Online-Journals.org

iJOE International Journal of Online and Biomedical Engineering

iJOE | eISSN: 2626-8493 | Vol. 19 No. 9 (2023) | OPEN ACCESS

https://doi.org/10.3991/ijoe.v19i09.40913

PAPER

Mobile Learning in Medical Coding Course: Intention to Use MedCoS

Nor Intan Shamimi Abdul Aziz(✉), Dilla Syadia Ab Latiff, Siti Noorsuriani Maon, Annurizal Anuar

Department of International Business and Management Studies, Universiti Teknologi Mara Kampus Puncak Alam, Selangor, Malaysia

shamimi4576@uitm.edu.my

ABSTRACT

Medical coding is a subject in which students must assign proper ICD-10 codes to patients' diagnoses as reported in the coding exercises. However, due to students' inadequate knowledge, incorrect codes are assigned to the cases, leading to coding errors. Thus, creating Medical Coding Simulation (MedCoS) is to help students strengthen their motor and technical abilities in challenging scenarios. The purpose of this study is to predict students' intention to use MedCoS based on attitudes (AT), subjective norms (SN), and perceived behavioral control (PBC). To meet the objective, SPSS was used to conduct descriptive, reliability, and multiple regression analyses. This study includes students in Semester five and six who have attended both courses. Majority respondents were female (89.9%, n=116) and aged between 23 and 24 years old (90.2%, n=102). Results showed that attitudes and perceived behavioral predicted the intention to use MedCos among the students. The significant outcome allows MedCoS to plan the next stage of the application's development with the goal of achieving the desired improvement in course performance.

KEYWORDS

mobile learning, theory of planned behavior, intention to use, medical coding, technology

1 INTRODUCTION

Online learning has been implemented in educational activity for the last two decades. Aggressively used when the world was hit by the outbreak of Covid-19, online learning combines techniques between use of materials and discussion in interactive format [1]. Because of the outbreak, more than 1.6 billion people worldwide in education field in over 190 countries suffered from temporary closure of educational setting. Thus, this is the starting point where online learning is implemented. Both educators and students have to adapt with new learning styles [2].

Mobile and wireless technologies are growing quickly, so mobile devices are being used in education more than ever. Using mobile devices and technologies, people are now utilizing new approaches and today mobile devices are an essential instrument

Aziz, N.I.S.A., Latiff, D.S.A., Maon, S.N., Anuar, A. (2023). Mobile Learning in Medical Coding Course: Intention to Use MedCoS. *International Journal of Online and Biomedical Engineering (iJOE),* 19(9), pp. 15–29. https://doi.org/10.3991/ijoe.v19i09.40913

Article submitted 2023-03-17. Resubmitted 2023-04-28. Final acceptance 2023-05-07. Final version published as submitted by the authors.

that offers new opportunities for education and assessment of learning. This evolution has changed how people think, work, and learn therefore, with the assistance of mobile devices, students are able to more easily complete their assigned educational tasks and gain access to the necessary educational materials without being limited by either time or space. This innovative method of education is referred to as "m-learning." It is a versatile and powerful component that makes learning simple and adaptable [3]. M-learning emphasizes the learner's mobility through interaction with portable technologies. Adaptive learning incorporates the use of mobile tools for the creation of learning aids and materials. E-learning environments can be used to tutor large and diverse student groups regardless of time and location constraints [4].

In addition, [5] stated that m-learning can be built into multimedia applications with the help of different software and hardware technologies. This makes it easier to share educational content in different ways, like games, short messages, quizzes, and multimedia contents. In the same way, m-learning can be used for many different subjects and levels of education, such as primary, secondary, higher, lifelong, community, and professional. M-learning applications can be used on a variety of devices, such as a smart phone, iPad, even a tablet computer. All of these applications work with WiFi, 4G, and 4G Long Term Evaluation (LTE) networks. Despite the benefits above, mobile learning will never be able to fully replace traditional education. However, if used correctly, it can make traditional learning styles more valuable [6].

2 LITERATURE REVIEW

2.1 Intention to use

As M-learning is also being used more and more in education, researchers and teachers are paying more attention to it [7]–[12] because it lets students to discover and learn whenever and wherever they want to. [9] said that m-learning, along with the Internet and the growth of technology, gives students a place to learn and talk to each other online. This will give them the chance to explore things on the go while they learn. Like other ways of teaching, m-learning has many benefits for its users, such as a large number of learning resources, quick access to information, two-way communication, and no time or place limits [7]–[12].

Other than that, students also interested to join online learning due to the positive energy brought by the educators, well prepared teaching materials, good teaching environment, accessible for discussion, time saving, convenience at home and accessible for online materials. However, the identified drawbacks from online learning are to maintain student's enthusiastic to keep on focus and concentration, noisy environment, unstable Internet networking, lack of interaction and practical applications apart from other distractions such as noisy environment, unstable Internet networking [2], [13], [14].

2.2 Mobile learning: medical coding simulation (MedCoS)

Before the Covid-19 endemic, m-learning program had existed for many years but was not actively used in academics. Because most medical students and professionals have a busy schedule, m-learning can aid them with flexible ongoing learning. They can opt to proceed with self-learning [15]. In addition, their curriculum includes the use of Evidence-based Practice in the medical and health fields. EBP is a decision-making technique that requires the utilization of the best evidence and its application

with a specific learning objective [16]. Previous research has shown that the use of m-learning, particularly smartphones, is on the rise. When compared to clinicians, medical students are more willing to embrace, adapt, and use digital learning content, and they feel that smartphones have a beneficial impact on their continuing education. Furthermore, many higher education institutions are transitioning to mobile learning in order to enable a smooth learning experience, and 80% of students and professionals are comfortable talking with patients via email, text messaging, and phone calls [17].

