Anticipating Students' Preferences: Investigating Factors Influencing the Choice between Block-Code and Source-Code Programming
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Anticipating Students' Preferences: Investigating Factors Influencing the Choice between Block-Code and Source-Code Programming

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Abstract

This study explores behavioral factors influencing students' choice between block-code programming (BCP) and source-code programming (SCP) among Community College students in Malaysia. Two hundred and twenty-six IT certificate students participated, answering questions based on the Technology Acceptance Model and Theory of Planned Behavior using a Likert scale survey. Analysis using structural equation modeling revealed that attitudes towards technology and behavior strongly influenced students' preference for BCP over SCP. However, further investigation into how these behaviors impact programming learning is needed. The study's findings emphasize the importance of perceived usefulness, ease of use, and subjective norms in students' preference for BCP. With substantial R2 effect sizes (0.864), the study underscores the significant influence of perceived usefulness (PU), perceived ease of use (PEU), and subjective norms (SN) on BCP adoption behavior. The implications of these findings extend to policymakers and educators, providing valuable insights for refining computing education standards. Moreover, the study lays the groundwork for future research, offering a deeper understanding of block-code programming's role in the digital education transition.

Keywords: block-code programming, source-code programming, technology acceptance model (TAM), theory of planned behavior (TPB), community college.

INTRODUCTION

Programming is one of the essential fundamentals that students must finish to graduate from Community College in Malaysia with a Certificate of Information Technology, or STM (short for *Sijil Teknologi Maklumat*, which translates to Certificate of Information Technology). Students must

complete programming courses such as Problem Solving and Program Design, Programming Fundamentals, Web Development, Object-Oriented Programming, Introduction to the Internet of Things (IoT), Mobile Application, and their Final Year Project, which calls for them to incorporate programming skills to demonstrate expertise, knowledge, and skills. The STM program has therefore attempted to develop people who possess the ability to adapt to the use of technology and who are responsible for computer systems and network technology to fulfill the demands of the nation and address the emerging challenges in the field of information technology. Expertise in data analytics and cyber security was identified as being extremely important when discussing digital skills (Budiastuti et al., 2023; Hasbullah et al., 2022; Sudin et al., 2022). It was found that using educational institutions could help balance the skills required for the workforce of the future (Roslin et al, 2022; Mohamad et al., 2022; Shahrizal et al., 2022; Mohamad Kasim et al., 2023).

Computer programming has consistently posed challenges within the realm of computer science. From the very beginning, introductory programming courses have witnessed elevated rates of failure and dropout, underscoring the inherent difficulty. As students embark on their programming journey, mastering the ability to address complex real-world problems becomes imperative; this proficiency extends beyond a mere grasp of syntax and language flow (Cheah & Chang et al., 2020). For STM students at the Community College, programming is one of the most difficult, intricate, and demanding disciplines. To effectively finish this course, students must be familiar with the basic concepts, structures, and syntax of computer programming. One of the challenges is that students are said to be less engaged in learning theoretical content, which makes it more difficult to write code to solve simple programming problems. The problem lies in the fact that community college students find it difficult to understand basic programming concepts and exhibit little interest in them, especially when theory is required to pass theoretical exams and fulfill assignments (Quah et al., 2023; Jamilah et al., 2022). Learning programming is perceived by most students as a tough and demanding undertaking when they are first introduced to it. To successfully navigate each stage of algorithm development, students require excellent problem-solving abilities, as a deficiency in this skill may lead to course failure. Numerous studies indicate that students experiencing challenges in problem-solving are more likely to encounter difficulties in programming classes (Jamilah et al., 2022). Students experience a range of feelings when studying programming, including nervousness, anxiety, confusion, and difficulty understanding the difficult process of coding programs. They encounter several obstacles and problems, including problems with the syntax of the program, errors, and debugging procedures; difficulties in the courses; analysis, resources, algorithms, time management, and personal elements (Olipas, 2022). This was supported by Cheah (2020), who found students' attitudes towards studying computer programming are influenced by their negative perceptions of the subject.

