Informal tools in formal context: Adoption of web 2.0 technologies among geography student teachers in Ghana

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ABSTRACT

Despite the popularity of Web 2.0 technologies and their educational benefits in the 21st century classroom environment, their use for teaching and learning purposes is still very limited. This study extended the technology acceptance model (TAM) to empirically examine factors that determine Ghanaian geography student teachers' acceptance of Web 2.0 technologies for pedagogical purpose. A self-reported questionnaire administered to 300 student teachers in two universities in Ghana out of which 254 responded. The results from the stepwise multiple regression analysis showed that technological complexity, perceived usefulness and attitude towards use had a significant direct effect on intention to use Web 2.0 technologies. However, social influence which is an exogenous factor had the strongest influence on the student teachers' intention to use the Web 2.0 technologies than the two key original TAM constructs. Contrary to the original technology acceptance model, statistically, perceived ease of use had no significant influence on perceived usefulness. The findings are intended to provide insights to policy makers about how to design pre-service teacher education programmes that address the demands of teaching and learning with Web 2.0 technologies in Ghana in particular and developing world context in general.

INTRODUCTION

Web 2.0 technologies such as wikis, social networking and many others, although not designed specifically for educational purpose, have for the last two decades received intense and growing educational research interest (Angelaina & Jimoyiannis 2012; Escobar-Rodriguez, Carvajal-Trujillo, & Monge-Lozano 2014). This is because, they have been found to provide myriads of educational benefits including multiple opportunities for share content and resources, self-directed learning, collaborative learning, ubiquitous and lifelong learning (Angelaina & Jimoyiannis (2012).

In their study "Game-Based Learning and Web 2.0 Technologies in Education," Stansfield, Connolly, Hainey and Baxter (2012:236-237) identified the following common Web 2.0 tools:
- Wikis (e.g. Wiki-site, Wikispace, Wikidot)
- Blogs (e.g. Wordpress, Twitter, Edublogs, Blogspot)
- Social Networking (e.g. Facebook, MySpace, Ning)
- Forums (e.g. phpBB, vBulletein)
- Social Bookmarking (e.g. Delicious, diigo, edutagger)
- Media Sharing (e.g. Flickr, Youtube, Teachertube, Podomatic)
- Document Sharing (e.g. Google docs, Zoho) and several others.

While some researchers continue to dispute the efficacy of Web 2.0 technologies in educational context and dismiss them as nothing more than marketing hype, or as a continuation of Web 1.0, many potential uses of the technologies to create constructivist learning environment have been articulated by several researchers and educational practitioners over the last decade (Harasim 2012; Ramanau & Geng 2009; Hough & Neuland 2013).

For example, in Europe, the importance of Web 2.0 technologies has been captured in the establishment of European Commission Web 2.0 ERC project. With the aim at significantly

increasing the number of teachers who can use Web 2.0 tools in a pedagogically sound way, the European Union, in collaboration with seven renown universities within the European continent established the Web 2.0 ERC Project in 2010 (Stansfield, Connolly, Hainey and Baxter 2012). Developed as an innovative pedagogical framework to help educators who are not confident and knowledgeable in using Web 2.0 technologies, the project provides a key resource that teachers from across Europe access and engage with their colleagues, students, technologists and decision-makers in learning more about adopting such technologies for their own teaching, as well as seeing examples of best practice (Stansfield et al 2012). Thus, in effect, the project promotes a Community of Practice where teachers from any level of education can share their experience and expertise.

However, while Web 2.0 technologies are widely recognised in educational contexts in western world, such technologies are yet to be accepted in the developing world, especially in Africa. Mostly, efforts related to the adoption of these new technologies in Africa are, if anything, sporadic and individualistic initiatives offered at unit or course levels as opposed to a universal uptake of such technologies by universities and faculties of education in the advanced countries. With more than 500 million active users (Davis 2012), Facebook which is the largest social net-working service in the world is predominantly used by the Ghanaian student teachers (Abrokwa 2015). For example, Abrokwa (2015) in his study in four faculties of education in universities in Ghana found that about 52% and 76% indicated that they use Facebook and WhatsApp for discussing and sharing of lesson notes. As Web 2.0 technologies becoming more widely used in mainstream education, attention needs to be focused on how the technology will be accepted and used by the student teachers given their role as the agents of change in our education system.

The overarching aim of this study was to identify factors that determine Ghanaian geography student teachers' acceptance of Web 2.0 technologies for teaching and learning purposes. To achieve this, the study extended the technology acceptance model by adding computer self-efficacy and social influence as external variables. This study has the potential to be the starting point for discourse about geography student teachers' acceptance of Web 2.0 technologies efforts in the Ghanaian educational context. It is important to state that, there are two major pathways to enter teacher education in Ghana. First, pre-service teacher education programmes in the faculties of education in some designated universities and second, 38 colleges of education in Ghana. However, the focus of this study is on pre-service teacher education programmes in the Ghanaian universities.