To reinforce the idea of adopting mobile learning in education further, it has been suggested to develop a mobile learning application called Medical Coding Simulation (MedCos). MedCos is a mobile learning application developed to teach Medical Coding in a hospital-based setting, ensuring that real-world experience with patient data is gained. Offered as one of the core subjects in Bachelor of Health Administration (Hons.), Medical Coding is a subject that train students to accurately assign codes based on patient's diagnosis. Provided with many case studies to solve, MedCos helps to develop various skills among students such as decision-making, problem solving, analytical thinking and communication. Furthermore, it will improve student basic's knowledge in Medical Terminology course as the case studies are involving patient scenarios with medical information. The utmost thing for this subject is the competency of the students to ensure that they are assigning codes according to the right sequence based on World Health Organization (WHO) ICD10 and ICD9 codes. Because the development of MedCos is still in the early stages, the mock interface is shown below:

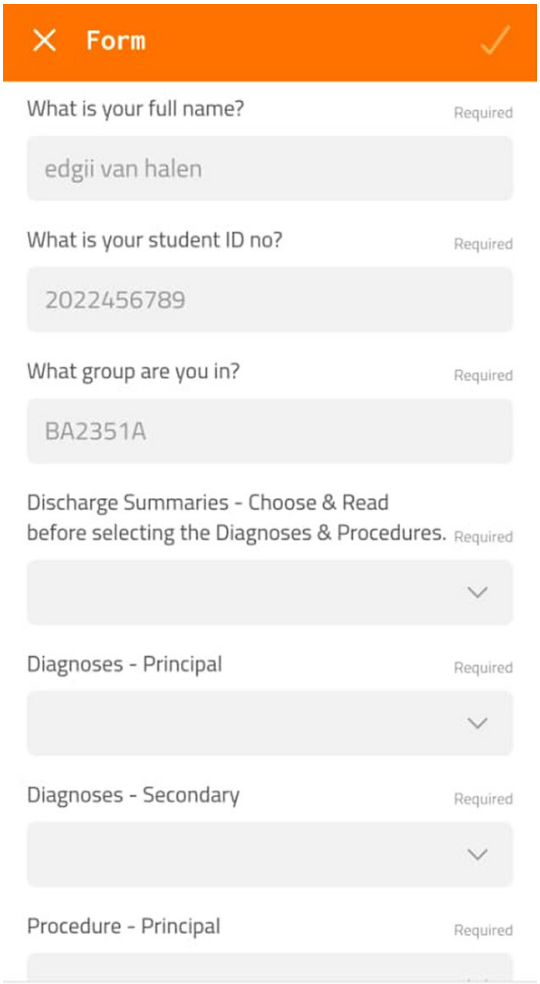

Fig. 1. MedCoS app interface

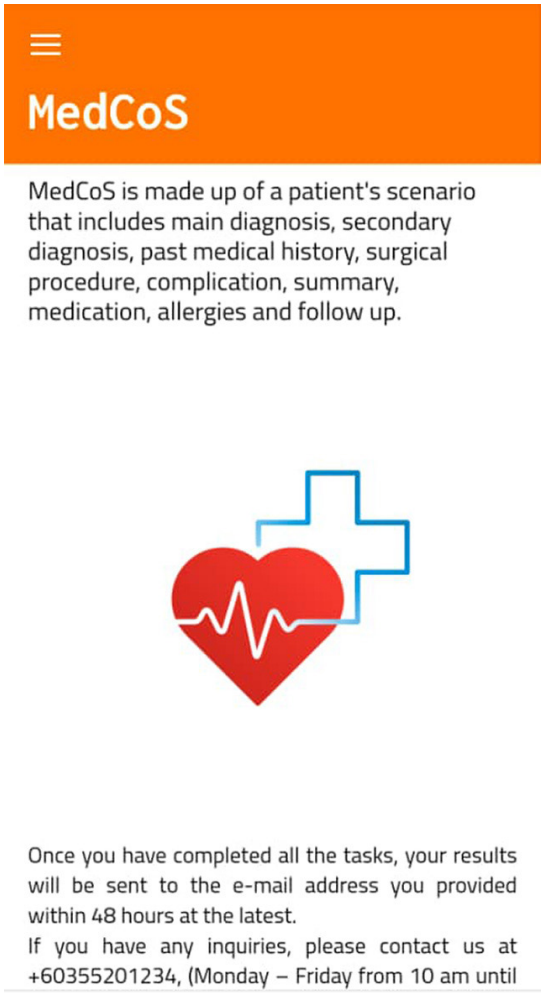

Fig. 2. MedCoS patient scenario

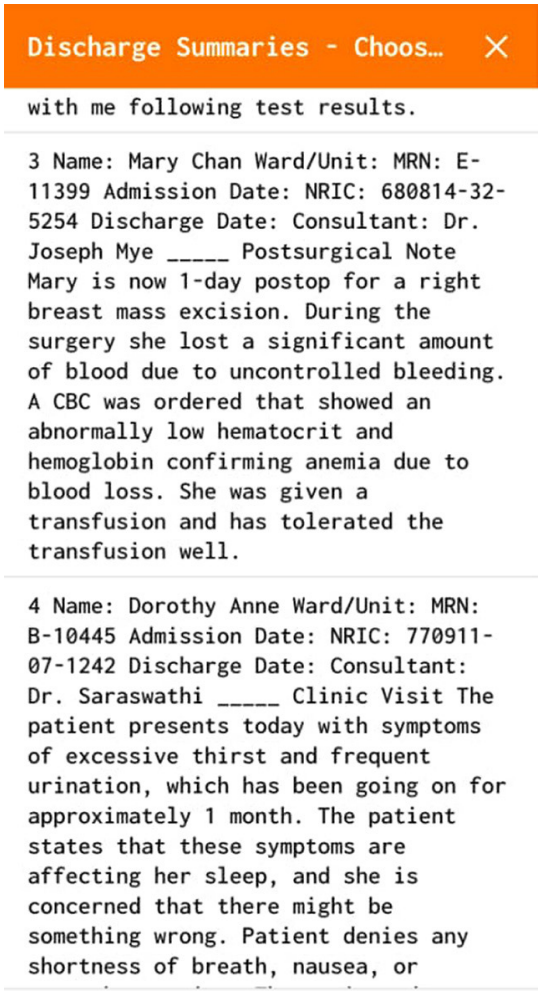

Fig. 3. Detail of patient scenario question

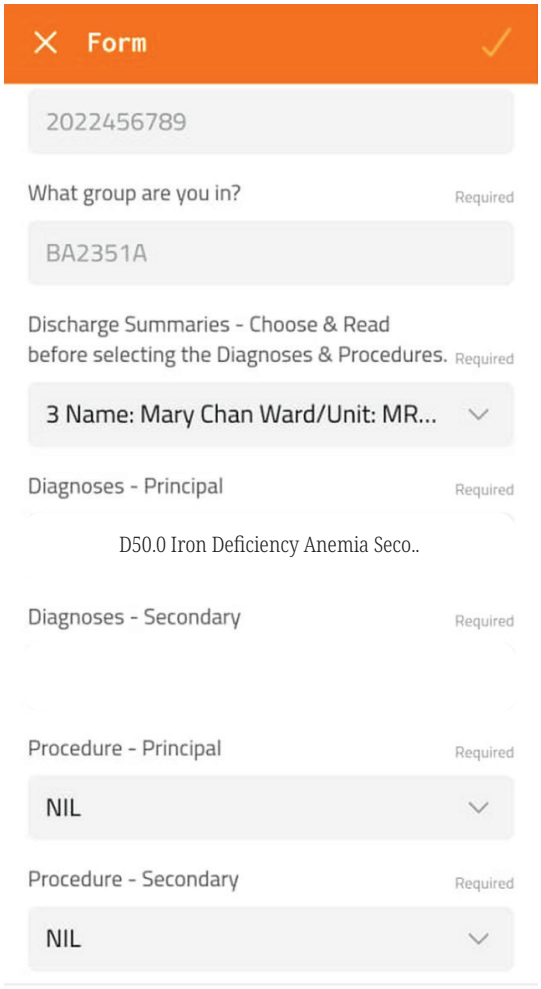

Fig. 4. Complete view of patient scenario answer

Figure 1 The MedCos login interface for a new user. To use this app, new users must create an account with a valid e-mail address. After keying in, a passcode is provided to the user's e-mail, which they must enter on the MedCos app.

Figure 2 Once they entered the passcode, this is the platform where users must write down their own name and semester group.

Figure 3 There will be several patient scenarios to pick from in the discharge summary box. They must carefully read the cases before deciding whether to correctly insert the ICD-10 diagnosis code and ICD-9 procedure code.

Figure 4 This is the completed view before the users hit the button "√" on the upper right of the app to submit their answers. Results will be shared via provided e-mail address.

2.3 Theory of planned behavior in intention to use mobile learning

The Theory of Planned Behavior is well-known for elucidating human behavior. Theory of Planned Behavior is an outgrowth of Fishbein and Ajzen's previous Theory of Reason Action, which only focused on two variables at the time: attitude and subjective norms toward behavior. Later, it was changed to become a Theory of Planned Behavior by adding a new variable called perceived behavioral control [18].

When it comes to technology use, attitudes might arise based on how users view the technology's use in the learning environment. Subjective norms rely on other people's opinions to determine whether or not they should be followed and whether or not certain behaviors should be performed. For example, when a teacher feels compelled to utilize new software because the institution requires it. Finally, our self-perception of how easy it is to carry out an activity determines our perceived behavioral control [19].