In the early 2000s, block-code programming (BCP) emerged as a response to the difficulties aspiring programmers experienced in learning the necessary skills. One well-known platform in this area is Scratch, which was introduced in 2007 by the MIT Media Lab's Lifelong Kindergarten Group. By logically joining graphic blocks that represent code structures, Scratch allows users to create programmers. The user-friendly Scratch programming environment has been widely used in educational settings to teach programming fundamentals, especially to beginners (MIT Media Lab,

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n.d). Several other BCP languages have since surfaced and are being well-received by programmers across the globe. One of the ways that BCP sets itself apart from SCP is that it leverages the jigsaw puzzle-piece metaphor, which gives learners visual cues about which commands to apply. This makes BCP a valuable programming language in educational environments. The primary benefit of BCP is its ability to lessen students' challenges in comprehending programming language syntax, thereby making programming more accessible to beginners. Prior research has examined metaphors in the context of BCP, including puzzles and microworlds. To develop and enhance BCP, they have looked into the idea of incorporating design science into the curriculum while highlighting design principles and methods for data analysis. Simply put, focusing on the intended message rather than the method of expression is the goal of BCP. Research in the field shows that students who use a BCP as opposed to those who use a textual programming language perform better, exhibit greater interest in the subject, and find the process more interesting (Glas et al., 2023). BCP's main goal is to assist students in expressing their thoughts by placing more emphasis on the "what" than the "how". The study is limited by the lack of extensive literature support for the non-significant factors. More rigorous, well-supported literature is needed for the factors that did not prove significant. Hence, the studies suggest more focus-finding in future research.

Hence, this study aims to examine STM students' readiness to understand BCP and SCP. Previous studies have emphasized the existence of BCP and SCP. Hence, this study concentrates on the elements that can be incorporated into the syllabus that can be maximized by students. This study intends to determine students' level of understanding of the topic studies. The specific objectives of the study are to investigate: (1) factors influencing students' preference for BCP vs SCP; and (2) the relationship between perceived usefulness, perceived ease of use, attitude, subjective norms, and behavioural intention regarding BCP and SCP. The subsequent sections provide more insights and are titled (1) literature reviews, (2) research methods, (3) research findings, and (4) discussions.

LITERATURE REVIEW

Forecasting students' preferences through an analysis of the variables influencing the decision between BCP and SCP is the main goal of the literature review. In comparison to SCP, this study focuses on the benefits of BCP, highlighting features like learnability, user-friendliness, and simplicity. Furthermore, the study emphasizes the understanding of the Technology Acceptance Model (TAM) and the Theory of Planned Behaviour (TPB). This entails examining the applicability of technology and figuring out how student attitudes and conduct mesh with new and developing technologies. As a result, this review aims to shed light on the main issues raised in the research.

How Visual Fluency Shapes Learning: Unravelling the Dynamics of BCP Versus SCP in Education.

BCP uses intelligent graphical elements to represent instructions, operations, and syntax in

programming. By organizing graphical pieces into useful programs, users create algorithms. The representation of code and how it is formed into a program is where SCP differs from this format. In contrast, SCP requires programmers to commit intricate syntax and operations to memory. By connecting blocks and replacing textual syntax with visual expressions like icons, forms, diagrams, nodes, and other graphical features that represent the idea of visual syntax, BCP streamlines the process for programmers (Kossakowski, 2023). BCP entails building programs with pre-made command blocks that are categorized and listed in blocks. There is no need for commands to be written in text because users put these blocks together to create the final program (Moraiti et al., 2022). BCP is frequently used in computer science education to simplify the frequently difficult syntax of a textual programming language and make it easier for beginners to solve computational issues. It allows users to program using reusable graphical pieces rather than writing SCP (Glas et al., 2023).

For inexperienced programmers, this visual method has advantages over traditional languages. Because BCP differs from SCP and other visual programming languages in a few important ways, it is a valuable programming language to employ in teaching settings. The most famous is the metaphor of the jigsaw puzzle pieces, which is used to give the students visual indications regarding which commands to use (Andersen et al., 2022). Researchers have delved into metaphors such as microworlds and puzzles associated with BCP; exploring basic programming lessons could benefit from a design science approach. This viewpoint concentrates on data analysis techniques and design standards with the goal of improving and perfecting BCP. BCP activities showed a moderate influence on computational thinking skills in a middle school experiment including 82 fifth graders. The study evaluated how fifth graders' academic performance, self-efficacy, and computational thinking abilities were affected by both BCP and unplugged coding (Namli & Aybek, 2022). Instead of utilizing SCP as is typically done, BCP enables users to program using reusable graphical elements.

