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Effect of Mobile Learning Application of Electric Motor Winding Tutor on Students' Self-Belief and Technology Acceptance Model (TAM)

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ABSTRACT

Electrical/electronic students are unlikely to gain employment in industry after university education because of their incompetence in winding or rewinding electric motors. One of the ways for students to acquire winding/rewinding skills during their undergraduate studies is to use a mobile application tutor. This study examined the effect of the mobile learning application of electric motor winding tutors on students' self-belief and technology acceptance model. The Mobile Learning Model (MLM) of electric motor winding was tested with a structural equation model with 308 undergraduate students from Nigerian universities via a questionnaire. The findings show that the variables from the TAM model factors (perceived ease of use, perceived usefulness, and attitude towards mobile) had a significant effect on students' self-belief (self-efficacy, self-esteem, and self-confidence). Findings also reveal that students' self-belief variables influence their success in using mobile application tutors and, as a result, they can wind electric motors without supervision.

Keywords: Mobile learning tutor; electric motor winding; self-efficacy; self-esteem; self-confidence; perceived ease of use; perceived usefulness and attitude towards mobile

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1. Introduction

Mobile phone service providers in Nigeria offer 3G and 4G services. Mobile phones are currently cheaper than desktop computers or laptops and can be a suitable tool for teaching and learning (Haug &Tumbo 2016; Dawson 2007). Mobile learning applications (Apps) are devices used throughout the world and are internet-based because internet connectivity is one of the fundamental requirements for successful electronic learning.

Kukulska-Hulme and Traxler (2007) pointed out that university students can be connected virtually by mobile phone with other students in another university and engage themselves in learning regardless of time and location. Wireless broadband connectivity is part of the reason for the popularity of mobile phones. These functionalities allow the users to communicate on the go and learn through the mobile learning app tutor.

In Nigeria, most students use mobile phones (such as the iPhone, Nokia, Tecno, Blackberry, and others) both within and outside universities. Smartphones, tablets, and Android phones are the most commonly used mobile phones for learning. Mobile phones have features like Multimedia Messaging Service (MMS), video recording, Bluetooth, Short Messaging Service (SMS), electronic books, educational software, and GPS, which may be the main reasons for their popularity (Attenborough & Abbott, 2018). The objective of these mobile phones is to allow people to learn on the go. While mobile learning cannot replace formal education, it promotes learning outside the classroom and for interactions (Sharples et al., 2010).

At the university level, mobile learning is becoming a tool for learning and providing students with improved attitudes toward learning and a thorough understanding of knowledge tasks (Abachi and Muhammad 2014, O'Bannon and Thomas 2014). Mobile learning encourages teachers and students to try new things. It clarifies challenging topics and connects people anywhere and at any time (Jeng, Wu, Huang, Tan, Yang, 2010; Parsons and Ryu, 2006).

Mobile learning is simple because of its compact design and self-managed nature, which encourages students to become more interested in studying and acquiring knowledge (Huang, Jang, Machtmes & Deggs, 2012). Learning using a mobile phone is hence referred to as mobile learning (Iqbal and Bhatti, 2016). It's an excellent tool for self-directed or group learning (Burden and Kearney, 2016; Callum and Kinshuk, 2006). It is emerging as a device in the teaching and learning process (Grant, 2019). Mobile learning encompasses the mobility of technology, space, and a learning experience.

A tutor is programmable software for mobile devices that allows students to learn on the go. One of the most basic needs for successful electronic learning is internet access, and a vast number of mobile learning apps (MLA) in use throughout the world are internet-based. Students use cell phones to connect online, interact with students from other colleges, and learn regardless of time or location (Kukulaska-Hulme and Traxler, 2007). These features enable users to collaborate and study through the mobile learning application tutors.

Mobile learning App tutor provides social synthesis, practical modelling support and learning intervention for electrical and electronic students. It presents the concept of electric motor winding simply by using the app offline and online (Hwang and Chang 2015; Oyelere and Suhonen 2015). As a result, the mobile learning app tutor is designed to ensure that the issues of internet connectivity and bandwidth, which persist in Africa and Nigeria in particular, have no detrimental impact on the teaching and learning of electrical motor winding. Mobile learning app tutors help electrical and electronic students with fault detection, electric motor winding completion, and the learning process.

Students lack the requisite background to grasp the principles of winding and rewinding through traditional education, lack self-belief and hence do not have the proper attitude toward studies. Instead of using a parochial strategy to solve the problem of learning in the classroom, a mobile learning application tutor was appropriate for electric motor winding. As a result, students were exposed to a novel approach to teaching and studying electric motor winding.

Students might benefit from using mobile learning app tutors to enhance skills that assist traditional teaching and learning (UNESCO, 2012). Mobile learning is needed for students' courses to make learning concrete, especially in the winding of electric motors (Liu et al., 2010). Park et al. (2012) observed that mobile application tutors' effectiveness has not yet been investigated and hence requires research priority.

Furthermore, mobile learning outside the classroom could benefit from a better understanding of self-belief as a mobile device construct incorporated into the technology acceptance model (Kukulska-Hulme, 2012). Mobile learning apps allow educators to support students as they engage in mobile learning activities across time and space (Almaiahi, 2018). It enables the students to create self-belief by winding an electric motor in the study area. Mobile learning app tutor has the potential to facilitate teaching and learning, thereby addressing the problem of age and sex discrimination among mobile learning app tutor users (Adekoya, Botha & Ogunleye, 2012; Adewole & Fakorode, 2013).

Self-belief is the ability in mind to execute a task within a set limit and is a concept in education since it affects the behaviour of both teachers and students (Bandura 1997, Cheung 2005a). Students with high self-esteem, for example, perform better academically than pupils with low self-esteem, according to studies (Bandura 1997; Britner and Pajares 2006; Tenaw 2013). The Technology Acceptance Model (TAM) enables students to understand and believe in themselves to promote learning beyond the classroom (Kukulska Hulme, 2012). And such an understanding of it informs educators to support mobile learning experiences across time and place (Almaiahi, 2018).

In this study, TAM theory structures the research findings to improve the process of self-belief in mobile learning for the skill acquisition of electric motor winding abilities in Nigerian universities. Perceived usefulness explains the contents and benefits of mobile learning for electric motor winding. Perceived ease of use specifies the functionality of the program model.

We examined the self-belief factors for the quick intervention of electric motor winding in the developed model to provide insights into how students use their personal beliefs about learning for the winding process and skill development. The purpose of this research aims to answer the following research questions:

(1) What is the effect of the mobile learning application of electric motor winding tutors on students' self-belief and technology acceptance model?
(2) What are the students' self-belief factors responsible for the quick intervention of electric motor winding using the mobile application tutor?

The study expanded constructs of the technology acceptance model (TAM) of self-belief constructs (self-efficacy, self-esteem, and self-confidence) for personal task construction on electric motor winding. Therefore, the researcher is interested in using mobile learning app tutors to educate students to learn electric motors in Nigerian universities to address the problem of unskilled, incompetent, and inexperienced electrical and electronic students. The study aims to investigate the effect of the mobile learning application of electric motor winding tutors on students' self-belief and technology acceptance model.

2. Choice of TAM

The design of the Theory of Unification of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. (2003) was to be better than previous models of the Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975), the Theory of Planned Behaviour (TPB) (Ajzen 1991), the Technology Acceptance Model (TAM) (Davis 1989), the Combined-TAM-TPB (Taylor and Todd 1995), the Model of PC Utilization (MPCU) (Thompson et al., 1991), the Motivational Model (MM) (Davis et al., 1992), Social Cognitive Theory (SCT) (Bandura 1986) and Innovation Diffusion Theory (IDT) (Rogers 1995). However, this UTAUT only explains age, gender, experience, voluntariness, and relationship of use to include effort expectancy, performance expectancy, and social influence to predict behavioural intention (Birch and Irvine, 2009).

