THE UTILIZATION OF TAM TO EVALUATE THE ACCEPTABILITY OF THE PROGRAMMABLE PEDAGOGICAL MOBILE ROBOT IN ELECTRO-MECHANICAL COURSE

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ABSTACT: *Mobile Robots have been on the rise for assisting teaching and learning strategies, especially in programming courses. Thus, the researcher made an innovation to ensure that programming courses have an added value of creativity and engagement. This innovation is called Programmable Pedagogical Mobile Robot (PPMR). To determine its acceptability, the Theory of Acceptance Model is utilized. The purpose of this study is to evaluate the acceptability of the PPMR in terms of PEU, PU, and BI. Four faculty lecturers and sixty students evaluate the PPMR. Results suggest that the PPMR is easy to use and is profitable in the programming course in Electro-Mechanical Technology (EMT) course. The high level of PEU and PU most likely cause the EMT students to have a high level of BI to use the PPMR. Recommendations to further enhance the PPMR for future studies are included in this study*

Keywords: Acceptability, Electro-Mechanical, Philippine State Universities, Programmable Pedagogical Mobile Robot, TAM,

INTRODUCTION

As technology continues to advance, there is a growing need for innovative and interactive teaching tools that can engage students and facilitate learning in new and exciting ways [1]. One promising solution to this challenge is the Programmable Pedagogical Mobile Robot [2].

The Programmable Pedagogical Mobile Robot combines the power of robotics and programming to create a mobile teaching assistant that can help educators bring lessons to life in the classroom. With its ability to move, interact with students, and respond to commands, the programmable pedagogical mobile robot is poised to revolutionize the way lecturers teach and students learn.

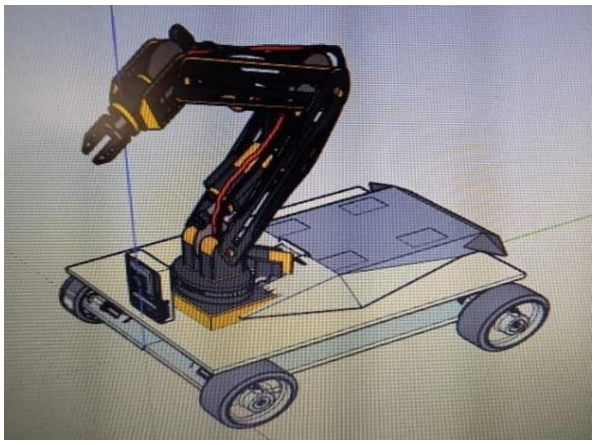

Figure 1. A Computer-generated Image of the Prototype, Programmable Pedagogical Mobile Robot which has a The robotic arm on its mobile platform

Programmable Pedagogical Mobile Robots (PPMRs) are becoming increasingly popular in educational settings [3] as they offer an interactive and engaging way for students to learn about robotics, programming, and other STEM-related topics [4].

Compared to other educational mobile robots, PPMRs have some unique features and advantages. To start with, PPMRs are highly programmable, which means that they can be customized to perform a wide range of tasks and activities. This makes them very versatile and suitable for a variety of educational applications. Some PPMRs are also equipped with sensors and other advanced features that allow them to interact with their environment, which further enhances their educational value [3]. Furthermore, the PPMRs are typically more affordable than other educational mobile robots, which makes them more accessible to schools and educators with

limited budgets. This is because PPMRs are often designed to be simple and easy to assemble, which reduces manufacturing costs [5]. Thirdly, PPMRs are often designed with an emphasis on pedagogy, meaning that they are specifically designed to facilitate learning and instruction [6]. This can include features such as intuitive programming interfaces, pre-designed lesson plans, and student-friendly documentation. This emphasis on pedagogy helps to ensure that PPMRs are effective teaching tools that can engage and inspire students.

In contrast, some other educational mobile robots may be more specialized or have specific applications, such as robots designed for use in research or industrial settings [7]. While these robots may be more advanced in terms of functionality, they may not be as accessible or affordable for educational purposes [8]. Additionally, some other educational mobile robots may have a steeper learning curve, which can make them more challenging to use for novice programmers or students [9]. Overall, while there are a variety of educational mobile robots available on the market, PPMRs offer a unique combination of affordability, versatility, and pedagogical focus that make them a valuable tool for educators and students alike during lectures and laboratories alike.

