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Assessment of College of Education Students Acceptability of the Use of Technology to Learn Science

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Abstract

Technology is rapidly changing the way education is being delivered to students. Schools are encouraged to adopt technology that will enable teachers and students to interact effectively, especially the use of online learning platforms. For these reasons, this study examined college students' acceptance and use of technology to learn science. A quantitative approach, descriptive design and a structural equation modelling approach were used to guide the data collection and analysis process. The study used a questionnaire to collect data on a sample of 346 students from the Bagabaga Training College, Tamale Training College and Gbewaa College of Education, with a total population of 3200 students using Krejcie and Morgan (1970). The results showed that the students were willing to use online technology to learn science. Their behaviour was the most significant factor in determining their use of technology. Also, facilitating conditions and habit significantly improved the student's behaviour towards the use of science.

Keywords

Bagabaga, Bagabaga College of Education, College of Education, Effor Expectancy, Electronic Learning, E-Learning, Facilitating Conditions, Gbewa College of Education, Hedonic Motivation, Price Value, Social Influence, Tamale Training College, Training College, Unified Theory of Acceptance and Use of Technology

1. Introduction

Learning science improves understanding of the world and changes that occur in it. In addition, everything about the universe, from reproduction to the development of machines, is the result of scientific research. For these reasons, human progress throughout history has primarily rested on scientific advances. Therefore, it is critical to improve tutors' teaching skills to enable them to educate students on science. The training colleges are designed to train and equip teachers with the right skill-set to teach the structure and behaviour of the physical, social, and natural worlds through observation and experimentation. Thus, this study sought to examine the use of online technology as an alternative modal for engagement with science students to enhance their understanding and application of scientific knowledge, concepts and processes.

Electronic learning systems are now the most innovative tool used by educational institutions worldwide to provide top-notch instruction (Sholikah & Sutirman, 2020). Studies on the use of e-learning platforms have shown that students greatly benefit from them. Elumalai, Sankar, Alqahtani, and Abumelha (2020) contend that the system offers a more practical method for handling academic assignments. Additionally, it has demonstrated success in enhancing students' learning. Additionally, it significantly advances participation, cooperation, and information sharing (Asad, Hussain, Wadho, Khand, & Churi, 2021). These factors account for the developed nations' successful adoption of the E-learning system. The E-learning system, in contrast, has not been thoroughly or adequately implemented in developing nations (Coman, Ţîru, Stanciu, & Bulgaria, 2020).

Additionally, even though many tertiary institutions in developing nations are starting to invest in e-learning programs, student usage of these programs is still not at a satisfactory level (Castro, 2019). However, not enough studies have examined how well it is used in training institutions. Instead, universities and other institutions are the subjects of most studies (Tawafak, Romli, & Alsinani, 2019). Moreover, it is precarious because trainee teachers or students at training colleges receive support from a teacher training provider as they pursue careers as teachers. Therefore, one of the essential factors of educational programs should be how well students comprehend and apply the concepts taught. This is how instructors' effectiveness is determined.

Due to these factors, UNICEF advises developing nations' governments to implement appropriate technologies to address improving education and the extent to which training colleges are accountable for their students' preparation for academic teaching (World Health Organization, 2022). Over the past ten years, active learning has received much attention in the literature as the best method for increasing student engagement in higher education. However, training colleges face challenges in figuring out how to spur and boost students' interest in their field (Ali, 2020). Many institutions rely on students' research and academic achievement efforts in addition to encouragement or rewards. However, they fail to recognise the enormous benefits of the current digital media and technology that can actively engage students (Suratni, Muhammad, & Sawir, 2022).

According to Martínez, Aguilar, and Ortiz (2019), the conventional face-to-face lecture format lacks the adaptability to engage students regardless of their location or time. Additionally, it contrasts with today's extremely tech-savvy and media-savvy students (Anggrawan & Jihadil, 2018). Gloria and Uttal (2020) noted that in Ghana, like most developing nations, there is a need for an even more significant shift toward interactive learning in order to engage this technologically savvy generation of college students in the instruction-learning process due to the intensity of technology use by teaching college students and the potential gap in technical expertise between their lecturers.