UTAUT is a research model based on psychology and sociology but not on self-belief constructs (Venkatesh et al., 2003). Hence, in this study, the TAM model was used to explain the self-belief construct.

2.1. A Technology Adoption Model (TAM)

The Technology Adoption Model (TAM) is a learning concept to explain mobile technology acceptance devices (Venkatesh & Davis, 2000). The findings of TAM inspired researchers to look into electronic system acceptance and utilization, learning satisfaction for educational videos (Nagy, 2018), and teleconferencing systems (Park et al., 2014b). The researcher investigates students' attitudes towards mobile phones, perceived ease of use (PEOU), and perceived usefulness (PU) as technological devices for learning.

TAM is considered one of the most effective models for explaining new technologies due to its extensive examination through validations, applications, and replications (Venkatesh 2000). Researchers like Padilla-Melé-Ndez et al. (2013), Lee and Lehto (2013), Park et al. (2012), Tarhini et al. (2016), and Yeou (2016) have used this model with success. Many research and technological applications apply the TAM model (Mohammad & Abu Dalbona, 2013). TAM is used to explain characteristics that influence technology adoption. The validity of the TAM applications in many situations and study designs (Chismar & Wiley-Patton, 2003)

Davis (1989) found the Technology Acceptance Model (TAM) to be a good model for software development and electronic learning. Figure 1 explains the use of the technology acceptance model (TAM) for the investigation of the effect of the mobile learning application of the electric motor winding tutor on students' self-belief and the technology acceptance model (TAM). As a result of the many applications of TAM models, the researcher proposed the application of TAM to investigate the effect of a mobile learning tutor app on electric motor winding.

2.2. Self-Belief

One way of understanding the students' thoughts is by examining their beliefs. Indeed, there is an assumption that beliefs are part of a group of constructs describing the structure and content of people's thinking and providing an understanding of their actions (Bryan & Atwater, 2002; Kagan, 1992; Nespor, 1987; Pajares, 1992; Richardson, 1996). People's knowledge and beliefs are related (Calderhead, 1996; Nespor, 1987; Verloop, Van Driel, & Meijer, 2001; Koen L., Free De B., Nadine E., Johan V. B., & James A., (2009).

Beliefs are the premises or superstitions about something a person feels (Calderhead, 1996). Beliefs are often related to other mental constructs: knowledge, dispositions, or attitudes (Hutner & Markman, 2016). Without belief, one cannot demonstrate nor meaningfully utilize a person's understanding and skills. Self-belief is the feeling of an individual that enables him to do something. Such an individual feels empowered. Self-belief gives one the freedom to learn new skills, stimulates lifelong learning and creates opportunities. It gives one self-confidence, self-worth, and self-esteem that permeate thoughts, feelings, and actions. Belief influences academic achievement (Bandera & Chunk, 1981).

Self-belief is a positive feeling that you can do something (Winfield &Eccles, 2000). It is the educational experience of students' prior success with a task (Bandera, 1986). Self-belief influences performance in a given situation (Haiti &Rodin, 1992). Self-beliefs are determinants of student choices and success (Teomara *et al.,* 2019) and are related to student educational experiences, such as prior success with a task (Bandura, 1886). Self-belief represents concepts such as self-efficacy (Bandura, 1997) and expectancy (Wigfield, 1994; Wigfield & Eccles, 2000).

Belief is the ability to apply skills and knowledge, which is of utmost importance in influencing academic achievement (Chunk & Pajares, 2002). Research studies have shown that highly self-believing students had more academic achievement than students with low self-belief (Britner and Pajares, 2006). Students express their interest and use their confidence in the winding of electric motors through a mobile learning application tutor. The researchers obtained the data from the students by using the following constructs: self-efficacy, self-esteem, and self-confidence.

2.3. Self-Confidence

Self-confidence is the ability to carry out a given activity to get a specified result (Bandura, 1966; Chemers et al., 2000). For example, believing that one can wind an electric motor by opening an App on a mobile phone indicates that the person has self-confidence in mobile learning for the experience of winding skills. This type of self-confidence is related to self-esteem, but the difference is the experience relating to that specific job (Bandura, 1977, 1988; Park and Crocker, 2005). As people learn and make decisions, they receive feedback about their talents, which leads to beliefs in those abilities.

Experience-specific definitions of self-confidence often arise from the need to address a particular research context, for instance, the winding of an electrical motor. In all cases, the definition addresses the belief in one's ability (Bandura, 1993). This research aims to find the effects of students' self-belief in the technology acceptance model (TAM) on mobile learning app tutors for electric motor winding in Nigerian universities.

The self-confidence of interest for this research is the experience possessed by the individuals who engaged in it to acquire the skill through mobile learning apps. Greenacre *et al.* (2014) explain that experience influences confidence and thus leads to greater perceptions of interpersonal effects. The following hypotheses effectively carry out skill winding on the electrical motor using a mobile learning app:

H1: Self-confidence has a positive effect on self-esteem.
H2: Self-confidence has a positive effect on self-efficacy.
H3: Self-confidence has a positive effect on perceived ease of use.
H4: Self-confidence has a positive effect on perceived usefulness.
H5: Self-confidence has a positive effect on attitudes towards use.

2.4. Self Esteem

Self-esteem is an attitude towards an individual or a person's overall subjective emotional evaluation of their worth. Self-esteem refers to self-perception and emotional states, including success, disappointment, pride, and shame (Hewitt, 2009). Smith and Mackie (2007) defined self-esteem as the self-concept of sentiments about oneself, which may be either a favourable or otherwise judgment of oneself.

Self-esteem is considered a component of socio-psychology since it has an impact on academic accomplishment (Marsh, 1990; Yagual, 2015), happiness (Baumeister et al., 2003), and marital and relationship satisfaction (Orth and Yagual, 2015).

On the other hand, self-esteem is a factor influencing technology acceptance. Self-esteem, rather than focusing on one's talents, usually refers to one's entire impression of oneself. As a result, the following hypotheses on self-esteem and TAM constructs are for mobile learning apps for this study:

H6: Self-esteem has a positive effect on self-efficacy.
H7: Self-esteem has a positive effect on perceived ease of use.
H8: Self-esteem has a positive effect on perceived usefulness.
H9: Self-esteem has a positive effect on attitudes towards use.

2.5. Self-Efficacy

Self-efficacy is the belief in one's ability to achieve the desired performance (Bandura, 1996). Senegmolu (2000) defined self-efficacy as an individual's assessment of his capability to cope with various conditions and succeed in a task. In this context, self-efficacy refers to a person's conviction in his ability to achieve something using his talents in a given scenario (Maddux, 2002). As a result, the most determinant of individual behaviour is self-efficacy belief. Bandura's social cognitive theory defines self-efficacy as one's ability to plan and execute a task, particularly when faced with adverse conditions (Bandura, 1997).

The ability of a person to wind an electric motor determines his self-efficacy perception of being able to execute a specific challenging activity. Self-efficacy predicts academic performance (Lane et al., 2004), and according to research, self-believers do better in skill programs than self-doubters (Tuekman, 2003).

In learning conditions, a person who is more self-efficacious in a given situation will take on more challenging tasks (Bandura, 1997). Students' academic success and achievement are influenced significantly by their self-efficacy behaviour (Venkatesh and Davis, 2000). There is a relationship between self-efficacy and opinion on abilities (Buyukduman, 2006).

In addition, people with self-efficacy choose to take on challenging activities, investigate their surroundings, or create new ones (Boz et al., 2016). This study provides a model based on self-efficacy explanations.