In other words, an attitude relates to one's expression in performing actions, whether positive or negative. Subjective norms refer to a person's personal sense of social influence to adopt a specific conduct. Perceived behavioral control, on the other hand, has been characterized as personal beliefs about how easy or difficult it will be to conduct the behavior [20]. Theory of Planned Behavior was chosen because it is important in understanding the relationship and has the potential to further explain mobile learning acceptance and intention to use based on attitudes, subjective norms, and perceived behavioral control [21]. In conclusion, Theory of Planned Behavior's attitude, subjective norms, and perceived behavioral control influence human intention based on cognitive reasoning.

The intention to use m-learning and other technology has been measured in a number of previous research. A study, which was conducted in Taiwan, proposed to examine the model and its hypotheses using the UTAUT model. The findings revealed three analyses: i) satisfaction, trust, performance expectancy, and effort expectancy have positive associations with behavioral intention; ii) perceived enjoyment, performance expectancy, and effort expectancy have positive associations with behavioral intention; and iii) mobile self-efficacy has a significantly positive effect on perceived enjoyment [22]. Another finding that supported the use of mobile learning came from a Malaysian study that focused on behavioral intention to use. They found that using Theory of Planned Behavior and Theory of Acceptance Model to predict students' behavioral intentions toward mobile learning yielded a good outcome, indicating that behavioral intention was highly influenced by mobile learning via attitude and perceived behavioral control [21]. A study on the intention to use technology through an extended model of Theory of Planned Behavior was also discovered in Ghana. All of the constructs have a strong link to students' willingness to use technology. The path coefficient revealed an attitude toward intention of .162, a subjective norm of .097, a descriptive norm of .223 and a perceived behavioral control of intention of .206 [23]. Nonetheless, due to the lack of variability in teachers' responses to key items, a Brunei study on the desire to use ICT in teaching based on Theory of Planned Behavior revealed that perceived behavioral control was not significant [24]. The following are hypotheses that have been proposed based on previous research:

H1: There is a relationship between attitude and intention to use MedCos among students.
H2: There is a relationship between subjective norm and intention to use MedCos among students.
H3: There is a relationship between perceived behavioral control and intention to use MedCos among students.
H4: Attitude significantly predict the intention to use MedCoS.
H5: Subjective norms significantly predict the intention to use MedCoS.
H6: Perceived behavioral control significantly predict the intention to use MedCoS.

Despite the fact that many previous studies [3], [15], [17], [21], [22], [25]–[27] have found that students are more likely to use mobile learning, the creation of MedCos is still in the planning stages and will not be implemented in the near future. Furthermore, based on the educational backgrounds of the students, which include a variety of non-medical programs, it is still unclear whether MedCos will be accepted for future usage. Furthermore, increased use of technology might cause barriers for students, such as shallow learning, decreased psychological well-being, poor sleep quality, increased cognitive distraction, smartphone addiction, anxiety, and professionalism and privacy issues [17]. Thus, aims of this study is to predict students' intention to use MedCoS based on attitudes, subjective norms, and perceived behavioral control.