For these reasons, this essay looks at the elements and circumstances that affect the degree of training college students intend to receive and their use of established and new technologies in the classroom. The study uses the Unified Theory of Acceptance and Use of Technology (UTAUT) to investigate how prepared college students are to engage in learning activities utilising information technology in higher education classrooms. It is specific to using technology in face-to-face science classroom instruction. The UTUAT model includes four moderators: age, gender, voluntariness, and experience, as well as performance expectancy, effort expectancy, social influence, hedonic motivation, habit, price value, and facilitating conditions (Venkatesh, Sykes, & Zhang, 2011).

The four moderators, however, will not be included in this study because their use in the model is optional. Except in rare circumstances, age, gender, experience, and voluntariness are not considered when making provisions for students' academic activities (Joekel, 1985; Niemczyk & Rónay, 2022). The model's seven key components are essential for students' academic success and potential professional teaching careers (Niemczyk & Rónay, 2022). Training institutions in Ghana encounter numerous difficulties in implementing technology in the classroom (Antwi, Bansah, & Franklin, 2018). Many training colleges lack the necessary technology for effective science teaching and learning because the use of digital technologies and learning platforms is still in its infancy. The traditional classroom setting is still crucial because many training colleges have not found the ideal.

The **staff's performance, satisfaction, and motivation** were the focus of recent studies on enhancing training in higher education. Others have researched political behaviour, institutional politics, staff loyalty, and retention goals (Quaicoe & Pata, 2020). However, most student studies have concentrated more on academic success, learning strategies, learning resources, teaching quality, and other topics (Tondeur, Petko, & Schmidt-Crawford, 2021). In addition, very few studies have been conducted on the impact of technology on students learning at the training college level, as noted in Arkorful, Barfi, and Aboagye (2021), even though these studies have produced fruitful findings that have, in one way or another, informed policy and resource allocations.

In summary, many studies have been done on students' academic achievement and learning ability (Cullen, Mallet, & Murphy, 2019). Others have examined strategies to improve students learning strategies (Budu, Mu, & Mireku, 2018). However, the literature shows that studies on assessing students' intentions to use technology to learn science at the college level are nonexistent. For these reasons, the study adopted the UTAUT 2 model of Venkatesh et al. (2012) to examine college students' behaviour and intention to use technology to learn science.

2. Objectives of the Study

The study seeks to examine:

1) The students' Actual Use of Technology to Learn the science.
2) The student's Intention to Use Technology to Learn the science.
3) The determinants of student's intention to use technology to learn science.

3. Theoretical Development

A comprehensive framework for forecasting the circumstances in which the use of technology for classroom learning can occur is the Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh, Morris, Davis, and Davis (2003) combined research on people's acceptance of technology into a single theoretical model based on components from eight earlier models. The model starts with four factors influencing a person's behaviour: performance expectations, effort expectations, social influence, and facilitating conditions (Venkatesh et al., 2003).

UTAUT "explained about 70% of the variance in behavioural intention to use technology and about 50% of the variance in technology use," according to longitudinal field studies of employee technology acceptance (Venkatesh, Thong, & Xu, 2012). The use of various technologies in numerous organisational settings has been studied using the UTAUT model, which is regarded as a baseline model. Hedonic motivation, price value, and habit are three more predictors that have since been added (Venkatesh et al., 2012). Consequently, it is commonly known as UTAUT2. The entire theoretical framework that underlies this study is shown in **Figure 1**.

4. Research Model

Venkatesh et al.'s (2012) UTAUT2 constructs are modified in **Figure 2** to fit the goals of the investigation. The two dependent variables of interest are the use of new technologies in the classroom for science instruction and the intention to use these technologies for science instruction in the future. Performance expectancy, effort expectancy, social influence, enabling circumstances, hedonic motivation, and habit are, thus, the model's independent variables, likewise, expanding it to the context of higher education. The literature on adopting information systems (IS) suggests that age, experience, and gender should not be used as moderators (Giua, Materia, & Camanzi, 2021). In addition, other data show that students, regardless of their gender, experience level, or age, are technologically savvy.