H10: Self-efficacy has a positive effect on perceived ease of use.
H11: Self-efficacy has a positive effect on perceived usefulness.
H12: Self-efficacy has a positive effect on attitude towards use.

2.6. Perceive Ease of Use (PEOU)

The degree to which a person believes that using a system does not require any physical or mental effort is known as perceived ease of use (PEOU) (Kesharwani and Singh Bisht, 2012). The TAM claims that attitudes, perceived usefulness, and perceived ease of use affect whether or not students accept technology. According to TAM, individuals' willingness to use technology affects actual application and attitudes toward technology that affect intention (Venkatesh et al., 2012).

Many research findings have demonstrated the predictive power of perceived ease of use and perceived efficacy for user technology acceptance. There was a relationship between perceived ease of use, perceived utility, attitude toward a new system, and behavioural intention to use the system (Teo, 2009).

Students would consider the mobile learning application a valuable and simple-to-use learning tool if they could wind an electric motor while deploying mobile learning apps for convenient access to learning materials (video, games, text, images, audio, and animation). The proposed theories are as follows:

H13: Perceived ease of use has a positive effect on perceived usefulness.
H14: Perceived ease of use has a positive effect on attitudes towards mobile

2.7. Perceived Usefulness (PU)

Students would consider the mobile learning application a valuable and simple-to-use learning tool if they could wind an electric motor while deploying mobile learning apps for convenient access to learning materials (video, games, text, images, audio, and animation). Based on the above, this study proposes the following hypothesis:

H15: Perceived usefulness has a positive effect on attitudes towards mobile use.

2.8. Attitude Towards the use of Mobile Learning

Attitude refers to the degree to which a person feels positive or negative about executing a task. Individual unfavourable or favourable judgment toward engaging in a particular behaviour is an attitude (Ajzen, 1991). Previous research (Ajzen, 1991; Taylor and Todd, 1995) has demonstrated that attitude is a substantial predictor of intention. When people believe they have more resources and confidence than they think they have, they feel more in control of their tasks (Ajzen, 1985; Hartwick and Barki, 1994; Kozar, 1995).

Chenet et al. (2012) researched college students' attitudes toward mobile learning in higher education and proposed a conceptual model based on the theory of planned behaviour (TPB). The data from 177 college students was analyzed using a structural equation model. The TPB stated that college students' behavioural control positively affected their intent to use mobile learning. These findings have important implications for improving college students' acceptance of mobile phones and attitudes towards their use.

2.9. Related Works Section

Li, Lee, Wong, Yau, and Wong (2018) examined the effects of mobile apps on the learning motivation, social interaction, and study performance of nursing students. The results showed that the students actively used mobile apps for studying supplementary materials and participated in class activities and clinical assessments. The students showed better study performance after practising mobile learning.

Cheon, Lee, Crooks, and Song (2012) investigated the current state of college students' perceptions of mobile learning in higher education. A structural equation model was used to analyze self-reported data from 177 college students using the theory of planned behaviour (TPB). The findings indicated that the TPB explained college students' acceptance of mobile learning well. More specifically, attitudes, subjective norms, and behavioural control positively influenced their intention to adopt mobile learning. The results have implications for college students' acceptance of mobile learning.

Teo (2009) examined pre-service teachers' self-reported attitudes toward computer use at a teacher training institution in Singapore. Students completed a survey questionnaire measuring their responses to five constructs, which formed a research model using the Technology Acceptance Model (TAM). Structural Equation Modeling (SEM) was the technique used for data analysis. The outcome showed that attitude toward computer use has an effect on perceived usefulness and ease of use, with two external variables, subjective norm and facilitating conditions. The results of this study suggest that the TAM is a valid and efficient model for explaining attitudes toward computer use among educational users.

Almaiah (2018) investigated the use and acceptance of the mobile information system developed and implemented by the University of Jordan. The data was obtained via a questionnaire from 275 undergraduate students at the University of Jordan to test the mobile service acceptance model using a structural equation model. The results revealed that user acceptance of mobile information system services is affected by trust, perceived security, perceived ease of use, and perceived usefulness. Findings also showed that the context of applications is a motivational factor of perceived usefulness and ease of use, with a significant effect on user intention to use the mobile information system.

Mao et al. (2005) investigated factors that influence the usefulness, ease of use, and intentions to use mobile services in the US and Turkey. The findings indicated that self-efficacy and personal innovativeness are the factors that most supported the acceptance and usage of the mobile service among students.

2.10. Proposed Research Model

The research model developed was titled 'Mobile Learning Model (MLM) of Electric Motor Winding. The model explained the relationship between six latent variables: students' self-confidence (SSC), students' self-esteem (SSE), students' self-efficacy (SSF), perceived ease of use (PEU), perceived usefulness (PU), and attitude towards mobile use (ATM).

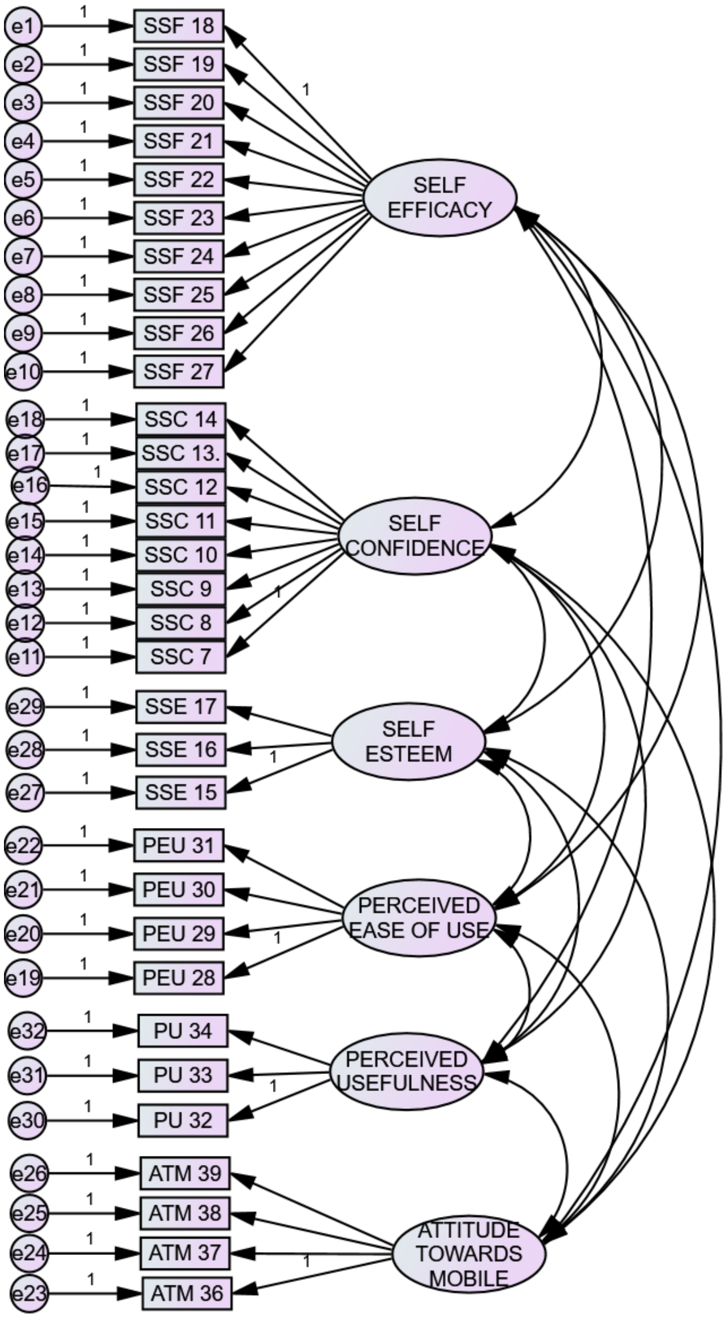

Figure 1: Proposed Mobile Learning Model (MLM) of Electric Motor Winding Self-belief

2.11. Model Fit

The researcher used SPSS 21 to do factor loading analysis. This study did not allow all objects to load at one spot when evaluating convergent validity using the Varimax rotation. It means that item loading as a separate factor isn't a valid method of determining the construct. When every factor loading is in place and is not less than 0.5, convergent validity is determined (Ahmed et al., 2017). As a result, due to model fit inconsistencies (inflating chi-square) and Mahalanobis distance values of more than 308, sixteen (16) components were eliminated from the hypothesized model: SSC7, SSC8, SSC9, SSE15, SSF18, SSF22, SSF20, SSF21, SSF24, SSF27, PEU 30, PEU 31, PU34, ATM35, ATM36, and ATM37.