LITERATURE REVIEW

Over the last decade many potential uses of Web 2.0 technologies in pre-service teacher educational context have been articulated by several researchers and practitioners (Dooly 2010; Huang & Neuland 2013; Guth & Helm, 2010). However, in Africa due to its novelty as teaching and learning tool, academic interest in Web 2.0 technologies are only recent and research into its application in teaching and learning environment is somewhat sparse (Okello-Obura Ssekitto 2015). Given the considerable benefits that the Web 2.0 technologies would offer in mainstream education in Ghana, it would seem very important to understand what influences the acceptance and use of Web 2.0 technologies that the student teachers may improve the likelihood of success when introducing the use of Web 2.0 in their course. For example, in a survey conducted in four universities in Ghana in 2015, Abrokwa (2015) found that about 90 percent of the student teachers used WhatsApp application extensively for an informal group discussion on assignments, examination questions and exchange of vital information relevant to their course. However, very few take the opportunity to use them formally for pedagogical purpose.

Dooly (2010) was of the view that when using the term Web 2.0, it is always important to define what it means. Therefore, it is important to begin the literature review with the definition of Web 2.0

technologies. Several different definitions of Web 2.0 technologies have been proffered in the last few years by different researchers (O'Reilly 2005; Paroutis & Al Saleh 2009). A search of academic literature published between 2004 and 2011 revealed 38 definitions of the term Web 2.0 (Stansfield et al. 2012). Examples of some of these definitions include that of Paroutis and Al Saleh (2009), O'Reilly (2005) and several others. Paroutis and Al Saleh (2009) defined Web 2.0 as "a perceived second generation of community-driven web services such as wikis, social networking sites, blogs and others, which facilitate a more socially connected web where everyone is able to communicate, participate, collaborate and add to and edit the information space. O'Reilly (2005) who has been described as the originator of the Web 2.0 identified Web 2.0 in the importance of the three aspects of the concept, including the Web as a shared space for "collective intelligence", more focus on participative and collaborative user experiences, and the notion of the "Web as a platform" for applications which were formerly found on individual computers (O'Reilly 2006:1-3).

The growing importance of Web 2.0 technologies such as academic wiki in teacher educational context, combined with their potential to facilitate communication, support collaboration, and foster the development of community makes them worthy of the attention of both student teachers and teacher educators. Ramanau and Geng (2009) posited that adoption of Web 2.0 technology such as wiki presents an architecture of participation that enable learners to create their self-regulated, collaborative work on the web. For example, they indicated that academic wikis make available a format for asynchronous discussion to take place at the convenience of the users, with this, student teachers can respond to each other at any place and anytime via wikis, and academic discourses can be tracked by name, subject and time. The newly coined terms such as Learning 2.0, School 2.0, Classroom 2.0, Education 2.0 and Teacher 2.0 (Dooly 2010; Guth & Helm 2010) clearly support the view that the impact of Web 2.0 technologies in education in the last ten years has been substantial.

The need for Web 2.0 applications in Ghanaian Pre-service teacher education

It is puzzling to observe that in the 21st century, behaviourism, which has been widely criticized by majority of modern educational researchers and scholars, on the grounds that it discourages learners from developing higher-order level of thinking, which is much needed in the 21st century Information Age (Harasim 2012), still remains a popular orientation in pre-service teacher education in Ghana. In the 21st century knowledge economy, memorisation of facts and procedures is not enough for students' success. To be successful, students in the knowledge economy need a deep conceptual understanding of complex concepts, and ability to work with them creatively to generate new ideas, new products and new knowledge. Several research studies have shown that transformative power of modern technologies in constructivist learning environment changes teacher's role from a mere transmitter of knowledge to a facilitator (Harasim 2012; Heafner & Friedman 2008). Hence, there is a need for Ghanaian geography student teachers to be trained in the constructivist learning environment. The acceptance and usage of web 2.0 technologies such as educational wikis, blogs and others by student teachers can offer enormous benefits to pre-service teacher education in Ghana in different ways. In the first place, they can allow the student teachers to create, contribute, collaborate, connect, share and participate in the learning community (Ray & Coulter 2008). Again, it can bring their work to an authentic and wider audience. Thus, the student teachers can interact not only with their tutors and their peers but with anyone in the world they can learn from. More importantly, it can be used to change the current Ghanaian student teachers' focus of traditional instruction to focus on collaboration and a shared construction of knowledge. Additionally, the collaborative character of web 2.0 applications allow multiple contributors and required no particular person to be in charge, which best fit the constructivist environment of learning which allows individual student teachers to assume leadership roles. One significant feature of web 2.0 is that unlike traditional web 1.0 technology that allows the student teachers to accept information passively, Web 2.0 allows web users to modify web information actively (Stansfield et al, 2012).