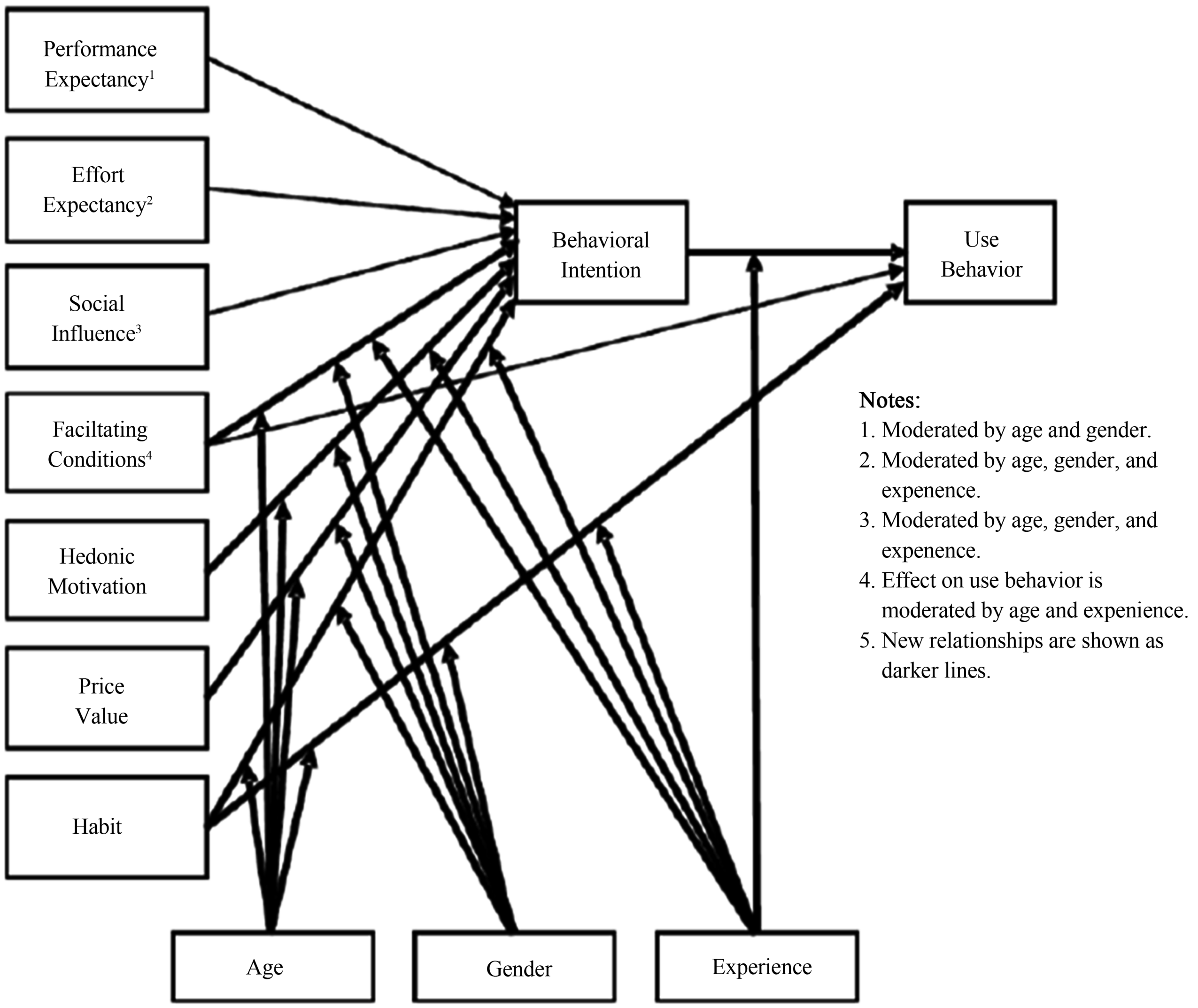

Figure 1. Theoretical model: UTAUT2 (Venkatesh et al., 2012).