The Programmable Pedagogical Mobile Robot is a cutting-edge technological innovation that is set to revolutionize the way lecturers and learners educate and interact with technology. This unique robot combines advanced robotics [10], artificial intelligence [11], and pedagogical theory [12] to create an engaging and effective learning experience for students of all ages.

What sets this robot apart from other educational technologies is its unparalleled social influence and perceived ease of use. The robot's friendly appearance [13], intuitive interface [14], and responsive behavior [15] create a sense of companionship and encourage students to engage with the material on a deeper level. Moreover, its adaptive learning algorithms personalize the learning experience to meet the needs and preferences of each individual student, ensuring optimal retention and knowledge acquisition. [16]

THEORETICAL FRAMEWORK

This assessment of the acceptability of the PPMR is anchored on the Technology Acceptance Model (TAM) by Davis [17]. The TAM signifies that a person is likely to use an innovative technology if it is perceived to be easy to use (Perceived Ease of Use - PEU), and it is functional in the performance of the task (Perceived Usefulness - PU). If PEU and the PU are high then it is likely that the behavioral intention (BI) of a person to use the technology is also high. In this study, it is hypothesized that the PPMR would be easy for the EMT students to use, thereby motivating them to potentially use the PPMR in their programming classes. Thus, this study seeks to answer the question: What is the level of acceptability of the Programmable Pedagogical Mobile Robot in terms of: (a) perceived ease of use, (b) perceived usefulness, and (c) perceived behavioral intention?

METHODOLOGY

This study aimed to assess the acceptability of the PPMR in terms of PEU, PU, and BI. To achieve this goal, this study employed a descriptive research design. Descriptive Research Design is a research method used to describe and analyze the characteristics of a phenomenon or population. According to Creswell [18], descriptive research design "is designed to obtain a snapshot of the current state of affairs" (p. 5). It is used to answer questions such as "What is happening?" or "What is the current state of a phenomenon?". A total of sixty (60) students from EMT and four faculty members who are teaching programming were employed as respondents of the study. The profile of the respondents is presented in Table 1.

Table 1 Profile of the Respondents

Characteristics	Students		Instructors	
	F	%	F	%
Sex				
Male	37	54	4	100%
Female	29	46	0	0%
Age				
17 yo and below	13	19	Average Age: 43.75 yo	
18 yo	35	51		
19 yo	16	23		
20 yo and above	5	7		
Academic Qualification	N/A			
Bachelor's Degree			1	25%
Master's Degree			3	75%
Doctoral Degree			0	0%

The research instrument in the study was adopted from the modified TAM questionnaire by Alharbi and Drew [19]. Some words from the original questionnaire were replaced to contextualize the survey in the research setting. For example, the word "this product" was replaced with PPMR. The word "job" was replaced with "programming course." And "productivity" is replaced with "academic performance in programming." Each item in the PEU, PU, and BI was measured using a five-point Likert Scale, 1 means Strongly Disagree and 5 means Strongly Agree.

To ensure that the question items are comprehensible to the actual respondents, five EMT freshmen students who are not part of the actual survey were recruited to answer the questionnaire. So far, the five participants reported that the question items are easy to understand. Hence, there were no changes in the question items. Furthermore, for the reliability of the instruments, 30 EMT sophomore students were recruited to answer the questionnaire. Cronbach's Alpha was run using SPSS. Results revealed that PEU has a value of 0.78, PU of 0.81, and BI has 0.85 [20].

During the data collection, the PPMR was introduced to 60 EMT freshmen students. The main author of this study personally implemented the PPMR using the PPMR laboratory manual as a guide. The students manipulated the PPMR through hands-on activities in their programming course. The data were collected during the second semester of School Year 2022-2023 within the span of two weeks.

The data collection was conducted after permission from the College Dean and Chairperson was sought. The data was analyzed using Mean and Standard Deviation. Table 2 presents the range of data on which the results of the analysis will be based.