The suggested approach produced various offending estimations based on CFA's early findings. The consequence was that the single-order measurement model of the Mobile Learning Model (MLM) of electric motor winding would be non-fit. As a result, the model was thoroughly scrutinized, with problematic estimates' values deleted. The factor loadings acquired were then defined with the Maximus Likelihood estimate conducted again.

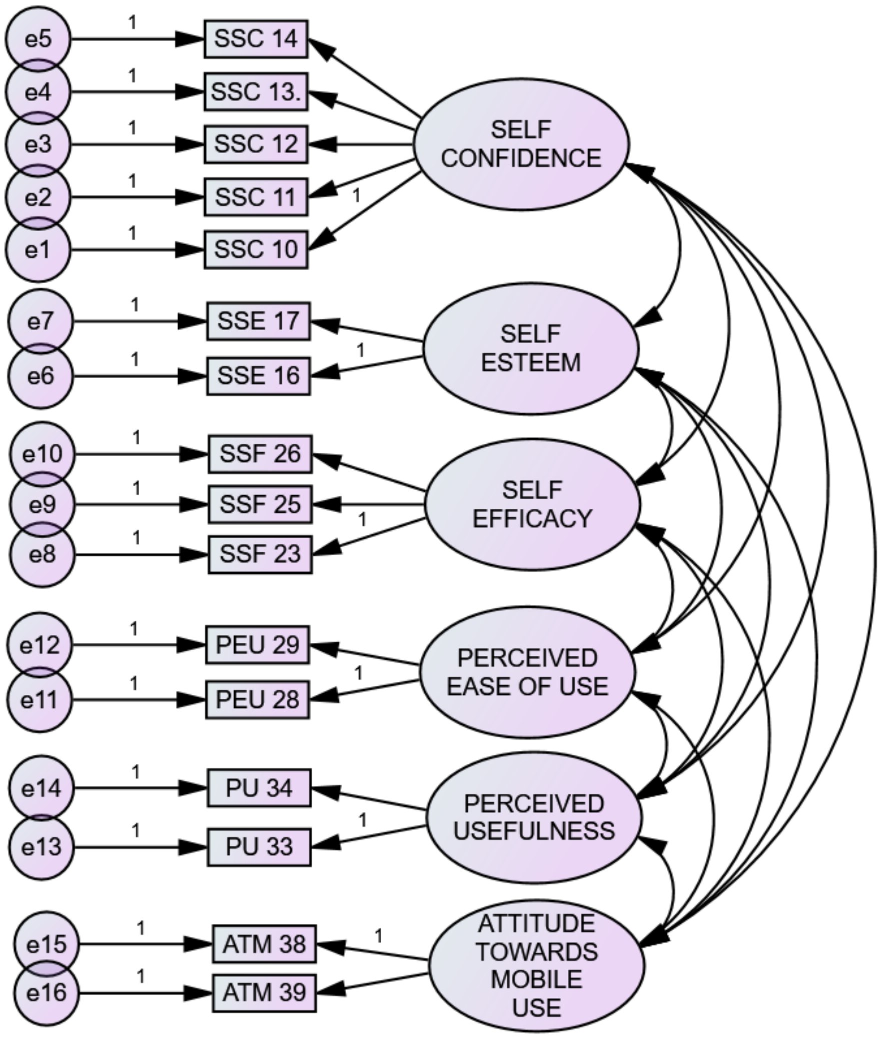

Figure 2: Re-specified Model for Mobile Learning of Electric Motor Winding

2.12. The Research Model and Learning Application

External variables of TAM could be extended to mobile learning self-belief factors (self-esteem, self-confidence, and self-efficacy) to influence perceived usefulness, perceived ease of use, and attitude toward mobile learning (Davis; 1989, 1993. Figure 3 explains the use of the Technology Acceptance Model for the winding of an electric motor by university students using the mobile learning app tutor.

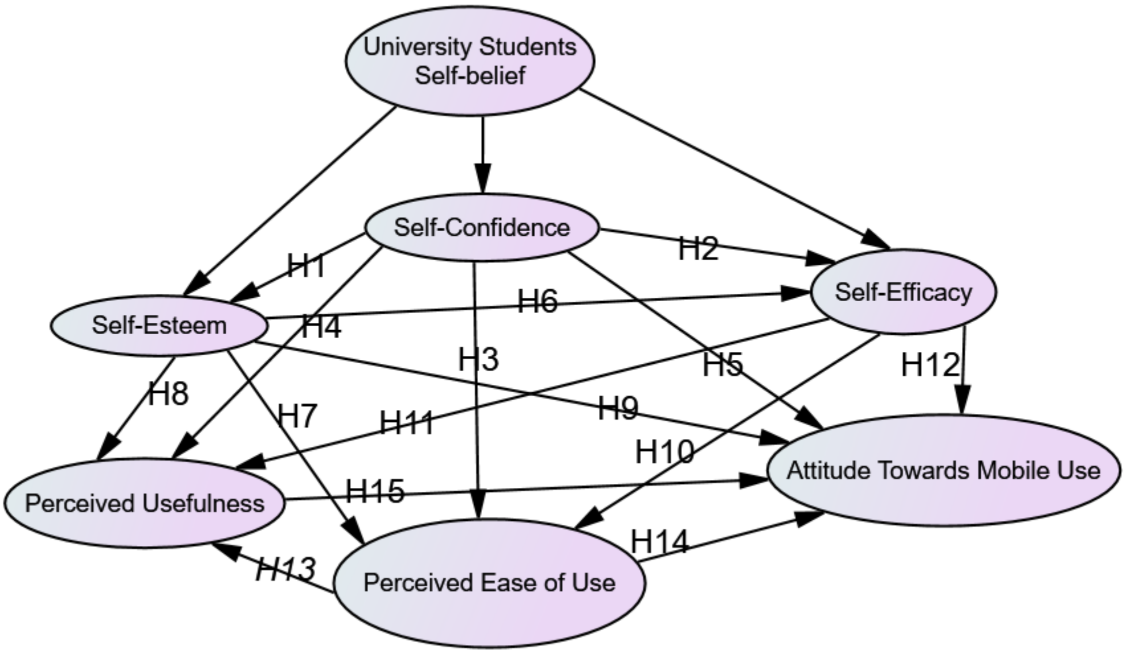

Figure 3: Research Model for the Winding of an Electric Motor in a Mobile Learning App Tutor Environment

Students were ready to use mobile learning app tutors to wind or rewind any electric motor for improved skill performance. TAM proposed a way to predict technology usage (Chang et al., 2012; Venkatesh et al., 2012). The study explains the students' self-belief in using the mobile phone app to wind an electric motor, their perceived ease of use, and their perceived usefulness, which affected the skill for winding an electric motor (see Figure 3).