3 METHODOLOGY

3.1 Study design and participants

This study employs cross-sectional survey research. The population in this study are students in the Health Administration bachelor's degree program at Universiti Teknologi MARA (UiTM), which includes students in Semesters 5 and 6 who were at least had completed a medical coding course. The total number of respondents for this study is 167 students.

3.2 Data collection and instrumentation

This study used a questionnaire to predict intention to use the Theory of Planned Behavior constructs, which includes attitude, subjective norms, perceived behavioural control and intention to use, to evaluate the research objectives. On a five-point Likert scale, the questionnaire has 15 questions. The questionnaire was consisted of three sections; including (a) four items identifying the background of respondents (b) 11 items accessing attitudes, subjective norms, and perceived behavioural control, and (c) four items measuring the intention to use MedCos application in learning the course. Each response was graded on a five-point scale, with 0 representing "Strongly Disagree" and 5 representing "Strongly Agree." [24]. Students are given one week to complete the survey prior to the next phase, i.e., data analysis.

3.3 Data analysis

All the obtained data were checked, cleaned, edited, and analysed using statistical package software for social sciences (IBM SPSS version 23.0). Both descriptive and inferential statistics were performed. Descriptive statistics (frequencies and percentage) were used to describe characteristics of respondents as well as their level of intentions towards the new technique in teaching medical coding. Reliability analysis was performed to measure internal consistency using Cronbach's alpha coefficient. Each of the dimensions was individually tested and the results are described in Table 1. A value greater than 0.7 is considered acceptable, according to the rule of thumb [28]. As a result, the value suggested a high degree of reliability, demonstrating the usefulness of using the items to predict students' intentions to use MedCoS in their learning.

Table 1. Reliability and normal distribution analysis

No	Variable	M	SD	Total Item	Cronbach's Alpha	Skewness	Kurtosis
1	Attitude	4.162	0.514	5	0.891	–0.122	0.359
2	Subjective norm	3.565	0.795	3	0.796	–0.501	0.378
3	Perceived behaviour control	4.164	0.543	3	0.81	–0.102	0.092
4	Intention to use	4.185	0.509	4	0.911	0.26	–0.181

3.4 Ethical approval

This study maintains the anonymity of all the participants, who can choose whether or not to participate. Informed consent was thus obtained from all respondents. Ethics approval for this present research was obtained from the ethics committees of the faculty with the reference number REC/09/2022 (ST/MR/188).

4 RESULTS AND FINDINGS

The major goal of this study is to predict students' intentions to use MedCoS when studying the subject of medical coding. Three elements from the Theory of Planned Behavior were included in the measurement: attitude, subjective norms, and perceived behavioural control.

4.1 Response rate

There were 167 survey questions in total. However, 128 were valid for analysis. Typically, response rates of around 60% are advised for research [29]. The current study had a 76.65% response rate. Regarding an acceptable minimum response rate, there is no set standard [30]. [31] state that a response rate of less than 20% is unfavorable for research.

4.2 Background of respondents

The majority of respondents (n=115, 89.9%) were female, while only 10% were male. The average age of respondents was 23.51 years, with 90.6% of them falling between the ages of 21 and 24. Regarding previous education level, 70% of respondents held a diploma, 28.1% had a Matriculation/STPM, and the remaining respondents had completed Foundation programmes. Lastly, 41.4% and 58.5% of responders, were from semesters five and six, respectively.

The gender gap in higher education has been an international phenomena, with female students enrolling in classes at higher rates than male students. According to the Global Parity Index (GPI) of enrollment ratio for Malaysian public universities published by the Ministry of Education in 2013, UiTM is one of the universities with "extreme disparity" at GPI greater than 2.0, indicating a lower enrollment of men and a higher enrollment of female students. The cause is attributed to topic segregation, with more female students predominating in fields of study such as commerce,

law, social science, and education as well as health and welfare. When it comes to many fields of study, such as engineering, manufacturing, construction, agriculture, veterinary medicine, science, mathematics, computers, the arts and humanities, and services, male students predominate more than female students [32].

Details of survey's findings are described in Table 2. Most respondents strongly agree or agree to the intention to use this novel teaching aid because to enhance the subject knowledge (n=120; 93.7%), help improving the decision-making skills (n=120; 92.8%), help to prepare for future learning independently (n=118; 92.1%) and use the MedCos application during studies (n=114; 89.1%). This is in line with the requirements for occupations of the future, where successful performance includes the use of mobile learning and higher levels of critical thinking, creativity, and interpersonal skills. Students in this study are eager to use MedCos in the Medical Coding subject so they can have a better knowledge, improve decision-making, and be able to learn the subject on their own. Even though some evidence has shown that using mobile learning has drawbacks, such as a lack of student interaction, a lack of face-to-face teacher interaction, and working independently to avoid interaction [33], the majority of higher education students and teachers have expressed similar positive feedback on using mobile learning. They discovered that mobile learning is beneficial and has recently become popular. For instance, in Spain, results from several universities were extracted in about 78% of cases due to the usage of mobile learning, which can regularly implement educational innovation. Its use is deemed appropriate, and its spread is anticipated [34]. Because mobile applications can improve knowledge formation and may have an impact on interpersonal relationships between people and groups, Brazilian accounting majors found that performance expectations and social influence had a substantial impact on their propensity to use them [35]. A systematic analysis of the use of mobile learning in higher education found that 103 papers, starting in the mid-2000s and rapidly increasing after the year 2010, demonstrated growth in the study with the use of mobile learning [36].