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Although, many researchers advocate higher-order thinking skills and metacognition and stress that they should be the primary focus of 21st century pre-service teacher education programmes (McTavish 2008; Conner 2005), the chief aim of Ghanaian pre-service teacher education curriculum still seems to be more about helping students absorb facts and less about helping them to develop as critical thinkers. As a consequence, acceptance of Web 2.0 technologies can promote opportunities for the student teachers to develop higher order thinking skills through collaborative problem solving and critical analysis (Adcock and Bolick 2011).

Given that becoming information literate is critical for student teachers to succeed in their profession in the current social media environment (Penzhorn 2011), Ghanaian student teachers need to become part of this social world in order to ensure that their teaching stay relevant with the diverse need needs of 21st century leaners. More importantly, acceptance and usage of Web 2.0 technologies will allow the geographically dispersed communities of student teachers to come together to learn skills which might otherwise be economically unavailable to deliver, or enabling student teachers to reach out to their colleagues elsewhere share ideas and tap knowledge from experts (Hough & Neuland 2013). The aforementioned pro-web 2.0 arguments suggest that web 2.0 technologies have great potential for Ghanaian student teachers.

THEORETICAL FRAMEWORK

Although there are a number of equally important models such as unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris, Davis & Davis 2003), Diffusion of Innovation (Rogers 2003) and others   that could have been employed in this study, the researcher deemed it more suitable to adopt the TAM as the main theoretical framework based on the following reasons: First, since its inception, the model has survived empirical scrutiny in varied contexts (Huang 2015; Persico, Manca & Pozzi 2014; Venkatesh et al 2003). For example, Wong (2015) extended the TAM using other factors, such as computer self-efficacy subjective norms and facilitating conditions to understand primary mathematics pre-service teacher's technology acceptance in Hong Kong. Additionally, the model has been found to have a stronger predictive power in studies among student teachers across the world (Acarly & Saglam 2014; Aypay, Celik, Aypay & Server 2012; Teo 2014). More importantly, while the TAM has been widely used as a tool with which to examine student teachers' intention to use technologies, to date there has been no study in Ghana based on the TAM considering geography student teachers' perspective in the Ghanaian universities.

Tracing its roots from the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980) and propounded by Davis (1989), the TAM was designed to be a useful explanation of why people vary in respect to their success in using technology. According to Davis (1989) the success of a system can be determined by user acceptance of the system, measured by three factors. Perceived usefulness (PU), perceived ease of use (PEU) and attitudes towards usage (ATU) of the system. Within this study, while perceived usefulness represents the extent to which the use of Web 2.0 technologies is promising to advance geography students teachers' work, perceived ease of use refers to the degree to which and individual geography student teacher believes that learning to use Web 2.0 technologies will require a little effort (Davis 1989).

Attitude towards usage refers to individual geography student teachers' favourableness or unfavourableness about the Web 2.0 technologies (Ajzen & Fishbein 1980), while behavioural intention (BI) refers to the extent to which an individual student teacher formulates a conscious plans to use or not to use a computer for teaching and learning purposes (Huang 2015). The Tam proposes that these three variables (PU, PEU and ATU) work together to impact behavioural intention to use which in turn influences actual use of technology in a given setting. Specifically, a

technology's usefulness and ease of use jointly influence one's attitude towards the technology, which in turn, affects behavioural intention to use which also influences a system's actual (see Figure 1).
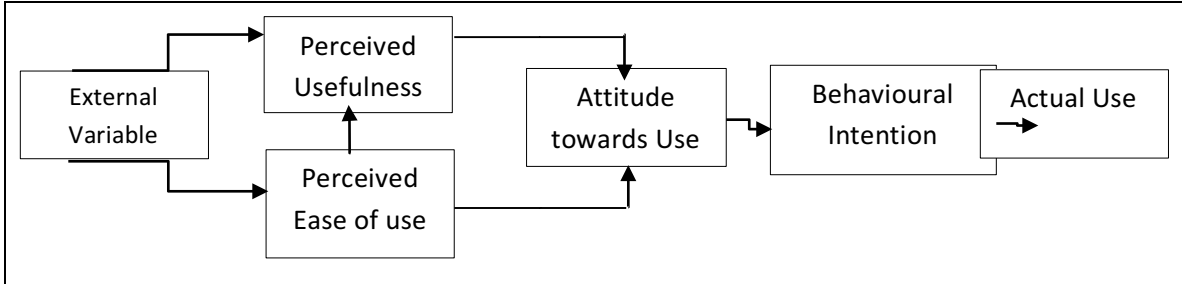

Figure 1. *Technology Acceptance Model (Davis 1989).*

RESEARCH MODEL AND HYPOTHESES

A majority of research studies that adopted the TAM have extended the model by including new variables or reducing existing variables to suit particular context of the study. Likewise, this study extended the model to suit the context of Web 2.0 technologies acceptance in Ghana. In this case the TAM was extended by including self-efficacy and social influence as exogenous constructs. This study considered BI as the main dependent variable instead of actual use (AU) of the technology (see Figure 3). As posited by Sanchez-Prieto et al (2015), the use of technology acceptance model in this study proposing BI as the main dependent variable presents three main advantages. First, Web 2.0 technologies are not widely available in the Ghanaian pre-service teacher educational context. Secondly, information on the actual use might be considered too sensitive by the universities, and that might hinder respondents' participation. Lastly, the use of self-reports to register the actual use of Web 2.0 technologies will make the student teachers' answers less reliable (Teo, Fan & Du 2015). Bearing this in mind, the selection of the behavioural Intention (BI) as the key dependent variable seemed the most reliable reasonable option for this study. This alternative has been frequently employed in acceptance models designed for studies with teachers and student teachers (Aypay et al. 2012; Teo, Fan & Du 2015).

