecting acknowledgment and incorporation of ICT as an instrument for instructing and learning in Kenyan teachers setting. TAM is widely acceptable due to its suitability in explaining the technology usage variance (McFarland & Hamilton, 2006). TAM has, however, been deemed to be overly general, hence; its failure to consider variables such as age, self-efficacy (McFarland & Hamilton, 2006). There is need, therefore, to expand TAM to cater for the essential variables missing for a sound explanation of teachers' perceptions and attitudes towards technology adoption in class. This research contributes to existing knowledge of the TAM model by

incorporating the PB exogenous factor viewed as the most important to ICT integration in the Kenyan secondary school teachers' setting. Researchers could use this study as a foundation for broad investigation in grasping the teachers' perceptions regarding ICT integration in teaching together with the utilisation of the TAM in similar settings.

5.1 Implications for Social Change

These findings have implications regarding the procedure of introduction and adoption of technology in schools. Technology should be presented in schools considering an unmistakable pedagogical bearing. The key objective should be the pedagogical thoughtful utilisation of the different innovative resources to improve the teaching process. Teachers should link technology integration to an explicitly stated reform toward learner-centred, constructivist pedagogical strategies. Therefore, teachers' technology training should be arranged according to pedagogical principles that mirror contemporary perspectives in education. It should equally provide a professional development opportunity for instructors to widen and build up their insight base both in technology and pedagogy.

The current study may inspire teachers to embrace ICTs for pedagogical purposes for the benefit and academic prosperity of their students. The overall study findings may promote and encourage teachers to perceive technology integration in a positive way. Teachers are likely to embrace technology in their teaching and become role models for their students, arouse their interest and engagement in ICT. This study would provide intuition and plan of action to aid teachers who face challenges in integrating technology in classroom teaching. Teachers may have an opportunity to learn from the intuitional perspectives of the successful participants who have integrated technology in their classroom instruction.

To realise the important integration of ICT that viably bolsters teaching, teachers need to learn and experience instances of good practice. They should equally have opportunities for hands on experimentation with ICT and contemporary pedagogy associated with their regular professional duties. For this to be realised, schools should be developed into dynamic learning communities for teachers. Thusly, collaborative organisational culture (Buabeng-Andoh, 2012; Park & Jelong, 2013; Tezci, 2011b) will be established in each school to advance the dissemination of salient pedagogical practice, the sharing of productive instructional techniques, and the productive participation between teachers. Moreover, instructors will have the chance to get more involvement with the integration of ICT, to better their ICT use abilities, to create techniques for the compelling and significant adoption of technology resources in teaching, and to comprehend the advantages that ICT can give to their teaching.

5.2 Limitations of the Study and Further Opportunities

Recognising limitations and challenges faced while conducting a study is an established practice (Strauss & Corbin, 2008). This study faced two limitations that merit attention.

First, this study embraced a purposive sampling strategy to choose secondary school teachers from only eight out of over 3000 secondary schools in Kenya. More explicitly, this study speaks to the voices of secondary school teachers who hail from schools which have embraced technology in teaching in Kenya. Involving teachers from only schools that have adopted technology in education, the outcomes may not precisely reflect the experiences of those schools struggling to acquire the basic ICT infrastructure (Patton, 2002). Some studies have advised that the views of teachers in schools with sufficient ICT facilities may contrast from those without (Hennessy et al., 2010; Palinkas et al., 2013; Teo, 2014) primarily because of access inequalities. This situation may restrict the capacity to extrapolate the discoveries of the current study to a more extensive Kenyan teachers' populace. Second, the current study included only one external variable (PB) to the original TAM. In quest for parsimony (Cronbach, 1968, Goloboff, 2017; Warner, 2013), it is conceivable that this study has barred factors that may significantly influence teachers' adoption of ICT in teaching. There is, therefore, a likelihood that different factors such as teachers' efficacy, school leadership, school culture and teachers' professional development may possibly significantly influence teachers' utilisation of ICT in teaching. The current study has demonstrated that teacher perceptions of ICTs integration in Kenya is determined by teachers' pedagogical beliefs (PB) in addition to the original TAM factors (PEU, PU and ATT). Future researchers ought to emphatically consider assessing the influence of the teachers' pedagogical beliefs on ICT acceptance and actual utilisation. Additional research is required to widen and deepen the current research by involving other actors involved in the assimilation of ICT in teaching. Broadening this research will necessarily engage other stakeholders. A suggested broadened research would additionally illustrate contrasting perspectives and generate common intuition. This broadened study might be piloted in a few selected counties first prior to its implementation at country level. This will in turn inform practical measures aimed at improving teachers' perceptions towards the adoption of ICTs for pedagogical purposes. According to Liu and Szabo (2009), technology integration takes a long process and tremendous amount of time as well as energy. A future research should therefore be longitudinal and contextual in nature.

The study has indicated that teachers' utilisation of technology is identified with their pedagogical beliefs and ways of thinking. As demonstrated, the teachers who hold constructivist, learner-centred pedagogical beliefs will in general use ICT more often to support their teaching. This is a significant finding since it shows the reasons why technology should be adopted in schools and gives the essential underpinnings to the benefits of integrating ICT in schools. However, further research is required to reveal more insight into the various aspects of this finding. For example, it would be intriguing to research how instructors' pedagogical philosophies –that reflect what they accept to be acceptable practice – are really implemented in classroom and how technology is incorporated into these practices. Research on this matter may require an investigation that incorporates classroom observations to affirm that instructors' beliefs compare with

what they really practice. It would also be fascinating to investigate if ICT is the motivation behind why these contemporary ways of thinking rise or if these beliefs are the motivation behind why instructors will in general use ICT more. To inspect this issue effectively, a longitudinal research might be required to examine the adjustments in teachers' practices through the span of time.

This research was a snapshot of 234 teachers' effects to integrate technology in teaching and learning from among over 300, 000 secondary school teachers in Kenya. Although informative, the 234 teachers' experiences and viewpoints were only a snapshot that took place at that time and may be influenced by a few hours of experience using technology. A more broadly research is required to study teachers over a four-year span as recommended and done by Liu and Szabo (2009). The rationale for such a longitudinal investigation is to enable teachers to gain insight into the always changing and dynamic nature of technology used in teaching. A continued study with the same participating teachers in the current study is proposed. This is to find out how their understanding of ICTs adoption change or remain the same over time.

Conflict of Interest Statement
The author declares no conflicts of interests.

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