In terms of attitudes, the majority of respondents strongly agree and agree that they will incorporate MedCos applications into their studies more frequently (n=116; 90.3%), make the studies more engaging (n=72; 86.7%), the MedCos will help them deliver better practises in the studies (n=116, 90.9%), and look forward to learning with MedCos applications (n=79; 95.1%). This is consistent with a recent study conducted in Pakistan that looked at students' intentions to use mobile learning during COVID-19 [37]. According to the study's findings, learning autonomy, perceived ease of use, perceived usefulness, perceived enjoyment, and mobile device self-efficacy had a significant influence on students' attitudes toward using the application. This is to emphasise the benefits of mobile learning and the willingness to utilise it, which is entertaining and can create motivation to employ more mobile technology features to accomplish academic goals. According to a study conducted in Australia and Indonesia, online instruction can assist students in developing strong motivations for adopting mobile learning because it is a convenient and comfortable way to advance their knowledge [38], [39].

Regarding perceived behavioural control, the students also strongly agree and agree that availability of resources such as technology and physical (n=116; 75.9%) are important when using the application, opportunities for career advancement through use of the application in education (n=116; 90.6%) and the MedCos is considered as good quality (n=112; 87.5%). This finding is corroborated by a recent study conducted in Ghana that used the expanded Theory of Planned Behavior to examine how students behaved when adopting new technology. It demonstrated a positive correlation between the level of perceived personal sufficiency and the amount of control a student may have over the use of technology to accomplish goals by making an intention and then acting on it [23]. To put it another way, it may be claimed that pupils are

more likely to accept technology when they feel confident and at ease doing so [40]. [19] study, which looked at teachers' intentions to use technology, shows that PBC was not substantially predicted to follow through on its goal to use technology. This is because, despite the fact that the situation is advantageous in that a support system is offered, PBC cannot directly convince the instructors to adopt technology.

Few respondents, however, strongly agree and agree that decision to use the MedCos application will be influenced by the medical coding course itself (n=73; 57.1%), the faculty (n=68; 53.2%) and the viewpoints from lecturers (n=104; 81.1%). Though they scored poorly for strongly agree and agree results in subjective norms, in general, the strong attitude and high level of perceived behavioral control led to the intention to use MedCoS because of the motivation and willingness to do the behavior in utilizing the program. While a prior study [19], [23] resembled the opposite result for subjective norms that it positively has related to technological adoption intention, this study demonstrated the students' degree of independence, positive attitudes, and eagerness to use the technology without having to be heavily persuaded by others. This is similar with [41] earlier research, which indicated a detrimental influence on teachers' intentions to use technology. The system's mandated use is to hold accountable for this unfavorable result because teaching experiences do not influence teachers' decision to utilize it or not, other from developing a very positive attitude that does not affect their ability to influence others.

Table 2. Descriptive analysis

No	Variable	M	SD	5 (SA)	4 (A)	2 (D)	1 (SD)
1	Attitude	4.162	0.514				
	A1 I'd like to apply MedCoS into my studies more frequently.			33(25.8)	83(64.5)	–	1(0.8)
	A2 My studies will be more engaging if I use MedCoS.			35(27.3)	82(64.1)	1(0.8)	1(0.8)
	A3 MedCoS will help me deliver my practices better in my studies.			34(26.6)	82(64.1)	–	1(0.8)
	A4 Using MedCoS will broaden the scope of my studies.			29(22.7)	86(67.2)	–	1(0.8)
	A5 I'm looking forward to learning with MedCoS.			39(30.5)	79(61.7)	–	1(0.8)
2	Subjective norm	3.565	0.795				
	A6 My decision to use MedCoS will be influenced by my course			12(9.4)	61(47.7)	15(11.7)	8(6.3)
	A7 My decision to use MedCoS will be influenced by the college			12(9.4)	56(43.8)	22(17.2)	6(4.7)
	A8 My decision to use MedCoS will be influenced by my lecturer's opinion.			20(15.6)	84(65.5)	3(2.3)	2(1.6)
3	Perceived behaviour control	4.164	0.543				
	A9 Availability of Resources. (Technology: Internet access, Medical Coding eBook) (Physical: classroom, desktop, screen projector)			37(28.9)	79(61.7)	1(0.8)	1(0.8)
	A10 Opportunities for career advancement through the use of MedCoS in education.			36(28.1)	80(62.5)	2(1.6)	–
	A11 Good quality of application.			35(27.3)	77(60.2)	–	–
4	Intention to use	4.185	0.509				
	A12 In the future, I intend to use MedCoS to improve my subject knowledge.			35(27.3)	85(66.4)	–	–
	A13 In the future, I intend to use MedCoS to help me improve my decision-making skills.			33(25.8)	87(68.0)	–	–
	A14 I'm likely to use MedCoS to help me to prepare for future learning independently.			35(27.3)	83(64.8)	–	–
	A15 In the future, I intend to use MedCoS during my studies.			33(25.8)	81(63.3)	–	–

Notes: a) M=Mean, SD=Standard Deviation b) Percentages do not equal 100% because neutral responses were excluded. Abbrev: SD–Strongly Disagree, D–Disagree, A–Agree and SA–Strongly agree

4.3 Correlation analysis

As shown in Table 3, the level of the students' intention to use the MedCos application in their learning is positively and significantly correlated with all three constructs of Theory planned behavior. The correlation between attitude and intention to use is r=.785, p<0.01. For subjective norm, the correlation with intention to use is r=.355, p<0.01 and correlation between perceived behavioral control and intention to use is r=.681, p<0.01. Overall, the study's findings indicate that the correlation magnitudes of attitudes and perceived behavioral control are within a large effect, however correlation magnitude of subjective norms is within medium effect. Therefore, all the hypotheses are supported.

Because mobile learning is simple to use and improves academic achievement, earlier research that examined this association found similar favorable results [42], [43]. Although there is a medium effect between subjective norms and intention to use, it can still be believed that effects from friends, family, and other close relatives can at least influence the usage of mobile learning [44]. Due to the degree of control students have over how they utilize mobile learning to achieve their goals, which in turn leads to performing behaviour, perceived behavioural control also posits a positive link with the intention to use [23].