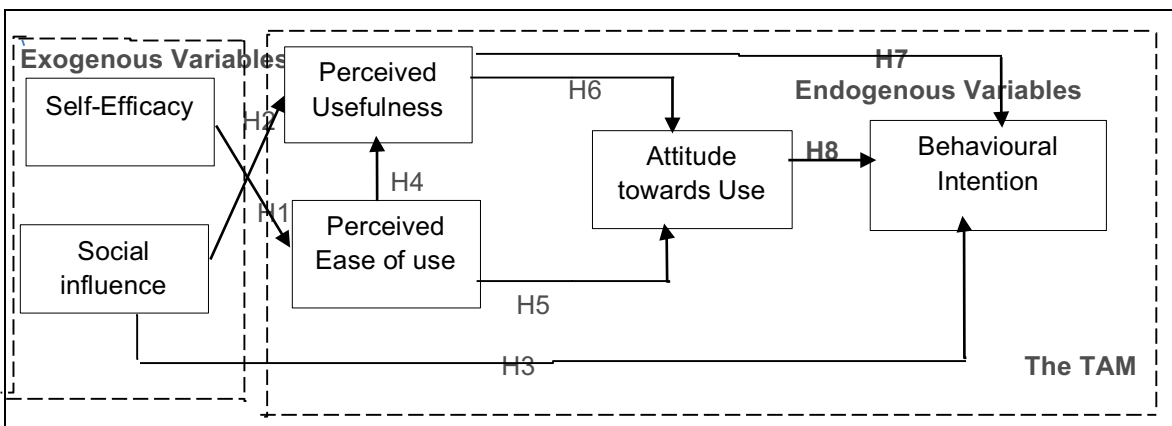The hypotheses and constructs are shown in Figure 2:

Figure 2. *The Research Model*

The proposed hypotheses have been carefully organised into exogenous and endogenous variables. In accordance with the research objective and consistent with the related literature, this study tested the following hypotheses:

Exogenous Variable

Self-efficacy

Bandura defined self-efficacy beliefs as peoples' "beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives" (Bandura 2001:257). In fact, some research studies have shown that self-efficacy beliefs may be more important than skills and knowledge among teachers who implement ICT in their classrooms (Ertmer & Ottenbreit-Leftwich 2010; Wong, Teo & Russo 2012). A study by Wozney, Venkatesh and Abrami (2006) indicated that one of the two greatest predictors of teachers' technology use was the confidence they had that they could achieve instructional goals using new technology. Supporting this view, researchers such as Ertmer & Ottenbreit-Leftwich 2010 suggest that self-efficacy should be a major focus in teacher education courses. A similar study by Hayes (2007) in Australia found that the more confident an instructor was in his or her abilities to use technology, the more the instructor believed that the system could be used easily. In this study self-efficacy is defined as a student teachers' self-confidence in his or her ability to learn via Web 2.0 technologies. On this basis it is hypothesised that:

H1:   There is a positive relationship between student teachers' self-efficacy and their perceived ease of use of Web 2.0 technologies.

Social Influence

Venkatesh et al (2003) refers to social influence as individuals' thoughts, attitudes, or behaviours influenced by their interactions with others. It also includes environmental factors, such as opinions of friends, relatives, and other important people, which have significant effects on a person's behaviour. It is also believed that student teachers seem to rely more on the opinions of significant others when they feel a greater degree of uncertainty with regarding the use of a new technology. In this study, social influence refers to as the extent to which student teachers perceive that most people who are important to them believe that they should or should not use the Web 2.0 technologies. Based on this, the following hypotheses are proposed.

H2:   Social influence is positively and significantly related to perceived usefulness
H3:   Social influence is positively and significantly influence student teachers' behavioural intention to use Web 2.0 applications.

Endogenous Variables

Perceived ease of use

Many research studies have hypothesised perceived ease of use to be a fundamental determinant of perceived usefulness. This implies that if Web 2.0 technologies are not easy to use then they will probably not be perceived as useful. A large body of literature provides evidence of the impact of perceived ease of use on the attitude towards usage and indirectly towards behavioural intention (Teo, Fan & Du 2015; Wong, Teo & Russo 2012). For example, Wong, Teo and Russo (2009) in their comparative study between student teachers in Malaysia and Singapore based on the TAM, documented that perceived ease of use was a significant determinant of both perceived usefulness and the attitude towards computer use among student teachers. All other things being equal, a

student teacher is likely to consider Web 2.0 technologies to be useful and also develop a positive attitude towards them when they are easy to use. Hence, the researcher proposed the following hypotheses:

H4:   An individual student teacher's perceived ease of use has a positive influence on his or her perception of Web 2.0 technologies usefulness.