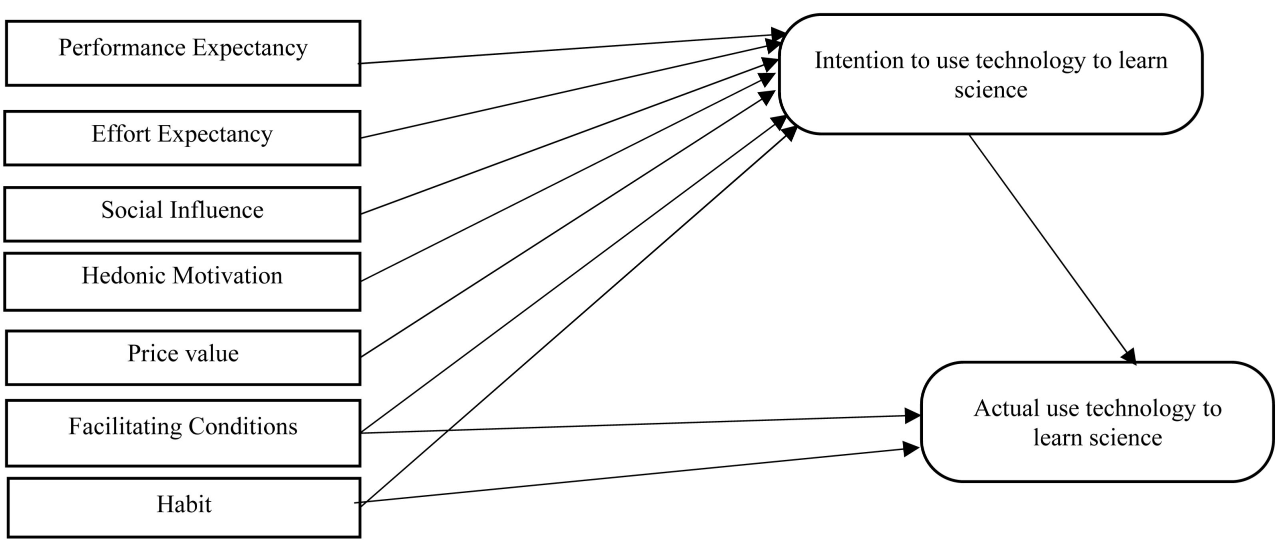

Figure 2. Research Model: UTAUT2 adapted from Venkatesh et al. (2012).

Performance Expectancy

It refers to how much a student thinks current and emerging technology will enhance their learning. Finally, the most crucial variable in explaining behavioural intention is performance expectancy. It is more critical for students to engage in active learning (Venkatesh et al., 2003).

Effort Expectancy

It reflects how much technology is perceived as being effortless by science students. It is predicted by technological traits like social presence, immediacy, and concurrency, as well as by individual and group traits like computer self-efficacy, prior experience with teamwork, and familiarity with others (Brown, Dennis, & Venkatesh, 2010).

Social Influence

It reflects how much science students think the key players in their social cycle anticipate using technology. Social influence can predict user intention less accurately than performance and effort expectations (Brown et al., 2010). However, it has been discovered to be more significant when users interact with technology less (Venkatesh et al., 2003).

Facilitating Conditions

It measures how much science students think the technical infrastructure at their college supports their use of the system. According to theory, these circumstances directly impact the intention and use of IS because they are "objective factors in the environment that observers agree to make an act easy to accomplish" (Venkatesh et al., 2003).

Hedonic Motivation

The UTAUT 2 is a recent addition to the original model with price value and habit (Venkatesh et al., 2012). Hedonic motivation is the enjoyment or pleasure one derives from using technology. It was used to forecast students' behavioural intention to use technology and has significantly impacted technology acceptance (Brown et al., 2006).

Habit

It is described as the degree to which science students typically exhibit behaviours out of habit related to using technology (Limayem et al., 2007). The significance of habit as a construct in a study of this kind is that, as a particular behaviour becomes more of a habit, the role of Behavioral intention in predicting behaviour tends to decline.

Price Value

It is the association that science students draw between the cost and calibre of the technology used in the classroom. The literature demonstrates that a higher price is frequently associated with higher quality.

Behavioural Intention

It has been described as a function of viewpoints and arbitrary standards regarding the intended behaviour, anticipating actual behaviour (Pickett et al., 2012). Behavioural intention can be used to evaluate the relative strength of a person's commitment to engaging in a particular behaviour.

Actual Use of Technology

The model contended that past behaviour favourably influences future behaviour. According to some researchers, past usage is the only factor that predicts future usage, even to the point where it has a more significant influence than the effect of intention to use (Venkatesh & Davis, 2000).

5. Research Method

The study used a descriptive research design, specifically a quasi-experiment design, and a quantitative research approach to collect its data. With a total population of 3200 students, the study used a questionnaire to gather data on a sample of 346 students from the Bagabaga Training College, Tamale Training College, and Gbewaa College of Education (1970). The training colleges were chosen using purposive sampling to gather data, and the science students were located using the snowball sampling technique. In SPSS version 25, the data were coded and recorded after being removed for missing values. In order to perform a partial least squares regression analysis in **Figure 2**, it was finally transferred to Smartpls3.