Table 3. Correlation analysis

No	Variable		1	2	3	4
1	Attitude	Pearson Correlation	1	.320**	.721**	.785**
		Sig. (1-tailed)		0.000	0.000	0.000
2	Subjective norm	Pearson Correlation	.320**	1	.348**	.355**
		Sig. (1-tailed)	0.000		0.000	0.000
3	Perceived behavioural control	Pearson Correlation	.721**	.348**	1	.681**
		Sig. (1-tailed)	0.000	0.000		0.000
4	Intention to use	Pearson Correlation	.785**	.355**	.681**	1
		Sig. (1-tailed)	0.000	0.000	0.000	

*Note: **Correlation is significant at the 0.01 level (1-tailed).*

4.4 Regression analysis

Table 4 shows the findings of regression analysis. A multiple linear regression analysis was used to test the dimensions from Theory of Planned Behavior model that influence the intentions to use the MedCos application in their learning. Prior to that, multicollinearity test is important because if multicollinearity exists between two or more independents variables it can deteriorate the results of multiple regression. In this study, multicollinearity has been examined between the Theory of Planned Behavior variables using VIF. The result in Table 4 indicates that multicollinearity does not exist among all Theory of Planned Behavior variables because the tolerance values are more than .10 and VIF values are less than 10. The result thus suggests that the current study does not have any problem with multicollinearity, and this allows for standard interpretation of the regression coefficients.

Table 4. Regression analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
	(Constant)	0.665	0.235		2.825	0.006		
	Attitude	0.593	0.076	0.599	7.782	0.000	0.475	2.104
	Subjective norm	0.055	0.036	0.087	1.518	0.132	0.869	1.151
	Perceived behavioral control	0.205	0.073	0.219	2.811	0.006	0.465	2.148
	R	0.806		F	76.843			
	R^2	0.650		Sig	<0.001			
	Adjusted R^2	0.642		df	3			
	Standard error of estimates	0.305			124			

In this model, R^2 value for the analysis regression model is 0.650, which indicates that the influencing factors explain 65% of the variance in the intention to use MedCos application. Standard multiple regression also provides an adjusted R^2 value. The adjusted R^2 value in this model was 0.642 indicating a moderate fitness of the model. ANOVA was used to assess the statistical significance of the result. The result indicates that the regression model is a good fit of the data, $F(4, 95) = 76.884$, $p < .0005$. In terms of the regression coefficients, the results demonstrate attitudes (t=7.782, p<0.001) and perceived behavioural control (t=2.811, p=0.006) were statistically significantly predict the intention to use MedCos application, but not the subjective norm (t=1.518, p=0.132).

Table 4 demonstrates the standard regression output indicating the effects of individual predictor variables on the intention to use. The unstandardized coefficients for attitudes and perceived behavioral control score are 0.593 and 0.205; respectively. This indicates that for each percentage rise in attitudes, and perceived behavioral control score, the intention to use the MedCos application will increase by 59.3%, and 20.5% respectively. This current study suggests that, two from three variables of Theory of Planned Behavior positively predict the intention to use Medcos. Thus, this means that H4 and H6 are accepted as attitude and perceived behavioral control positively predict the intention to use Medcos. This finding is consistent with studies that utilized TPB by [21], where in their study found that positive or negative attitude of individual is a predictive factor in the intention or decision to use technology.

However, for each increase in percentage subjective norms scores, the predict intention to use MedCos application only increased by 5.5%. This findings challenge H5 on subjective norms. This result is in line with [45], who explained that even when people think a system is useful and simple to use by attitude and behavioral, when there is not pressure or requirement to use it, it may have a less substantial impact on subjective norms. In other words, whether or not to use the technology, it is up to the user's own decision. Conversely, it is inconsistent with previous empirical study [46], [47]. In their findings learner's intention to engage with m-learning increased by the encouragement and influence from important individuals to them such as lecturers, trainers, and friends. This contradiction is perhaps due to the

students attitude is much stronger and it greatly affects their intent to use mobile learning. Thus, the motivating learning environment that encourage the adoption of m-learning has small implication in behavioral change of the students.

5 CONCLUSION

Finally, the results of this study demonstrated that students, regardless of different educational backgrounds and gender, demonstrated interest in using MedCoS to learn the subject of medical coding. This is due to the high level of internal consistency of Theory of Planned Behavior items in predicting students' intention to use MedCoS and the association between the variables. It makes sense that learning technology will improve decision-making, critical thinking, and the ability to code independently. The study will move on to the next stage of development by incorporating the content into the MedCoS application system because the results have been positive. The major drawback of this study is that it is only focused on one subject in the Bachelor of Health Administration degree, which students enroll in for semesters 4 and 5. To generate generalizations of the results and establish links, future research may concentrate on examining the effects of mobile learning using the Theory of Planned Behavior.

6 REFERENCES

[1] W. Elshami, M. H. Taha, M. E. Abdalla, M. Abuzaid, C. Saravanan, and S. Al Kawas, "Factors that affect student engagement in online learning in health professions education," *Nurse Education Today*, vol. 110, p. 105261, 2022, https://doi.org/10.1016/j.nedt.2021.105261

[2] V. Gherheș, C. E. Stoian, M. A. Fărcașiu, and M. Stanici, "E-learning vs. Face-to-face learning: Analyzing students' preferences and behaviors," *Sustainability (Switzerland)*, vol. 13, no. 8, 2021, https://doi.org/10.3390/su13084381

[3] M. Mohammadi, M. S. Sarvestani, and S. Nouroozi, "Mobile phone use in education and learning by faculty members of technical-engineering groups: Concurrent mixed methods design," *Frontiers in Education*, vol. 5, pp. 1–9, 2020, https://doi.org/10.3389/feduc.2020.00016

[4] D. N. Sotiropoulos, E. Alepis, K. Kabassi, M. K. Virvou, G. A. Tsihrintzis, and E. Sakkopoulos, "Artificial immune system-based learning style stereotypes," *International Journal on Artificial Intelligence Tools*, vol. 28, no. 4, pp. 1–27, 2019, https://doi.org/10.1142/S0218213019400086

[5] M. Mohanna, "Using knowledge engineering for modeling mobile learning systems," 2015.