H5:   An individual student teacher's perceived ease of use has a positive effect on his or her attitude towards the use of Web 2.0 technologies.

Perceived usefulness

Perceived usefulness has been hypothesised to be a fundamental determinant of attitude towards use, and hence, behaviour of user's acceptance of a specific application system. Luan and Teo (2009) found that perceived usefulness has a positive influence on both attitude towards use and intention to accept and use technology. In this current study it is hypothesised that:

H6:   An individual student teacher's perceived usefulness has a positive effect on his or her attitude towards the use of Web 2.0 technologies

H7:   An individual student teacher's perceived usefulness has a positive effect on his or her behavioural intention to use of Web 2.0 technologies

Attitude towards use

Although some researchers argued that attitude is a weak mediator between perceived ease of use, perceived usefulness and intention to use and therefore does not significantly influence users intention to use a particular technology (Davis et al 1989; Teo & Schalk 2009), Kersaint et al., (2003) found that teachers who have positive attitudes towards technology feel more comfortable with using the technology, and usually incorporate it into their teaching. By contrast, those who have negative attitudes, resist using it (Teo 2014). Consequently, attitude has been hypothesised as a direct determinant of student teachers' intention to use Web 2.0 technologies.

Hypothesis: 8. A student teacher's perceived attitude towards use will significantly and positively influence his or her intention to use Web 2.0 technologies.

METHODOLOGY

The methodology used in this study was quantitative approach. In addressing the research question, a quantitative cross-sectional survey research design (Creswell 2014) was adopted. The use of this design was grounded within the positivist epistemology in an effort to understand Web 2.0 technologies acceptance among geography student teachers in two universities in Ghana.

Context and Participants

Participants consisted of 300 geography student teachers randomly selected from two universities in Ghana offering a 4 year-long bachelor of education (B.Ed). All participants were briefed on the purposes of the study and informed that they could withdraw their participation during or after they had completed the questionnaire.

Survey Instrument

The study adopted original TAM constructs validated and extended by Teo 2009 and Venkatesh et al 2003 with wording carefully modified to suit the context of the current study. The survey instrument consisted of two parts. The first part included socio-economic characteristics of the respondents whilst the second part required the respondents to give their opinions on 21 items on 6 TAM constructs. All the constructs were measured by multiple-item, five-point scales from Strongly Agree (1) to Strongly Disagree (5). A printed questionnaire was used to maximise the response rate and reduce sample bias in comparison to web-based surveys, which tend to involve low response rates and are biased towards technologically literate and enthusiastic respondents. It was also designed to be completed within a maximum of 15 - 20 minutes to maximise the completed response rate and minimise impact on the time of students.

Validity and Reliability

Pallant (2013) described validity and reliability as two critical factors in quantitative research because they have influence on quality of the data the researcher obtains. To ensure validity in the study, two research experts in ICT in teacher education from the University of Education, Winneba were consulted to determine whether the questionnaire had content validity. After their recommendations, a random pilot survey of 30 bachelor of education students from Catholic University College of Ghana was conducted. Results and feedback from the pilot study and experts' advice were helpful in revising the questionnaires and changes made accordingly. A reliability test based on the most widely utilised Cronbach's alpha coefficient was performed to ensure internal consistency. All the items were over and above the recommended threshold of the Cronbach's alpha co-efficient scale of 0.7 (DeVellis 2012). Therefore, the survey was considered a reliable measurement instrument. Table 1 showed the results:

Table 1. *Cronbach's Alpha*

Scale		Cronbach's Alpha (α)	No of items
Intention to Use	(ITU)	.089	2
Attitude towards Use	(ATU)	.088	4
Perceived Usefulness	(PU)	.085	4
Perceived Ease of Use	(PEU)	.085	4
Computer Self-Efficacy	(CSE)	.084	3
Social Influence	(SI)	.091	4

DATA ANALYSIS AND RESULTS

The data analysis was done by employing IBM Statistical Package for Social Science (SPSS) version 21. The total number of valid survey was 254 out of 300, giving a response rate of 84.6%. The majority of the respondents' age varied between 19 and 25 consisting 51% females and 49% males. Pearson correlations were conducted to gauge the strengths and the relationships of the TAM constructs whilst stepwise multiple regression analysis were conducted to test the hypotheses.