This self-belief of students, together with the students' characteristics (sex, age), predicts the performance of skills in winding and rewinding the electric motor (Allil and Khan, 2016). The implication is that this study enhances the learning of motor winding and rewinding techniques. It also makes winding easy and assists the students in acquiring the desirable skill.

TAM has helped researchers to investigate the acceptance and adoption of e-portfolio systems (Cheng et al. 2015), teleconferencing systems (Park et al. 2014b), green information technology (Akman and Mishra 2015), e-learning systems (Persico et al. 2014), and social media tools (Acarli and Salam 2015). TAM is a modification of the theory of reasoned action (TRA) proposed by Ajzen and Fishbein (1980) to explain computer usage behaviour.

3. Research Methodology

It was the structural equation model (SEM) technique that assessed the effect of mobile learning on students' self-belief: self-confidence (SSC), self-esteem (SSE), self-efficacy (SSF), perceived ease of use (PEU), perceived usefulness (PU), and attitude toward mobile learning. SEM is a confirmatory strategy and a multivariate method that incorporates measured variables, latent constructs, and measurement error. It is a statistical method for evaluating many hypotheses between observable and latent variables (Hoyle, 1995).

In this study, the SEM technique was the most appropriate method due to its ability to analyze a series of hypotheses and relationships simultaneously, and other statistical methods, such as multiple regression, or multivariate analysis of variance, are limited to the investigation of the relationships between each variable singly (Byrne 2013). It checks the patterns of directional and non-directional relationships between a set of measurable (observed) and latent (unobserved) variables (MacCallum and Austin, 2000).

3.1. Data Collection Method

The data obtained using the questionnaire method for this study consisted of 16 questions to determine six components in the research model for the acquisition of winding of electric motor skills. The data was collected using an online questionnaire created with the help of a Google Survey.

Accordingly, a structured questionnaire derived from the literature was adapted from earlier research, modified, and distributed among the students. During the COVID-19 period, 308 students received questionnaires on November 2nd, 2020, by e-mail and WhatsApp, and the survey was open online until January 15th, 2021. Electrical/electronic university students in Nigeria's technical education departments (300L, 400L, and 500L) make up the sample. The questionnaire was completed by 308 students, with no incorrect responses; hence, the sample size of 308 was sufficient for evaluating the study model.

3.2. Samples and Sampling Techniques

The primary objective of this study was to investigate the effects of the mobile learning application of electric motor winding tutors on self-belief and technology acceptance models. Students from the University of Nigeria, Nsukka, the University of Lagos, Ondo State University, Akungba, Akoko, the University of Ilorin, and the Federal University of Technology, Minna, were chosen as participants. The sample comprised 308 students, with 248 males and 60 females from the five listed universities (see Table 1).

According to Kline (2005), the structural equation model (SEM) is an effective tool for 308 sample analyses because of the large sample size. A sample size of 150 people is the minimum recommendation for structural equation model (Bentler & Chou, 1987). Many scholars recommend a sample size of 200–500 for structural equation models, with at least 200 (Yilmaz et al., 2018).

A purposive sample is a type of non-probability technique designed for this study. The choice of purposive sampling technique for this study was because some universities in Nigeria do not have a functional workshop setting where these categories of students could undertake the winding of the electric motor. Furthermore, the students had the experience of using a mobile phone. Thus, the researcher purposely selected the universities that are running courses in technical education and have functional winding workshop settings for practice, thereby comparing the one done using a mobile phone with that of workshop practice in terms of speed and time management.

Before the COVID-19 period, the researcher trained the research assistants on mobile learning, and subsequently, the research assistants tutored the students in their respective universities. During the first two weeks of the student's enrolment, they participated in the research of mobile learning for the winding of electric motors, and their involvement was voluntary and complete confidentiality was assured. The students responded to the invitation issued by the research assistant, and those who agreed to take part in this study were told to download the mobile learning from the play store and were given a password and user name to access the program on their mobile phones.

After successfully learnt the electric motor winding using mobile learning, the students completed an online questionnaire (see Table 1). Before questionnaires were completed, all students attended a training program where they were given both the mobile learning app and module handbooks. These handbooks contain detailed information on learning objectives, syllabi, lecture/seminar topics, and tips on the winding process. Additionally, module handbooks would include examples of previous MCQ examinations, charts, and coursework assignments. Given this information, plus the fact that there is an accomplice video of the winding tutor embedded in the app, it was felt that the students would be able to make reasonable estimates of their self-belief in the process of winding electric motors via mobile learning. No reward was given to the participants who were happy to rewind the electric motor using the mobile app.

3.3. Measurement Model

The study used the questionnaire items of earlier research with adjustments made such that the components fit the research's inter-relationship self-belief: self-efficacy (Urver et al., 2017), self-esteem (Yu, 2020); self-confidence (Christensen and Knezek, 2017); attitude toward the use of mobile learning app tutor (Teo, 2009); perceived case of use and perceived usefulness (Christensen and Knezek, 2017). The survey maintained content validity in Nigeria's six geographical zones, with five universities representing each zone, and students were required to learn electric motor winding through mobile learning.

Students' self-confidence (SSC), self-esteem (SSE), self-efficacy (SSF), perceived ease of use (PEU), perceived usefulness (PU), and attitude toward mobile learning are all included in the instrument questions. The questionnaire included six items to collect demographic data from the sample, with two sections of an online survey completed by participants. Section 1 covers questions about the respondents' characteristics, such as the university's name, age bracket, gender, type of mobile devices used for mobile learning, years of mobile learning experience, and current undergraduate level. Section 2 asks about other variables in a forty-one-variable theoretical model. Items on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Table 1 shows the demographic data of the respondents.

Table 1.
Demographic information

	Characteristics	Frequency	%
Name of the University	University of Nigeria, Nsukka	91	29.5
	University of Lagos	45	14.6
	Ondo State University, AkungbaAkoko	59	19.2
	University of Ilorin	65	21.1
	Federal University of Technology, Minna	48	15.6
Gender	Male	248	80.5
	Female	60	19.5
Age	15 – 18	91	29.5
	19 – 22	134	43.5
	above 23	83	26.9
What type of phone do you use?	Basic/Ordinary mobile phone	-	-
	Smartphone	308	100
	I don't know the type of phone I use	-	-
Including current year, how many years have you been using Mobile phone?	0 – 2 years	69	22.4
	3 – 5 years	134	43.5
	over 6 years	105	34.1

What is your current level of study?	300	125	40.6
	400	110	35.7
	500	73	23.7

3.4. Pilot Study

Five final-year students from the Department of Industrial Technical Education at Yaba College of Technology in Lagos state used mobile learning tutors as a pilot study of the winding of the electric motor. Three of the students were males, and two were females. At the beginning of the pilot study, the students received training to use a mobile learning tutor for the winding of the electric motor by downloading the mobile learning tutor from the play store and were given a password and user name to access the program on their mobile phones.

The students are to fill out a questionnaire intended to evaluate the training effectiveness of mobile tutors and the use of module handbooks. This study uses descriptive statistics data to determine the mean and standard deviation. An exploratory factor used the hidden variable structure (EFA) to examine the data in this study. The traditional chi-square method tested whether the model suited the data, as it is a good fit for a model that is sensitive to sample size (Hair et al. 2012).

4. Results of Descriptive Analysis

Table 2 shows descriptive statistics for all measured variables. The mean ranges from 4.41 to 4.64, with a standard deviation of 1.11 to 2.56, indicating that students could utilize a mobile learning app to wind an electric motor. The findings also demonstrate that the respondents agree that students' self-belief and the technology acceptance model (TAM) are variables and models to consider while developing a mobile learning app for electric motor winding at a Nigerian university.