[6] S. S. Liaw, M. Hatala, and H. M. Huang, "Investigating acceptance toward mobile learning to assist individual knowledge management: Based on activity theory approach," *Computers and Education*, vol. 54, no. 2, pp. 446–454, 2010, https://doi.org/10.1016/j.compedu.2009.08.029

[7] L. Briz-Ponce, A. Pereira, L. Carvalho, J. A. Juanes-Méndez, and F. J. García-Peñalvo, "Learning with mobile technologies–Students' behavior," *Computers in Human Behavior*, vol. 72, pp. 612–620, 2017, https://doi.org/10.1016/j.chb.2016.05.027

[8] H. Crompton and D. Burke, "The use of mobile learning in higher education: A systematic review," *Computers and Education*, vol. 123, pp. 53–64, 2018, https://doi.org/10.1016/j.compedu.2018.04.007

[9] H. Hamidi and A. Chavoshi, "Analysis of the essential factors for the adoption of mobile learning in higher education: A case study of students of the university of technology," *Telematics and Informatics*, vol. 35, no. 4, pp. 1053–1070, 2018, https://doi.org/10.1016/j.tele.2017.09.016

[10] H. Hamidi and M. Jahanshaheefard, "Essential factors for the application of education information system using mobile learning: A case study of students of the university of technology," *Telematics and Informatics*, vol. 38, pp. 207–224, 2019, https://doi.org/10.1016/j.tele.2018.10.002

[11] H. J. Kim, J. M. Lee, and J. Y. Rha, "Understanding the role of user resistance on mobile learning usage among university students," *Computers and Education*, vol. 113, pp. 108–118, 2017, https://doi.org/10.1016/j.compedu.2017.05.015

[12] S. A. Nikou and A. A. Economides, "Mobile-based assessment: Investigating the factors that influence behavioral intention to use," *Computers and Education*, vol. 109, pp. 56–73, 2017, https://doi.org/10.1016/j.compedu.2017.02.005

[13] L. Sun, Y. Tang, and W. Zuo, "Coronavirus pushes education online," *Nature Materials*, vol. 19, no. 6, p. 687, 2020, https://doi.org/10.1038/s41563-020-0678-8

[14] M. Zhu and Y. Zhang, "Medical and public health instructors' perceptions of online teaching: A qualitative study using the Technology Acceptance Model 2," *Education and Information Technologies*, vol. 27, no. 2, pp. 2385–2405, 2022, https://doi.org/10.1007/s10639-021-10681-2

[15] E. Tashkandi, "E-learning for undergraduate medical students," *Advances in Medical Education and Practice*, vol. 12, pp. 665–674, 2021, https://doi.org/10.2147/AMEP.S314509

[16] S. G. Johnson, K. B. Titlestad, L. Larun, D. Ciliska, and N. R. Olsen, "Experiences with using a mobile application for learning evidence-based practice in health and social care education: An interpretive descriptive study," *PLoS ONE*, vol. 16, no. 7, pp. 1–16, 2021, https://doi.org/10.1371/journal.pone.0254272

[17] K. Singh et al., "Smartphones and educational apps use among medical students of a smart university campus," *Frontiers in Communication*, vol. 6, pp. 1–9, 2021, https://doi.org/10.3389/fcomm.2021.649102

[18] M. Gopi and T. Ramayah, "Applicability of theory of planned behavior in predicting intention to trade online: Some evidence from a developing country," *International Journal of Emerging Markets*, vol. 2, no. 4, pp. 348–360, 2007, https://doi.org/10.1108/17468800710824509

[19] T. Teo and C. Beng Lee, "Explaining the intention to use technology among student teachers: An application of the Theory of Planned Behavior (TPB)," *Campus-Wide Information Systems*, vol. 27, no. 2, pp. 60–67, 2010, https://doi.org/10.1108/10650741011033035

[20] G. Godin and G. Kok, "The theory of planned behavior: A review of its applications to health-related behaviors," *American Journal of Health Promotion*, vol. 11, no. 2, pp. 87–98, 1996, https://doi.org/10.4278/0890-1171-11.2.87

[21] J. A. Kumar, B. Bervell, N. Annamalai, and S. Osman, "Behavioral intention to use mobile learning: Evaluating the role of self-efficacy, subjective norm, and whatsapp use habit," *IEEE Access*, vol. 8, pp. 208058–208074, 2020, https://doi.org/10.1109/ACCESS.2020.3037925

[22] C. M. Chao, "Factors determining the behavioral intention to use mobile learning: An application and extension of the UTAUT model," *Frontiers in Psychology*, vol. 10, pp. 1–14, 2019, https://doi.org/10.3389/fpsyg.2019.01652

[23] V. E. Arkorful, A. Hammond, B. K. Lugu, I. Basiru, K. K. Sunguh, and P. Charmaine-Kwade, "Investigating the intention to use technology among medical students: An application of an extended model of the theory of planned behavior," *Journal of Public Affairs*, vol. 22, no. 2, 2022, https://doi.org/10.1002/pa.2460

[24] S. Hj. Mohd. Salleh and P. Albion, "Using the Theory Of Planned Behaviour to predict Bruneian science and mathematics teachers' intentions to use ICT in teaching," *Ninth International Conference of the Department of Science and Mathematics Education, Sultan Hassanal Bolkiah Institute of Education*, p. 470, 2004.

[25] E. J. Kim, J. J. Kim, and S. H. Han, "Understanding student acceptance of online learning systems in higher education: Application of social psychology theories with consideration of user innovativeness," *Sustainability (Switzerland)*, vol. 13, no. 2, pp. 1–14, 2021, https://doi.org/10.3390/su13020896

[26] L. Sri Istiyowati and P. Prati, "Mobile learning readiness in higher eduction based on the theory of planned behavior," *International Journal of Recent Technology and Engineering*, vol. 8, no. 1C2, pp. 831–836, 2019.