Pearson Correlation Analyses

In an efforts to determine the strength and directions of the relationships among the various TAM constructs, a Pearson correlation analysis was conducted. 7 out of the 8 correlations were

significant and positively correlated. Statistically significant and strong positive correlations were found among SI and BI (r=.247**, P<.000), ATU and BI (r=.206**, P<.00); CSE and PEU (r=.140**, P<.000). Other statistically significant but moderate correlations were found among 4 important pairings: SI and PU (r = 124**, P < .000); PU and ATU (r = .111*, P < .031); PU and BI (r = .118*, P < .021); PEOU and ATU (r = .106*, P < 039). Perhaps, the most interesting results from the correlation analysis were the relationships that were insignificant. Contrary to the expectations, a weak correlation was present between PEU and PU (r =.098, P >. 056) as a result rendered statistically insignificant. This is inconsistent with major TAM studies (e.g. Teo 2009 and Davis 1989) findings that found a strong link between PEU and PU. Based on the results of the correlation analyses a multiple stepwise regression analyses were conducted to test the hypotheses. The symbol * means Correlation is significant at the 0.05 level (2-tailed) and means ** Correlation is significant at the 0.01 level (2-tailed).

HYPOTHESES TESTING

A multiple stepwise regression analysis was employed for the hypotheses testing. As Howitt and Cramer (2014) posited, multiple regression quite simply helps us to choose empirically the most effective set of predictors for any criterion. A number of stepwise multiple regression analyses were conducted to test the hypotheses in the study. Each multiple stepwise regression analysis was between a set of independent variables and a single dependant variable. Following a standard practice in the Social Sciences research (Creswell 2012), a statistical significant level of 0.05 (5%) was adopted as a benchmark to accept or reject the hypotheses.

A stepwise multiple regression analysis in which Perceived Ease of Use was set as a dependent variable was conducted to test the first Hypothesis (H1).

Table 2: Influence of SE on PEU

Model	Unstandardized Coefficients		Standardised Coefficients	t	Sig
	B	Std. Error	Beta		
CSE	.095	.043	.114	2.226	.027

   a.   Dependent Variable: Perceived Ease of Use (PEU)
   b.   Independent Variables (constant) Self-efficacy (SE).

Table 2 depicted multiple regression analysis for the influence of computer self-efficacy (CSE) on perceived ease of use (PEU). Results from the table showed that student teachers' computer self-efficacy has a positive influence on their perceived ease of use (PEU) (β = .114; P < .027). Hence, H1 was supported.

Table 3: Influence of SI and PEU on PU

Model	Unstandardized Coefficients		Standardised Coefficients	t	Sig
	B	Std. Error	Beta		
SI	.133	.052	.111	2.165	.031
PEU	.033	.034	.101	1. 618	.517

   a.   Dependent Variable: Perceived Usefulness
   b.   Independent Variable: (Constant), social influence (SI), perceived ease of use (PEU)**

Data from Table 3 showed a surprising result. Whilst social influence was found to influence perceived usefulness (β = .111, P < .031) contrary to the expectations, the relationship between PEU and PU was surprisingly found to be insignificant (β = .101, P < .517). This results contradicted the original TAM that PEU has positive influence on PU (Davis, 1989). Consequently, whilst H2 was supported, H4 proved contrary.

Table 4: *Influence of PEU and PU on ATU*

Model	Unstandardized Coefficients		Standardised Coefficients	t	Sig
	B	Std. Error	Beta		
PEU	.202	.054	.189	3.738	.000
PU	.083	.041	.104	2.036	.042

    a. Dependent Variables: Attitude towards Use (ATU)
    b. Independent Variables (Constant): perceived ease of use (PEU).

Results from Table 4 showed that both perceived ease of use and perceived usefulness have a significant influence on the geography student teachers' attitude towards the use of Web 2.0 technologies. However, PEU (β = .189, P< .000) has a stronger influence on ATU than PU (β = .104, P< .042). Consequently, hypothesis H5 and H6 were supported.

With the ultimate objective of examining factors that determine geography student teachers' acceptance of Web 2.0 technologies, the final aspect of the stepwise multiple regression analysis was to verify the influence of SI, PU and ATU on student teachers' behavioural intention (BI) to use Web 2.0 technologies.

Table 5: *Influence of SI, PU and ATT on BI*

Model	Unstandardized Coefficients		Standardised Coefficients	t	Sig
	B	Std. Error	Beta		
SI	.088	.018	.247	4.951	.000
PU	.072	.031	.118	2.318	.025
ATU	101	.027	.173	3.674	.000

    a. Dependent Variable: Behavioural Intention to use
    b. Independent Variables (Constant): social influence (SI) perceived usefulness (PU) attitude towards use (ATU).

Table 5 depicted the results of multiple regression results for the influence of SI, PU and ATU on student teachers' behavioral intention to use (BI) to use Web 2.0 technologies. Consistent with the findings of major TAM studies (Teo 2009; Hu et al 1999), the proposed model of this study demonstrated that behavioural intention of the student teachers to use Web 2.0 technologies was significantly influenced by social influence (β = .247, P < .000), perceived usefulness (PU) (β = 118, P < .025) and attitude towards use (ATU) (β = .173, P < .000). Consequently, hypotheses 3, 7 and 8 are supported. However, the data showed that social influence (β = .247, P < .000) which is an exogenous factor has the strongest direct influence on geography student teachers' intention to use than the two main TAM constructs (PU, and ATU) which also had direct effect on BI.