Table 2 Range of values for interpreting data analysis results

Scale	Range	Description	Interpretation
1	1.01-1.80	Strongly Disagree (SD)	The PPMR is totally not usable in the programming course.
2	1.81-2.60	Disagree (D)	The PPMR is not usable in the programming course
3	2.61-3.40	Neutral (N)	The usability of PPMR is unidentified.
4	3.41-4.20	Agree (A)	The PPMR is usable in the programming course
5	4.21-5.00	Strongly Agree (SA)	The PPMR is totally usable in the programming course

RESULTS AND DISCUSSION

Mean and Standard Deviation were used to determine the level of acceptability of the PPMR in terms of PEU, PU, and BI. Results revealed that the level of perceived ease of use of the PPMR, as experienced and perceived by the EMT students, is totally easy to use in their programming course *(M=4.26, SD=1.018).* Moreover, regarding the perceived usefulness, the EMT students revealed that the PPMR is usable in their programming course *(M=3.88, SD=0.888)*. Finally, in terms of the behavioral intention to use the PPMR, results revealed that the EMT students agreed that the PPMR is totally useful in their programming course *(M=4.33, SD=0.933).* Tables 2, 3 and 4 present the summary of the results.

Table 3 Level of Acceptability in terms of PEU

Items	Mean	SD	Description
Learning to operate PPMR would be easy for me.	4.26	1.12	SA
I would find it easy to get PPMR to do what I want to do.	4.15	0.93	A
My interaction with PPMR would be clear and understandable.	3.89	1.01	A
I would find PPMR clear and understandable.	4.51	1.13	SA
It would be easy for me to become skillful at using PPMR.	4.67	0.98	SA
I would find PPMR easy to use.	4.09	0.94	A
Overall mean for PEU	4.26	1.018	SA

Table 4 Level of Acceptability in terms of PU

Items	Mean	SD	Description
Using PPMR in my programming course would enable me to accomplish tasks in programming quickly.	4.01	0.832	A
Using PPMR would improve my performance in programing.	3.70	0.924	A
Using PPMR in my programming class would increase my academic productivity.	4.10	0.831	A
Using PPMR would enhance my effectiveness in my programming course.	3.82	0.869	A
Using PPMR would make it easy to do programming.	3.89	0.943	A
I would find PPMR useful in my programming course.	3.75	0.926	A
The overall mean for PEU	3.88	0.888	A

Table 5 Level of Acceptability in terms of BI

Items	Mean	SD	Description
I plan to use the PPMR in the future.	4.11	0.894	A
Assuming that I have access to the PPMR, I intend to use it.	4.56	0.971	SA
Overall mean for BI	4.34	0.933	SA

CONCLUSION

The researchers have used TAM to investigate the acceptance and adoption of PPMRs among students. Based on the findings of this study, there is evidence to suggest that the TAM is a valid acceptability model for programmable pedagogical mobile robots (PPMRs) in educational settings. The high level of acceptability of the PPMR could be attributed to its added sensory feature as well as its ability to move in different directions. Its four-legged platform allows the PPMR to move forward, backward, and in diagonal movements. Its arm mobility and its ability to interact with the user are also identified as extra factor for its acceptability. The robot's friendly appearance, intuitive interface, and responsive behavior were also believed to have caused the high level of acceptability of the PPMR. Hence, this study confirms other empirical evidence and findings based on TAM. Finally, the study successfully confirms the applicability of TAM in the use of PPMR in the EMT course among students specifically in a Philippine state university in Northern Mindanao settings.

RECOMMENDATION

Any research endeavors have their limitations, and so is this current project. First, this study was limited by time. The data was conducted for only two weeks to accommodate the two sections of EMT students in their programming class. Another limitation is that this current study is descriptive by nature, thus causality is not captured. For future studies, it is recommended that longitudinal research may be conducted to better predict the behaioral intention and use behavior of the students. Moreover, multiple regressions and structural equation modelling could be conducted to confirm the empirical results of this study. Finally, qualitative data may be collected through observations and interviews to further understand the students' perceptions and experiences as to why the PPMR has been received to be highly useful in the EMT students' programming course.

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