For languages like Java, C, Python, and others, SCP is generally seen as a programming style that blends in and is used in professional contexts. Many of its characteristics, like its robust portability, rigorous syntax, and large function libraries, are also inherited by the text-programming language SCP. SCP has also been shown in numerous studies to significantly improve students' computational cognition, creativity, programming, and problem-solving skills (Bai et al., 2021; Kim et al., 2019). Additionally, studies have shown that using SCP can improve students' programming abilities and have a favorable effect on their learning of new concepts and knowledge (Sentance et al., 2019).

Research showed that SCP programming improved students' overall computational problem-solving abilities, had a major impact on new or inexperienced students' growth in computational thinking, and significantly affected students' advancement in computer programming. Students are further helped by SCP to develop their programming careers. Learning complex syntax rules using SCP can help students advance in their computer programming jobs and stay employable in the field (Sun & Zhou, 2023).

According to studies, SCP programming enhanced students' capacity for general computational problem-solving, had a major impact on the development of computational thinking in novice or new

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students, and advanced students' proficiency in computer programming. As students are ready for careers in programming, SCP assists them in the process. Students who use SCP to master difficult syntax rules can progress in their computer programming careers and maintain their competitiveness in the market (Sun & Zhou, 2023). Addressing misconceptions and focusing on grammar rules and fundamental programming knowledge is essential to foster students' engagement with SCP, known for its complex syntax. As for novices entering the programming domain, comprehending computational thinking within an SCP programming environment and acquiring programming skills swiftly can be challenging. Nevertheless, the precise syntax rules of SCP, the organization of program code, and the logic of problem-solving collectively contribute to the cultivation of well-developed programming attitudes among students. Despite the growth in this field, a comprehensive literature review systematically organizing and evaluating research on SCP for the enhancement of programming abilities is yet to emerge (Aslam et al., 2020).

BCP makes learning programming language syntax easier for pupils and makes programming more approachable for beginners. Other academics have examined the possibility of teaching beginning programming from a design science viewpoint, emphasizing design rules and data analysis techniques that may be used for building and enhancing BCP. They have also highlighted microworlds and puzzles as metaphors related to BCP (Andersen et al., 2022). As for students in kindergarten through 12th grade, BCP is useful scaffolding tools that help them acquire computational thinking abilities. The study found that BCP learners in educational contexts play four distinct roles: quitters, approaches, solutions, and knowers. The approaches made some progress but fell short of the best answer; the early quitters left the group too soon; the solvers made significant progress and came up with the best solution; and the knowers showed mastery in problem-solving (Jiang et al., 2022). BCP is essentially meant to free up learners to focus on communicating their ideas instead of trying to figure out how to do them. Research on 82 middle school fifth graders found that BCP activities had a moderate impact on students' computational thinking abilities. BCP and unplugged coding were found to have an impact on student's academic achievement, self-efficacy, and computational thinking abilities (Namli & Aybek, 2022)**.**

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a foundational paradigm in the fields of technology management and information systems. TAM, which was created by Fred Davis in the late 1980s, is well known for its ability to accurately forecast whether people or organizations will successfully embrace new technology solutions. The capacity of TAM to identify negative attitudes towards technology and its significant contribution to understanding and forecasting user acceptance and adoption patterns of emerging technologies are both highlighted in this study (Dziak, 2020), as illustrated in Figure 1. TAM is a simple theory that states that two important factors determine a person's inclination to use technology: perceived usefulness, which indicates how much a person believes using technology will increase their productivity or efficiency, and perceived ease of use,

which indicates how simple a person believes using technology to be, as mentioned in Figure 1 (Buabeng-Andoh, 2018).