[27] Y. Y. Wang, Y. S. Wang, and S. E. Jian, "Investigating the determinants of students' intention to use business simulation games," *Journal of Educational Computing Research*, vol. 58, no. 2, pp. 433–458, 2020, https://doi.org/10.1177/0735633119865047

[28] G. Ursachi, I. A. Horodnic, and A. Zait, "How reliable are measurement scales? External factors with indirect influence on reliability estimators," *Procedia Economics and Finance*, vol. 20, no. 15, pp. 679–686, 2015, https://doi.org/10.1016/S2212-5671(15)00123-9

[29] J. E. Fincham, "Response rates and responsiveness for surveys, standards, and the Journal.," *American Journal of Pharmaceutical Education*, vol. 72, no. 2, p. 43, 2008, https://doi.org/10.5688/aj720243

[30] K. Mellahi and L. C. Harris, "Response rates in business and management research: An overview of current practice and suggestions for future direction," *British Journal of Management*, vol. 27, no. 2, pp. 426–437, 2016, https://doi.org/10.1111/1467-8551.12154

[31] M. K. Malhotra and V. Grover, "An assessment of survey research in POM: From constructs to theory," *Journal of Operations Management*, vol. 16, no. 4, pp. 407–425, 1998, https://doi.org/10.1016/S0272-6963(98)00021-7

[32] J. Y. Tienxhi, "The gender gap in Malaysian public universities: Examining the 'lost boys'," *Journal of International and Comparative Education*, vol. 6, no. 1, pp. 1–16, 2017, https://doi.org/10.14425/JICE.2017.6.1.0116

[33] B. Gilbert, S. John, and F. College, "Online learning revealing the benefits and challenges how has open access to fisher digital publications benefited you?," 2015.

[34] J. M. Romero-Rodriguez, I. Aznar-Diaz, F. J. Hinojo-Lucena, and G. Gomez-Garcia, "Mobile learning in higher education: Structural equation model for good teaching practices," *IEEE Access*, vol. 8, pp. 91761–91769, 2020, https://doi.org/10.1109/ACCESS.2020.2994967

[35] A. S. Rodrigues Martins, A. C. Quintana, and C. Gularte Quintana, "Factors that influence the intention of using an app in higher education," *Revista Catarinense da Ciência Contábil*, vol. 20, p. e3193, 2021, https://doi.org/10.16930/2237-7662202131931

[36] M. S. Goundar and B. A. Kumar, "The use of mobile learning applications in higher education institutes," *Education and Information Technologies*, vol. 27, no. 1, pp. 1213–1236, 2022, https://doi.org/10.1007/s10639-021-10611-2

[37] N. A. A. Abdelwahed and B. A. Soomro, "Attitudes and intentions towards the adoption of mobile learning during COVID-19: Building an exciting career through vocational education," *Education and Training*, 2022, https://doi.org/10.1108/ET-02-2022-0048

[38] J. Scull, M. Phillips, U. Sharma, and K. Garnier, "Innovations in teacher education at the time of COVID19: An Australian perspective," *Journal of Education for Teaching*, vol. 46, no. 4, pp. 497–506, 2020, https://doi.org/10.1080/02607476.2020.1802701

[39] L. R. Octaberlina and A. I. Muslimin, "Online learning: Students' autonomy and attitudes," *XLinguae*, vol. 14, no. 1, pp. 49–61, 2021, https://doi.org/10.18355/XL.2021.14.01.04

[40] S. M. Azizi and A. Khatony, "Investigating factors affecting on medical sciences students' intention to adopt mobile learning," *BMC Medical Education*, vol. 19, no. 1, pp. 1–10, 2019, https://doi.org/10.1186/s12909-019-1831-4

[41] T. Teo, M. Zhou, and J. Noyes, "Teachers and technology: Development of an extended theory of planned behavior," *Educational Technology Research and Development*, vol. 64, no. 6, pp. 1033–1052, 2016, https://doi.org/10.1007/s11423-016-9446-5

[42] S. Iqbal and Z. A. Bhatti, "An investigation of university student readiness towards m-learning using technology acceptance model," *International Review of Research in Open and Distributed Learning*, vol. 16, no. 4, pp. 83–103, 2015. https://doi.org/10.19173/irrodl.v16i4.2351

[43] A. I. Saroia and S. Gao, "Investigating university students' intention to use mobile learning management systems in Sweden," *Innovations in Education and Teaching International*, vol. 56, no. 5, pp. 569–580, 2019, https://doi.org/10.1080/14703297.2018.1557068

[44] Z. Hussein, "Subjective norm and perceived enjoyment among students in e-learning," *International Journal of Civil Engineering and Technology*, vol. 9, no. 13, pp. 852–858, 2018.

[45] R. Titah and H. Barki, "Nonlinearities between attitude and subjective norms in information technology acceptance: A negative synergy?," *MIS Quarterly: Management Information Systems*, vol. 33, no. 4, pp. 827–844, 2009, https://doi.org/10.2307/20650329

[46] A. S. Al-Adwan, A. Al-Adwan, and H. Berger, "Solving the mystery of mobile learning adoption in higher education," *International Journal of Mobile Communications*, vol. 16, no. 1, pp. 24–49, 2018, https://doi.org/10.1504/IJMC.2018.088271

[47] M. N. Masrek and I. Samadi, "Determinants of mobile learning adoption in higher education setting," *Asian Journal of Scientific Research*, vol. 10, no. 2, pp. 60–69, 2017, https://doi.org/10.3923/ajsr.2017.60.69

7 AUTHORS

Nor Intan Shamimi Abdul Aziz, Department of International Business and Management Studies, Universiti Teknologi Mara Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia.

Dilla Syadia Ab Latiff, Department of International Business and Management Studies, Universiti Teknologi Mara Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia. E-mail: dillasyadia@uitm.edu.my

Siti Noorsuriani Maon, Department of International Business and Management Studies, Universiti Teknologi Mara Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia. E-mail: sitinoor123@uitm.edu.my

Annurizal Anuar, Department of International Business and Management Studies, Universiti Teknologi Mara Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia. E-mail: annurizal@uitm.edu.my