Table 2.
Descriptive analysis of the constructs

Construct	Mean	Standard deviation
Self-Confidence	4.62	2.56
Self-Esteem	4.57	1.25
Self-Efficacy	4.64	1.58
Perceived Ease Of Use	4.41	1.15
Perceived Usefulness	4.57	1.18
Attitude Towards Mobile Use	4.64	1.11

4.1. Assessing Validity and Reliability

Hair et al. (2010) defined reliability as a measure of consistency across multiple variables. This study evaluates the overall reliability of each aspect of the self-belief and technological acceptance model of mobile learning apps for winding the electric motor. Hair et al. (2010) indicate that all Cronbach's alpha coefficient values were above 0.70, implying that the questionnaire was accepted and admissible. It showed that the items were judged dependable due to their internal consistency. The mean values for various components ranged from the lowest (m = 4.32) to the highest (m = 4.68).

This study also explored construct validation utilizing analysis of moment structures software (AMOS) and maximum likelihood (ML) to analyze the data to validate the instrument. This method is called confirmatory factor analysis and is more advanced because the postulated components are related to the underpinning theory (Hair et al., 2010). The study shows the details in Tables 3, 4, 5, 6, 7, and 8.

4.2. Analysis of the Measurement Model

The reliability of questionnaire items uses confirmatory factor analysis to access the measurement model and thus explains the construct's variables (Hair et al., 2010).

We used exploratory factor analysis (EFA) to test the measurement model by estimating the construct factor loadings. The researcher calculated Cronbach's alpha and average variance extracted (AVE) to assess the items' reliability and then confirmed that the constructs' reliability and validity should be greater than 0.70 (Hong, Thong, and Tam, 2006).

As shown in Table 3, each of the constructs has a Cronbach's alpha greater than 0.7, indicating good internal consistency and thus satisfactory reliability for all variables.

Table 3.
Internal Consistency of the construct

Construct	Mean	SD	Cronbach's alpha
Students' Self Confidence			**0.85**
I feel confident that I could use mobile phone to have access to online learning activities	4.59	0.65	
I feel confident that I could transfer photos of electric motor winding or other video via a mobile phone	4.6	0.63	
I am confident that this mobile learning covered critical content necessary for the mastery of electric motor winding curriculum	4.61	0.64	
I am confident that I am developing the skills and obtaining the required knowledge from this mobile learning to perform necessary tasks in electric motor winding setting	4.62	0.66	
I am confident to use mobile phone to perform critical aspects of skills acquired for motor winding	4.66	0.68	
Students' Self-esteem (SSE)			**0.77**
I feel proud of using mobile learning for electric motor winding	4.5	0.7	
I think mobile learning can make me successful in learning electric motor winding	4.64	0.69	
Students' Self efficacy (SSF)			**0.78**
I can solve most problems if I invest the necessary effort on my phone while using it for learning Electric Motor winding	4.68	0.6	
When I am confronted with a problem on my phone while using it for learning Electric Motor winding, I can usually find several solutions	4.6	0.66	
I can usually handle whatever comes my way while using mobile phone for learning of electric motor winding	4.64	0.63	
Perceived ease of use (PEU)			**0.77**
Using mobile phone for electric motor winding, learning is easy for me	4.32	0.64	
My interaction with mobile phone for electric motor winding does not require much effort.	4.5	0.66	
Perceived usefulness (PU)			**0.73**
Using mobile phone for learning enhances my effectiveness.	4.54	0.64	
Using mobile phone for learning enables me to accomplish motor winding more quickly	4.6	0.69	
Attitude towards Mobile learning (ATM)			**0.71**
Mobile learning will improve communication between student and teacher while winding electric motor.	4.62	0.61	
Mobile learning is a quicker method of getting feedback in electric motor winding	4.67	0.64	

4.3. The Hypothesized Strategy for the Model

The confirmatory approach (CFA) provides a single model of a collection of relationships and uses SEM to assess the model's suitability. Thus, the confirmatory factor analysis results in Table 4 explain all observed variable factor loadings. It stated that all the factors were satisfactory. The scores range from 0.62 to 0.85. Factor loadings and regression weight estimates of latent or observable variables should be greater than 0.50 (Hair et al., 2006; Byrne, 2010).

It shows that all constructs passed the construct validity test, implying that all elements belonged to the core values stated. Figure 3 illustrates the performance of the CFA model of students' self-belief. Second, all six constructs were correlated, yielding fifteen hypotheses. Figure 4 shows a schematic depiction of this paradigm.

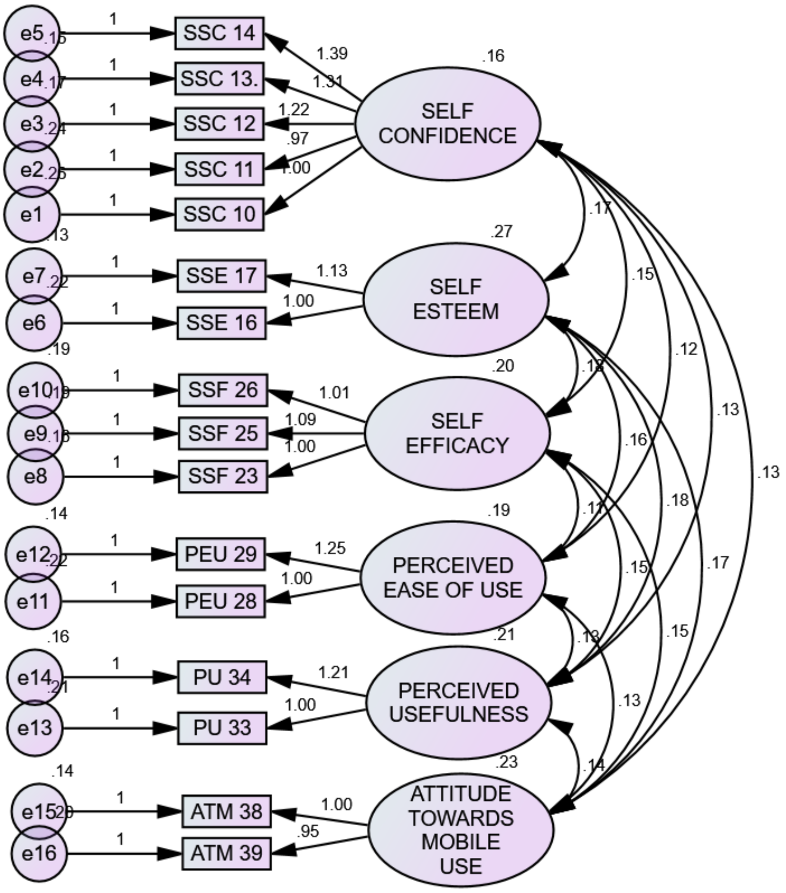

Figure 4: Hypothesized model of factorial structure for Mobile learning of Electric Motor winding

4.4. The Convergent and Discriminant Validity of the Constructs

Convergent and discriminant validity are two forms of validity analysis in this study to assess the components of each construct. Fornell & Larcker, 1981; Arifin & Yusoff, 2016 advised that all factor loadings must be greater than 0.70 before a construct's validity is confirmed for statistically acceptable convergent validity. Additionally, each construct's average variance extracted (AVE) value should be at least 0.50. (Fornell and Larcker, 1981). Table 4 demonstrates that AVE values are more than 0.5, and factor loading is higher than 0.7 for each construct.