6. Results

Figure 3 shows that blue circles represent the constructs with their effects written on the inside. The lines connecting the constructs show the path coefficients, which show changes' effects on one another. Again, the interpretation will be given in percentages even though the values are expressed in decimals.

Students' Actual Use of Technology to Learn Science

Figure 3 shows that regarding the students' intended use of technology for learning science, roughly 76.6% of the students stated that they intended to use online platforms for learning science, close to 82.8% stated that they intended to attend online lectures, and 57% stated that they intended to learn more about technology use for learning science. As a result, according to **Table 1**, these three variables account for 62.4% of the variance in **Figure 3**'s model. They are 67% reliable (Cronbach's Alpha). Additionally, the AVE of 532 indicates that discriminant reliability was attained and that the three factors do not predict one another linearly. However, Cronbach's Alpha is not preferred over the composite reliability of 76.9%. It suggests that the three factors' model's dependability should

Figure 3 shows that, as a construct, 9.6% of students used technology to learn science due to changes in their behavioural intentions, the facilitating condition, and their technological habits. Additionally, a further boost in the students' behavioural intentions can result in a 26.5% increase in their actual use of technology for science learning. Additionally, facilitating conditions can increase students' actual use of technology by 11.8% and their attitudes toward technology use by 16.5%. Therefore, it is sufficient to conclude that students will use technology to learn science based on the impact of the determinants.

Table 1. Reliability of the constructs and their determinants.

Construct	Cronbach's Alpha (%)	Rho_A (%)	Composite Reliability (%)	AVE
Actual Use of Technology to Learn Science	67	62.4	76.9	0.532
Intentions Towards Science	75.9	77.6	83.6	0.506
Effort Expectancy	68.6	73.8	81.6	0.692
Performance Expectancy	64.7	64.9	76.7	0.523
Social Influence	66.2	66.5	70.4	0.544
Habit	63.6	67.5	74.7	0.507
Hedonic Motivation	61.4	63.4	74.0	0.549
Price Value	61.8	66.5	76.0	0.620
Facilitating Conditions	70.7	71.0	83.7	0.631

Source. Field data, 2022.