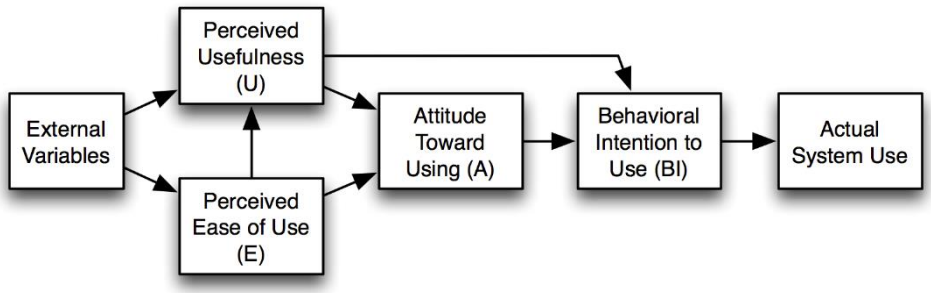

Figure 1: Technology acceptance model adapted from (Buabeng-Andoh, 2018)

According to the approach, potential users' motivation is directly impacted by the characteristics of a new technology system. The likelihood that users will adopt and incorporate the new system into their workflows is well predicted by this motivating level. TAM's significance also stems from its function in examining the software applications and information technologies that are adopted in various situations. A third motivating component, attitude towards utilization, is shaped by the combination of perceived usefulness and ease of use (Dziak, 2020). This component captures how prospective users feel about the system in general. When consumers believe a system is beneficial and easy to use for their jobs, they are more likely to have a favorable attitude. In contrast, people are likely to have a very unfavorable attitude if they believe the system will bring more difficulties than benefits (Dziak, 2020; Buabeng-Andoh, 2018).

Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB) is regarded as a strong and thorough framework in the fields of behavioral science and social psychology. It has proven to be effective in guiding interventions and campaigns aimed at behavior modification and is a useful tool for researching the psychological underpinnings of behavior. TPB was developed by Icek Ajzen as an extension of the Theory of Reasoned Action (TRA) Ajzen (1991), with the goal of understanding and forecasting human behavior in general and acts involving conscious decision-making in particular, as shown in Figure 2.

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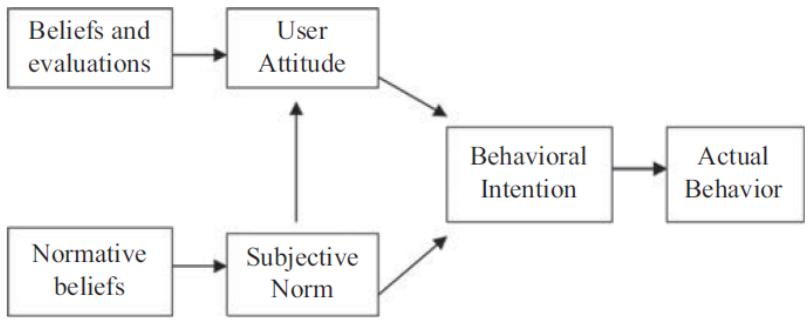

Figure 2: Theory of Planned Behaviour adapted from (Davis et al., 1989)

Fundamentally, TPB suggests that people consider several aspects before deciding on a specific course of action. According to the idea, three main factors shape behavioral intention, which in turn shapes actual behavior: (1) Attitude towards Behaviour (AB), which captures a person's assessment of a certain behavior, whether favorable or unfavorable. This includes thoughts about the behavior's results and the weight given to those results; (2) subjective standards (SN), which include the behavior's perceived social pressures and standards. It incorporates the sway of others' opinions, expectations, and societal norms on an individual's decision to engage in the behavior; and (3) perceived behavioral control (PBC), covering an individual's perception of the ease or difficulty associated with executing a behavior. This component considers perceptions of resources, barriers, and self-efficacy. Taken together, these three elements have a complex role in determining how someone plans to engage in a particular behavior. In addition, behavioral intention precedes actual behavior directly, meaning that stronger intentions make the behavior more likely to occur. This complex framework provides a complex understanding of the complex interaction between behavioral outcomes and psychological factors (Ajzen, 2011; Buabeng-Andoh, 2018).