As shown in Table 4, the factor loadings for students' self-confidence (SSC), self-esteem (SSE), self-efficacy (SSF), perceived ease of use (PEU), perceived usefulness (PU), and attitude toward mobile learning (ATM) are all more than 0.70. As a result, the measuring model complied with Fornell and Larcker's suggestions (1981). The scales are valid and dependable because both prerequisites are satisfied.

Table 4.
Construct Convergent Validity

Construct	Items	Factor Loading	Average Variance Extracted (AVE)	Convergent Validity (CV) ≥ 0.5
Self Confidence	SSC10	0.62	**0.53**	**Established**
	SSC11	0.62		
	SSC12	0.77		
	SSC13	0.8		
	SSC14	0.82		
Self Esteem	SSE16	0.74	**0.64**	**Established**
	SSE17	0.85		
Self-Efficacy	SSF23	0.75	**0.55**	**Established**
	SSF 25	0.75		
	SSF26	0.73		
Perceived Ease of Use	PEU28	0.68	**0.57**	**Established**
	PEU29	0.82		
Perceived Usefulness	PU33	0.71	**0.58**	**Established**
	PU34	0.81		
Attitude Towards Use	ATM38	0.78	**0.55**	**Established**
	ATM39	0.71		

4.5. Discriminant Validity

Finally, Fornell and Larcker (1981) proposed that the correlation shared between two constructs should be less than the square root of the AVE for discriminant validity. As shown in Table 5, the measuring model met these criteria and demonstrated good discriminant validity. The square root of the average variance extracted is indicated by the bold diagonal figures (AVE) except for the correlation squares of self-esteem and self-efficacy with self-confidence, which is higher than the AVE value and has a difference of 0.02 between them. Each AVE value was higher than the correlation square, and the interval between them is too minimal (0.02) to determine that discriminant validity exists between the remaining constructs. It implies that all constructs are distinct from one another.

Table 5.
Construct Discriminant Validity

Latent Variables	SSC	SSE	SSF	PEU	PU	ATM
Self-Confidence	**0.73**					
Self-Esteem	0.82	**0.80**				
Self-Efficacy	0.82	0.76	**0.74**			
Perceived Ease of Use	0.67	0.70	0.57	**0.75**		
Perceived Usefulness	0.73	0.76	0.74	0.65	**0.76**	
Attitude towards use	0.66	0.67	0.72	0.60	0.67	**0.75**

4.6. Reliability Analysis

Composite reliability checks the accuracy of the measurements by ensuring that all items within the same construct are consistent. According to Hair et al. (2010), if the composite reliability in a construct is higher than 0.7, it is considered very reliable, whereas 0.6 to 0.7 is deemed acceptable. The values of composite dependability for all constructions were reliable, based on the results of Table 6.

Table 6.
Composite Reliability (CR) and Cronbach's Alpha Reliability

Item Numbered	Standadized Loading	Error Variance	Item R Square	Item Construct	CR Item Construct	Reliability (Cronbach's Alpha)	≥0.7 Reliable
1	0.62	0.616	0.384	SSC10			
2	0.62	0.612	0.388	SSC11			
3	0.77	0.409	0.591	SSC12			
4	0.8	0.36	0.64	SSC13			
5	0.82	0.333	0.667	SSC14	**0.85**	**0.85**	**Accepted**
6	0.74	0.448	0.552	SSE15			
7	0.85	0.281	0.719	SSE17	**0.776**	**0.77**	**Accepted**
8	0.73	0.473	0.527	SSF23			
9	0.75	0.442	0.558	SSF25			
10	0.75	0.443	0.557	SSF26	**0.784**	**0.78**	**Accepted**
11	0.68	0.538	0,462	PEU28			
12	0.82	0.326	0.674	PEU29	**0.723**	**0.77**	**Accepted**
13	0.71	0.499	0.501	PU33			
14	0.81	0.352	0.648	PU34	**0.729**	**0.73**	**Accepted**
15	0.78	0.385	0.615	ATM38			
16	0.71	0.499	0.501	ATM39	**0.716**	**0.71**	**Accepted**
	Total CR				**0.953**	**0.922**	**Accepted**

5. Analysis of a Structural Model

To test the hypotheses of the relationships between the research models construct variables (See Tables 7 and 8), the findings of the structural model analysis provided the model fit indices.

Table 7.
Results of model fit indices

Fit Index	Research model	Acceptable value	Source
x2 /d.f	1.217	< 5.00	Kline (2005)
GFI	0.959	> 0.90	Bagozzi and Yi (1988)
AGIF	0.937	< 0.80	Fornell and Larcker (1981)
RMSEA	0.027	< 0.06	Hair et al. (2010)
SRMR	0.043	< 0.08	Bagozzi and Yi (1988)
NFI	0.954	> 0.90	Hair et al. (2010)
NNFI	0.938	> 0.90	Bentler and Bonnet (1980)
CFI	0.991	> 0.90	Fornell and Larcker (1981)
IFI	0.991	> 0.90	Widaman and Thompson (2003)

5.1. Results of Model Fit

This study uses the Goodness of Fit (GoF) analysis to determine how well the suggested model fits the obtained data using confirmatory factor analysis (CFA). The model-fit indices of the measurement model using CFA was on Goodness-of-Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), and Incremental Fit Index (IFI).

The Root Mean Square Error of Approximation (RMSEA; Steiger, 1990) is defined as a measure of approximate fit in the population and is therefore concerned with the discrepancy due to approximation. There is a general agreement that the value of RMSEA for a good model should be less than 0.05, as Hu and Bentler (1999) suggested an RMSEA of less than 0.06 as a cutoff criterion. Table 7 shows that the RMSEA of the model is 0.027 and therefore indicates that the model is a good fit (Hair et al., 2010). Also, a rule of thumb is that the Standardized Root Mean Square Residual (SRMR) should be less than 0.05 for a good fit (Hu & Bentler, 1995), whereas values smaller than 0.10 are acceptable. Table 7 indicates SRMR to be 0.043, which is less than 0.05.

Furthermore, measures based on the usual rule of thumb for the Normed Fit Index (NFI) are that 0.95 is indicative of a good fit relative to the baseline model (Kaplan, 2000, p. 107) and values greater than 0.90 indicate an acceptable fit (Marsh & Lomax, 1996). NFI, NNFI, and GFI in Table 7 show 0.95, 0.93, and 0.99, which indicate a good fit. Thus, the structural model of the mobile learning app for motor winding in the entire sample of universities in Nigeria is suitable to be adopted as a model for the learning of motor winding where any other university student could adopt its use.

5.2. Evaluation of the Model

A Structural Equation Model (SEM) analysis tests the proposed model for students' self-belief and technology acceptance (TAM) on a mobile learning app tutor for electric motor winding at a Nigerian university. The result analysis confirms the assumptions in the research model, as shown in Tables 7 and 8, Figure 3 and 4.

Self-esteem is positively affected by self-confidence (H1, â=0.170, p0.023 0.05; H2, â=0.147, p0.020.05). The direct relationship between self-confidence (F1) and self-esteem (F2) yielded substantial results. It attains a critical ratio as large as 7.422 absolute value. Self-confidence also has a positive impact on perceived ease of use (H3, 0.115, p0.018 0.05; H4, 0.133, p0.019 0.05). The direct relationship between self-confidence (F1) and perceived ease of use (F4) produced a significant result. It reaches a crucial ratio as large as 6.279 absolute value. In other words, at the 0.05 level, the covariance between F1 and F4 is significantly different from zero (two-tailed).

It shows a high intervention rate (H6, â = 0.176, p 0.023 0.05; H7, â = 0.156, p 0.023 0.05). The direct association between (F2) self-esteem and (F3) self-efficacy (F3) produced a significant result. It reaches a crucial ratio as large as 7.649 absolute value. It implies that at the 0.05 level, the covariance between F2 and F3 is significantly different from zero (two-tailed).