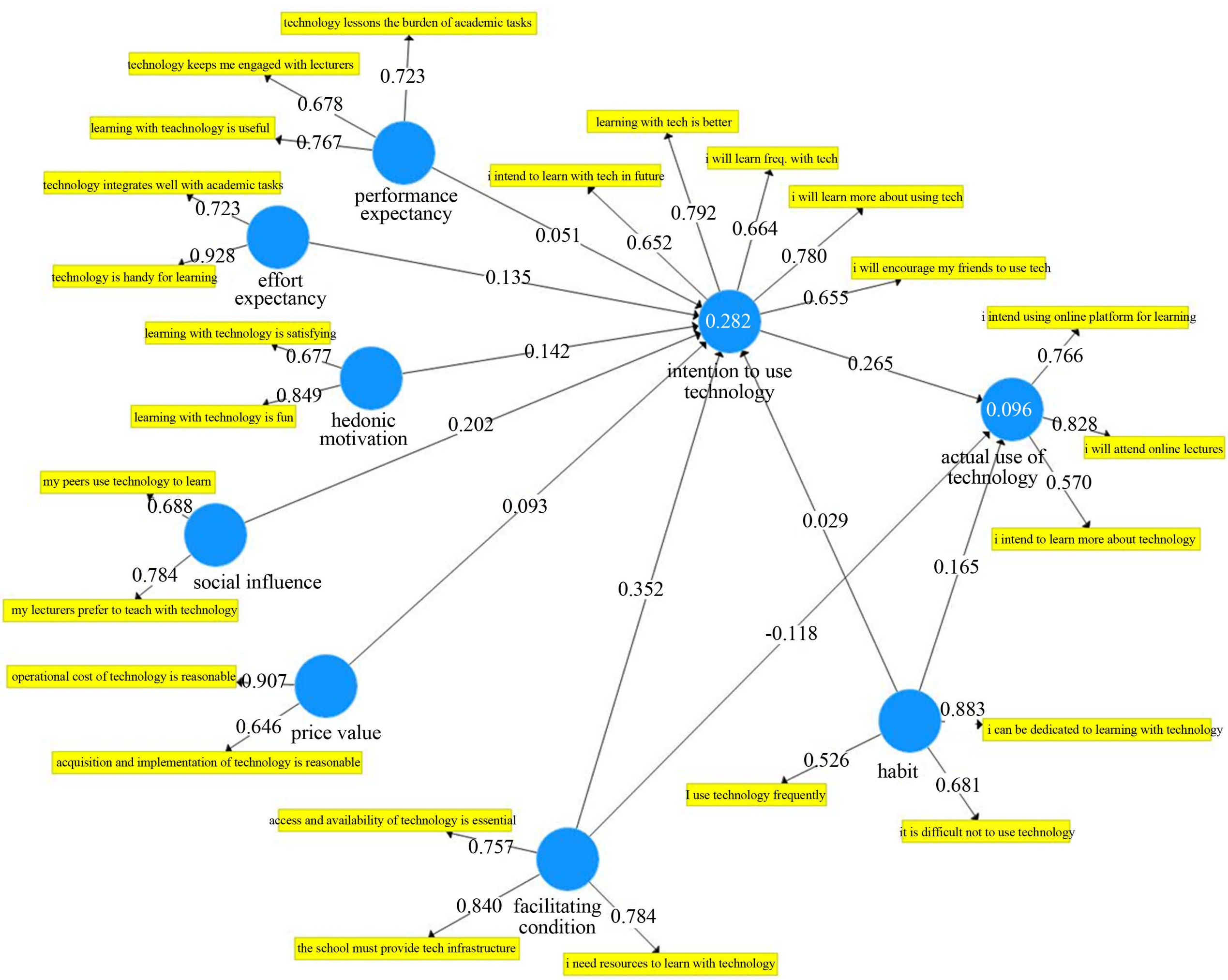

Figure 3. Determinants of student's actual use of technology to learn science.

Student's Intentions to Use Technology to Learn Science

Figure 3 shows five factors that affected the student's intentions to use technology to learn science. First, 79.2% of respondents said learning online is superior to face-to-face instruction, and 65.2% said they plan to learn with technology in the future. Second, 66.4% of respondents said they frequently use technology to learn. Third, the majority of students—78%—said they would learn more about technology and how to use it to learn science, and 65.5% said they would encourage their friends to do the same. According to Table 1, the five factors account for 77.6% of the changes in Figure 3 (rh0 A) and are 75.9% reliable (Cronbach's Alpha). Additionally, the discriminant validity was attained due to the value of 0.506, which indicates that the five variables do not linearly correlate.

However, the internal consistency of the five factors as a construct is indicated by the composite reliability of 83.6%. In light of this, it is strongly advised for policy and resource allocation. Additionally, it can be seen that at the moment, 28.2% of students' intentions were influenced by their expectations for their performance, effort, hedonic motivation, social influence, price value, enabling circumstances, and technology use habits. Additionally, the student's intentions will rise by 5.1%, 13.5%, 14.2%, 20.2%, 9.3%, 35.2% and 2.9%, respectively, as these seven factors improve.

The determinants of student's intention to use technology to learn science

The student's intention to use technology was influenced by seven factors, each composite of two or more variables. First, the students were asked to describe how much they thought using technology would enhance their science learning (the performance expectancy). About 72.3% of respondents said using technology would make academic work more accessible. In addition, approximately 67.8% of students think using technology will keep them in touch with their professors, and 76.7% believe using technology to learn will improve their academic performance in science.

Second, the students were questioned regarding any connections between their use of technology, academic success, and the benefits attained due to their efforts (effort expectancy). Because technology and academic tasks work together well, about 73.2% of respondents said yes (hedonic motivation). In addition, 92.8% of respondents agreed that technology helps learn science. Thirdly, when asked if using technology to learn science gave them pleasure, about 67.7% of the students responded positively because it is satisfying, and 94.9% of the students agreed that using technology to learn science makes it enjoyable.

Fourth, the students were asked if their use of technology had affected how they would feel, act, or believe about someone else using technology to learn science (social influence). While most (68.8%) noted that their peers preferred technology, most students (78.4%) responded affirmatively because their lecturers use it more frequently. Finally, Firth asked the students if the price of technology corresponded to the level of service it provides for scientific learning (Price value). The vast majority of students (90.7%) responded affirmatively when asked if they believed that technology's operating costs were reasonable. Additionally, 64.6% of those who answered affirmatively think investing in and using technology is reasonable.