Summary of Hypotheses Testing Results

Based on the correlation and multiple stepwise regression analyses the results of the 8 hypotheses tested are summarized in Table 5 below:

Table 6: A summary of hypotheses testing results.

Hypotheses	Path	Hypotheses	Results
H1	CSE ⟶ PEU	P < .027	Supported
H2	SI ⟶ PU	P < .031	Supported
H3	SI ⟶ BI	P < .000	Supported
H4	PEU ⟶ PU	P >.517	Not Supported
H5	PEU ⟶ ATU	P < .000	Supported
H6	PU ⟶ ATU	P < .042	Supported
H7	PU ⟶ BI	P < .025	Supported
H8	ATU ⟶ BI	P < .000	Supported

N=254, Significance level at 0.05 (5%) confidence level.

In precis, the study showed that apart from hypothesis 4, all the 8 hypotheses were supported as showed on Table 5. The next section focuses on the discussion of the data linking them to the literature and the theoretical framework of the study.

DISCUSSION AND IMPLICATIONS

This study attempted to validate an extended technology acceptance model (TAM) on data derived from 254 geography student teachers from two universities in Ghana. This was achieved by incorporating two exogenous variables namely computer self-efficacy and social influence to the original TAM. Several noteworthy findings emerged from the study.

First, apart from hypothesis 4, all the eight hypotheses proposed in the study were supported (see Table 6). Again, the study found that attitude towards use, perceived usefulness and social influence had direct significant influence on the student teachers' behavioural intention to use Web 2.0 technologies. However, from the effect sizes, social influence which is an exogenous variable (β = .247, P < .000) was found to be the most dominant determinant of the geography student teachers' behavioural intention to use Web 2.0 technologies compared with the two original TAM variables PU (β = .118, P < .025) and ATU (β = .173, P < .000). From this perspective, geography student teachers in the two universities in Ghana may choose Web 2.0 technologies not only because that they perceived learning via Web 2.0 technologies would be useful or have positive attitudes towards use, but predominantly for the reason that they perceive the pressure from the people who are important to them, such as vice chancellors, deans, lecturers, parents and even political appointees as well as traditional authorities. In the same vein, it is important to recognise that, as more and more geography student teachers in the two Ghanaian universities continue to embrace the Web 2.0 technologies such as Facebook, WhatsApp's, wikis and blogs their colleagues' student teachers will also be attracted to embrace them. Consistent with this finding, Venkatesh et al (2003) posited that, factors such as opinions of friends, relatives, and other important people, have a significant effect on a person's behavioural intention to use technology. This finding could also be attributed to the data in Table 1 which showed that the participant population in the study overwhelmingly fitted within the age range focused on by the 'digital natives' debate in education (Prensky 2001).

In examining the relationships among the original TAM constructs, PU and ATU were found to have direct effect on BI. Consistent with this finding is Legris et al (2003) who concluded in their study

that teachers' attitude towards technology and its perceived usefulness are significant determinants of behaviour that may influence teachers' success in high-level use of technology for instruction. This finding is inconsistent with the findings of other major TAM studies (Afari-Kuma & Achampong 2010;   Al-Azawei, Parslow & Lundqvist, 2017; Teo & Schalk 2009) which established that ATU is a weak mediator between PEU, PU and therefore, excluded it from their analyses. For example, Davis et al (1989) documented that users may use technology even if they do not have positive attitudes towards technology as long as they perceived it to be useful and easy to use in ways that enhance their productivity. Similarly, a local study by Afari-Kuma and Achampong (2010) in Ghana found that ATU has no influence on BI. This finding warrants further studies to validate it.

An unexpected but interesting finding from the study was that perceived ease of use which has been found to be a dominant influence on perceived usefulness had no significant influence on perceived usefulness (β = .101, P >.517). This suggests that the geography student teachers will tend to use Web 2.0 technologies if they perceive Web 2.0 technologies to be a useful and meaningful way to work more effectively. A number of plausible reasons could be assigned to this particular finding. The first reason could be that, since Web 2.0 technologies such as Facebook, blogs and WhatsApp's in particular have been extensively used in Ghanaian society for over a decade, the student teachers might have been relatively conversant with the use of these technologies for personal purposes and therefore, see PEU of Web 2.0 technologies as insignificant but focused on its usefulness. Again, the participants generally fall within the age bracket focused on digital native debate in education (Prensky 2001) which favours the acceptance and adoption of new technologies. The finding that PEU had no significant influence on PU is interesting and new. Further research is necessary to determine whether this finding is found in other contexts and to clarify the mechanism that explains it.