Perceived ease of use is positively influenced by self-efficacy (H10, â = 0.111, p 0.019 0.05; H11, â = 0.150, p 0.021 0.05). The direct relationship between (F3) self-efficacy and (F5) perceived ease of use yielded a significant result. It attains a crucial ratio as large as 7.212 absolute value. In other words, at the 0.05 level, the covariance between F3 and F5 is significantly different from zero (two-tailed).

Perceived ease of use influences perceived usefulness positively (H13, â = 0.128, p 0.021 0.05; H14, â = 0.125, p 0.021 0.05). The direct relationship between (F3) self-efficacy and (F5) perceived ease of use yielded a significant result. It attains a crucial ratio as large as 6.221 absolute value. In other words, at the 0.05 level, the covariance between F4 and F5 is substantially different from zero (two-tailed).

Attitude toward mobile learning positively influences perceived usefulness (H14, p 0.021 0.05). The direct association between (F5) perceived usefulness and (F6) attitude toward mobile learning yielded a significant result (See Figure 3). It attains a crucial ratio of 6.771 absolute value. In other words, at the 0.05 level, the covariance between F5 and F6 is substantially different from zero (two-tailed). These findings were similar to the research conducted by Almaiah and Alismaiel (2018), who investigated the factors impacting the adoption of mobile learning systems through an empirical study.

Table 8.
Results of Structural Model

Hypotheses	Standard Coefficient (β)	SE(P)	CR	Supported
H1: Self-confidence has a positive effect on Self Esteem	0.17	0.023	7.422	**Yes**
H2: Self-confidence has a positive effect on Self Efficacy	0.147	0.02	7.472	**Yes**
H3: Self-confidence has a positive effect on Perceived Ease of Use	0.115	0.018	6.279	**Yes**
H4: Self-confidence has a positive effect on Perceived Usefulness	0.133	0.019	6.823	**Yes**
H5: Self-confidence has a positive effect on Attitude towards Use	0.129	0.019	6.823	**Yes**
H6: Self-esteem has a positive effect on Self Efficacy	0.176	0.023	7.649	**Yes**
H7: Self-esteem has a positive effect on Perceived Ease of Use	0.156	0.023	6.659	**Yes**
H8: Self-esteem has a positive effect on Perceived Usefulness	0.179	0.024	7.299	**Yes**
H9: Self-esteem has a positive effect on Attitude towards Use	0.165	0.023	7.066	**Yes**
H10: Self-Efficacy has a positive effect on Perceived Ease of Use	0.111	0.019	5.988	**Yes**
H11: Self-Efficacy has a positive effect on Perceived Usefulness	0.15	0.021	7.212	**Yes**
H12: Self-Efficacy has a positive effect on Attitude towards Use	0.154	0.021	7.447	**Yes**
H13: Perceived Ease of Use has a positive effect on Perceived Usefulness	0.128	0.021	6.221	**Yes**
H14: Perceived Ease of Use has a positive effect on Attitude towards Use	0.125	0.02	6.121	**Yes**
H15: Perceived Usefulness has a positive effect on towards Use	0.145	0.021	6.771	**Yes**

6. Discussion

The effect of the mobile learning application of electric motor winding tutors on students' self-belief and technology acceptance model was determined using the TAM model. The findings show that the constructs from the existing TAM model have significant effects on students' self-belief (self-efficacy, self-esteem, and self-confidence) and aid in learning electric motor winding.

The concept of mobile learning, through the application of the TAM model, allows students to experience the process of winding through play, games, conversation, and other kinds of learning. The results showed the positive effects of self-confidence, self-esteem, self-efficacy on perceived ease of use, perceived usefulness, and attitude towards mobile learning for electric motor winding (H1–H6: Table 8). As a result of its widespread availability, mobile learning makes learning more adaptable. Self-confidence has a higher intervention rate than self-efficacy and self-esteem (See Table 8).

Mobile learning assists university lecturers and students in implementing instructional and collaborative learning strategies. This assertion is in line with Bellini and McConnells' (2010) findings on the applications of video and consistent practice as an effective intervention for promoting skill learning, performance, or reducing student problem behaviours. When students utilize a mobile learning app to learn winding an electric motor, their behaviour changes, and the skill becomes permanent.

Further direct interactions between TAM variables proved significant (H7–H15: Table 8). All the hypotheses were accepted. The result shows a relationship between self-belief in mobile learning apps and electric motor winding as the students use the technology acceptance model. Several studies have found that students have favourable attitudes regarding the usage of mobile learning (Nguyen et al., 2015; Park et al., 2012), and others have found that mobile learning increases student involvement (Wang et al., 2009). By boosting their learning experiences (Martin & Ertzberger, 2013), the students would be able to communicate and have easy access to information.

It shows that using a mobile learning application tutor to educate and learn electric motor winding is a novel way. Perceived ease of use and attitude toward use affect mobile learning utilization. It also promotes favourable attitudes towards mobile learning.

Perceived ease of use is one of the reasons for the application of mobile learning to learn electric motor winding. It is the same with Li et al. (2018) on the impact of mobile apps on nursing students' learning motivation, social engagement, and academic achievement. The findings showed that students performed well and learned effectively, but their satisfaction and self-efficacy with mobile learning were low. According to the findings, they showed improved study results after using mobile learning.

Assessing self-efficacy and using appropriate ways to increase students' efficacy is critical. In contrast to earlier studies (Liu, 2008; Shi, Chen, and Tian, 2011; Tsai and Tsai, 2003; Kuo et al., 2014; Wombe, 2007), this study confirms that self-efficacy has a direct positive effect on attitude toward motor winding (0.154; $p = 0.021$) and perceived ease of use of mobile learning (0.111; $p = 0.019$). A mobile application tutor in electrical motor winding would eliminate the abstract knowledge of students' electrical machine courses. The design of the motor winding app was to teach basic electrical skills to anyone who needs to do first-line electrical maintenance activities like safe isolation, replacement, and testing of a variety of electrical equipment (motors, sensors, heating elements, solenoids).

The students would use this research as a performance checklist to document the tasks during any winding or rewinding of the electrical machine, step by step. The results also demonstrate that self-efficacy, self-esteem, and self-confidence are variables for the students' attitudes toward electric motor winding by determining their performance in the application of perceived ease of use and perceived usefulness of the mobile app tutor.

6.1. Limitations and Future Studies

Although this study contributes to theory and practice, it has limitations when interpreting the results. One of the many factors contributing to the difficulty of assessing attitudes was students' perspectives. As a result, future research should expand on the research framework employed in this study by including more theoretical concepts and features to assess students' attitudes and interactions.

Second, the scope of this research is single-phase motors. The mobile phone device is limited in space. However, to ensure university students have enough practical experience using the mobile learning application tutor for electric motor winding, it did not explain generators, transformers, 3-phase induction motors, and direct current motors. The emphasis on deploying mobile learning tutors for 300L, 400L, and final-year university students in Nigeria limits the findings to other developing countries.

Finally, future research should include learning theories, gratification theories, individual psychological qualities, and other moderating variables to improve the understanding of students' perspectives regarding mobile learning app tutors for electric motor winding at the university.

6.2. Conclusion

The self-belief constructs in this study confirmed the role of TAM model based on the research findings. TAM model provided a valuable tool to acquire the skill of electric motor winding. The findings also differentiated between self-efficacy, self-esteem, and the self-confidence of the students' feelings to use mobile technology within the classroom. The study highlights the notion that students not only need to learn electric motor by face-to-face methods but also be able to implement mobile learning at any location for its learning.

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