The students were questioned on whether the organisational and technical infrastructure can support using technology to learn science in question six (facilitating conditions). According to 75.7% of respondents, they think the college should prioritise accessibility and availability of technology. Additionally, 84% of respondents agreed that the college must offer the infrastructure required to support the technology for science education. Finally, 78.4 respondents said they agreed because they need tools to use technology to learn science. Seventh, the question "Do you have a regular tendency or practice of technology that is hard to give up?" was put to the students. About 68.1% of respondents said they find it difficult to avoid using technology, and about 52.6% said they use it frequently. In contrast, 88.3% of respondents indicated they could devote their time to learning with technology.

7. Validity of the Model

Table 2's findings evaluate the study's methodology for accuracy, specifically how the data was gathered and analysed. It also demonstrates how the variables used by the constructs to measure the same concept are linked. The student's behaviour toward technology thus accurately measures how they use technology to learn science, as the Fornell larker values are more significant than 0.7. However, it also implies significant differences between the variables used to gauge students' intentions and actual use of technology. This is comparable to AVE's earlier conclusion that the variables are not linearly correlated.

The HTMT values, which evaluate this conclusion because the student responses are latent measurements, support it. The fact that all of the HTMT values are greater than 0.1 suggests that the construction variables are noticeably different. Given that it provides a more accurate representation of the variable inflation factor, it also suggests the absence of multicollinearity. Last but not least, the f-square demonstrates that the relationship between a student's intentions and their actual use of technology is crucial, followed by the relationship's moderating effect and facilitating condition, in addition, behavioural intentions and performance expectations. According to the bootstrapping analysis, each path coefficient had a statistically significant value.

8. Policy Implications of the Model

Based on the performance and importance of the constructs and their respective measurement variables in the model in Figure 3, the study's conclusions about how resources and college policies should be structured to ensure the rapid adoption and integration of technology for teaching and learning science are presented. Figure 4's findings highlight specific areas of the model where management can concentrate on choosing a less expensive course of action while

Table 2. The quality criteria.

	Constructs	Actual Use	Behavioural Intention	Effort Expectancy	Facilitating Condition	Habits	Hedonic Motivation	Price Value	Performance Expectancy	Social Influence
Fornell lacker	Actual Use	0.729								
	Behavioural Intention		0.711							
	Effort Expectancy			0.832						
	Facilitating Condition				0.795					
	Habits					0.712				
	Hedonic Motivation						0.768			
	Price Value							0.787		
	Performance Expectancy								0.723	
	Social Influence									0.737
f-square	Behavioural Intention	0.236								
	Effort Expectancy		0.000							
	Facilitating Condition	0.126	0.122							
	Habits		0.000							
	Hedonic Motivation		0.001							
	Price Value		0.006							
	Performance Expectancy		0.116							
	Social Influence		0.107							
Heterotrait-Monotrait Ratio (HTMT)	Behavioural Intention	0.633								
	Effort Expectancy		0.566							
	Facilitating Condition			0.172						
	Habits				0.154					
	Hedonic Motivation					0.401				
	Price Value						0.351			
	Performance Expectancy							0.191		
	Social Influence								0.352	

vastly improving students' ability to use technology to learn science. In addition, it demonstrates that policy and resources should emphasize enhancing students' intentions to use technology and their technological habits.

Secondly, the training college's administration should focus its technology policy on enhancing the social influence and performance expectations of science students. Next are price value and performance expectations. Finally, it is necessary to put in place the facilitating condition to allow science students to use technology for learning.

Figure 5's findings are a follow-up to Figure 4 and go into greater detail about the measurement variables' contributions to all the constructs in Figure 3's allocation of policy and resources. The measurement variables' effects on how much a student uses technology to learn science vary depending on their importance and performance. The crucial ones, though, are the ones who believe that technology is useful for science education. They are committed to using technology to learn. They are open to learning more about using technology to learn science and think it is superior to conventional methods of instruction. This ought to be the cornerstone of any college policies that allocate funds to enhancing how effectively science students use technology to learn the subject. Figure 5 displays the remaining measurement variables. Despite being in the centre, they are depicted on the chart.