Rather than PU which shows stronger influence on ATU in the Western culture (Davis 1989; Persico, Manca & Pozzi 2014), this study found that PEU had a stronger influence on the student teachers' attitude towards Web 2.0 use (β = .202, P < .000) than PU (β = .104, P< .042). Another significant finding was that CSE was a significant predictor to PEU (β = .114, P < .027). This is consistent with Hayes (2007) who found in his study in Australia that CSE had a significant influence on PEU. This finding suggests that the two universities should provide special training courses in order to improve the geography student teachers' self-confidence.

CONCLUSIONS

This study was set to adopt an extended version of the TAM to empirically investigate geography student teachers' acceptance of Web 2.0 technologies in Ghana. Noteworthy findings were that all the three original TAM constructs PEU, PU and ATU were found to have a significant positive direct and indirect influence on the geography student teachers' willingness to accept Web 2.0 technologies. These results indicate that the TAM holds very well in the Ghanaian teacher educational context. Inconsistent with the findings of this study, is a prior study in Ghana by Afari-Kuma and Achampong (2010) which concluded that the TAM is not applicable to a developing country like Ghana. The inconsistencies in the findings could be attributed to the type of technology adopted, the participants and the contexts of the study. Thus, whilst this current study focuses on acceptance of Web 2.0 technologies by geography student teachers in Faculties of Education in two universities for pedagogical purpose, the study by Afari-Kuma and Achampong (2010) examined the use of computers by students who were not trained to use computers for pedagogical purpose in a single university. Interestingly, social influence which is an external construct had the strongest direct impact on the student teachers' behavioural intention to use Web 2.0 technologies. Surprisingly, PEU which has been found to be the dominant variable influencing PU did not have a significant influence on PU. This inconsistency in the findings could be attributed to the prior reasons given in the study as well as the differences in the participants' cultural context compared

to those in the Western world. In line with this finding is Teo (2010) who put forward the need for validating the TAM in different cultures so as to strengthen its cultural validity. Based on the literature and the data analysis, this study has been able to develop a new theoretical model which could provide a better explanation of the Ghanaian geography student teachers' intention to accept the Web 2.0 technologies for pedagogical purposes. This new model could be adopted in predicting Ghanaian geography student teachers' intention to use Web 2.0 technologies.

LIMITATIONS

In spite of the significant findings of this study, the study was not without limitations. First, the sample has a bias towards the data source gathered from student teachers in only two universities in Ghana. This may not represent the opinions of student teachers in other universities in Ghana. Second, as this study was based on a single course of study, any generalisation of its results to other subject areas should be done with caution. Future research on geography student teachers' acceptance of Web 2.0 technologies should focus on number directions. Firstly, it should take into consideration on a broader range of variables rather than only social influence and computer self-efficacy. Relevant variables including leadership support, job relevance, technical support, prior knowledge and others could be considered to make the TAM more fruitful. Secondly, since this study was limited to only geography student teachers, it is valuable to consider student teachers in other core subject areas in Ghanaian educational system such as Mathematics, English Language, Social Studies, Science and others. Lastly, a large-scale survey covering all the universities offering teacher training programmes should be conducted to confirm the findings to a more generalised population.

IMPLICATIONS

Given that geography student teachers in Ghana are unlikely to be conversant with the Web 2.0 technologies in the classroom context due to their newness as a teaching and learning tools, the use of these new technologies could be modelled by the geography teacher educators as well as the geography teacher mentors in the practicum schools. However, the major challenge is that, in Ghana most of the teacher educators and mentor teachers who are supposed to model the Web 2.0 technologies use to raise these student teachers self-efficacy, themselves lack confidence and competence in their ability to use these new technologies. In this respect, ICT skill training courses should be organised for the student teachers in order to enhance their self-efficacy which will in turn can positively influence their beliefs about Web 2.0 acceptance. Relevant training sessions should also be organised for the teacher educators and the mentor teachers in order to enhance their knowledge about how Web 2.0 can be effectively be use in the classroom. Additionally, given that 'pressure from authority' and 'peer pressure' are the most influential factors for Web 2.0 technologies acceptance among Ghanaian geography student teachers, it is important to foster an institutional culture such that prominent figures could provide a model to use the Web 2.0 technologies. In the context of this study the vice chancellors, deans, lecturers have a critical role to play. However, it remains a question about the role of the leadership in the universities in the lecturers' professional development in the use of Web 2.0 technologies. Again, influential people such as political and traditional leaders should continue to make it their responsibility to educate and create awareness to the youth about the need to embrace these new technologies whenever they get a platform in the community. Ghanaian government ICT initiatives through building of Information Community Centres equipped with ICT facilities in various communities in the country is a good step in the right direction which can help equip the youth.

Lastly, for Web 2.0 technologies to be accepted and effectively used by geography student teachers in Ghana, these new technologies should be introduced as early as possible in these

students' university career. With the rapidly changing context of technology today, understanding how technology acceptance knowledge develops within a specific teacher preparation programme will, in no doubt be a critical planning component for effectively preparing students for the increasingly technology-infused workplace. This study adds to the existing literature by applying an extended TAM in a non-Western cultural context, hence, allowing researchers to assess the validity and robustness of the model across cultures.

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