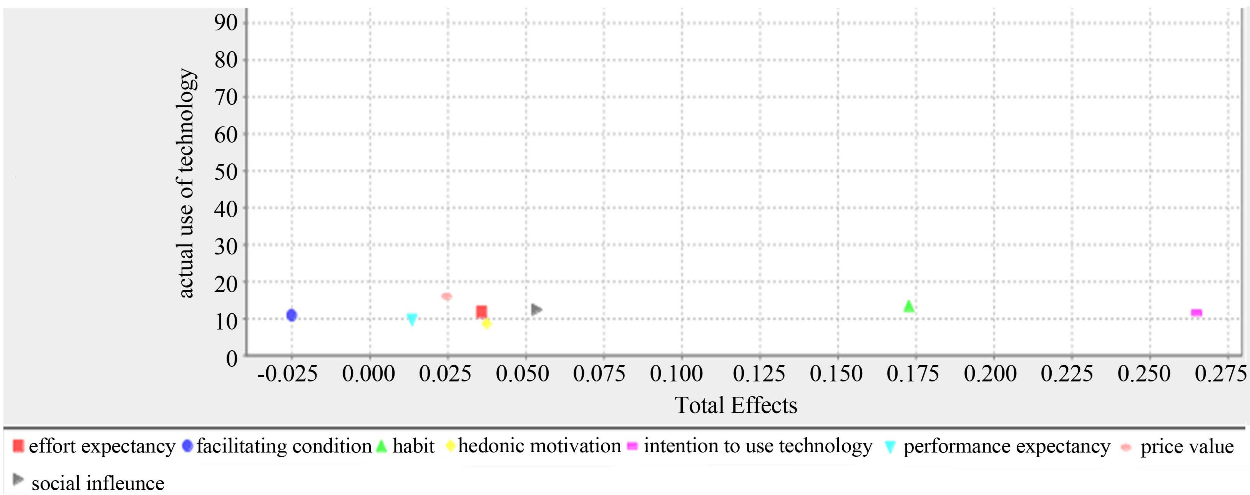

Figure 4. Performance and importance of constructs.

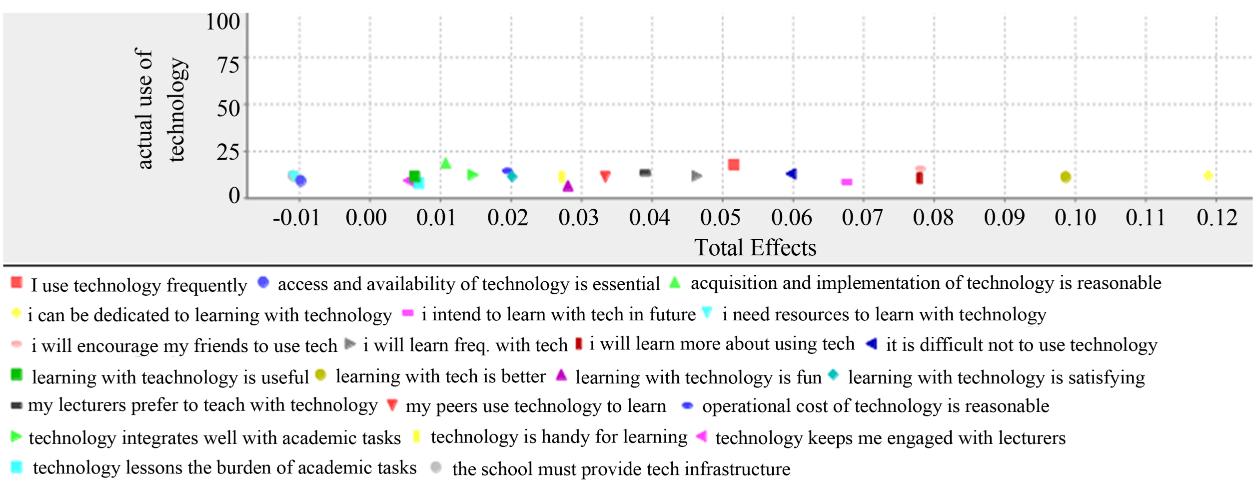

Figure 5. Performance and importance of the measurement variables.

9. Conclusion

The students have demonstrated a readiness to use technology in their science classes. Their technological intentions are closely related. Additionally, the students appear to be very tech-savvy and can use it quickly for academic tasks. The schools should implement technology that enables the students to interact with one another, with their teachers, and with academic tasks as part of the facilitating conditions. Technology must support teaching and learning; it fills classrooms with digital learning tools like computers and mobile devices; it broadens the range of available courses, activities, and learning resources.

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Author Contributions

Rudolf Anyoka Nyaaba: Conceptual idea through to Conclusion.

Conflicts of Interest

There is not conflict of interest. It is a sole authorship paper.

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