Numerous studies comparing students' preferences for BCP and SCP have consistently emphasized the benefits of BCP, especially at the certificate level, and its ease of use and approaches. It's important to remember, though, that most of these studies are carried out abroad, and Malaysia needs more locally focused research. Based on variables including demographics, past knowledge, institutional contexts, curriculum, and technology infrastructure, the results of this kind of research may vary. One interesting finding is that, although community college students have great expectations for a more secure future after finishing their courses, they frequently lack confidence in their talents (Quah et al., 2023). The reasons behind students' preference for BCP over SCP are clarified by this study, which makes it noteworthy. The study is noteworthy for focusing on the influence of subjective norms and attitudes regarding use among third-semester students of Certificate in Information Technology in Malaysian community colleges. Examining things more broadly, this study advances our knowledge of how community colleges respond to technology. Researchers, educators, and authorities can all

benefit from the study's conclusions, which provide a more nuanced picture of how Malaysian community college students view and use technology.

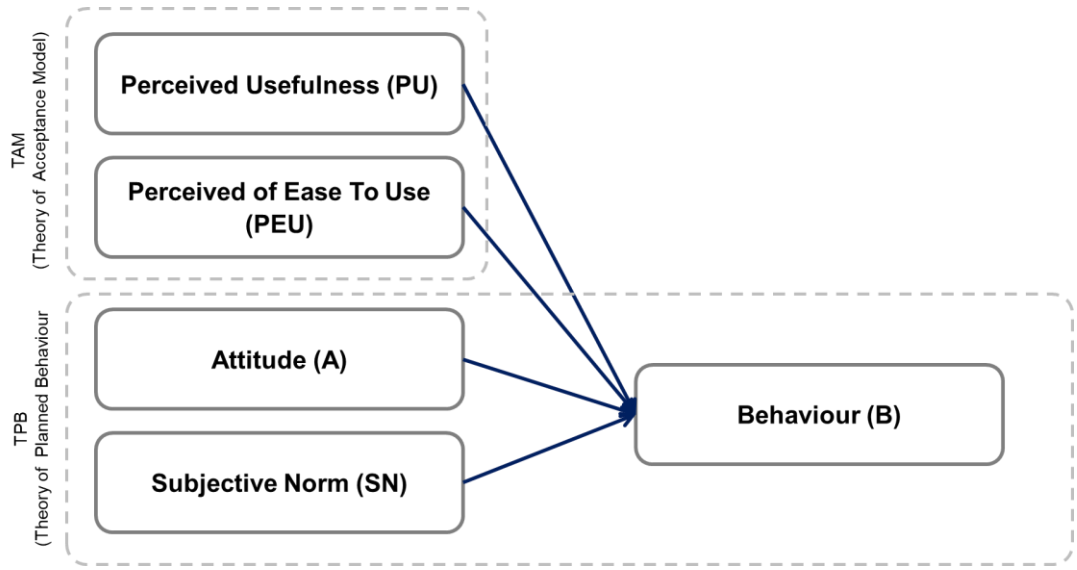

Figure 3: Conceptual framework

Drawing from Figure 3, the underlying theory is the Technology Acceptance Model (TAM), developed by Davis et al. (1989), combined with the Theory of Planned Behavior (TPB), established by Ajzen (1991). This framework was used to predict and understand how individuals might behave when adopting new technologies. Perceived PU and PEU, which indicate the degree to which an individual believes that utilizing technology will increase their productivity or efficiency, are the five primary study components that require attention. A, SN, and BN all play a significant role in influencing a person's intention to engage in a particular behavior. This intention acts as a direct predictor of actual behavior, meaning that a stronger intention raises the possibility that the behavior will materialize and influence behavior assessment.

RESEARCH METHODOLOGY

Participants and data collection methods

This research is designed to focus on descriptive analysis and relationships between variables using PLS-SEM 4.0. Data on students, including their institutions, age, gender, and *Sijil Pelajaran Malaysia* (SPM) results for two subjects—1,119 English and 1,449 Mathematics—were gathered using an online survey. The respondents had to answer a questionnaire related to perceived usefulness, perceived ease of use, attitude, subjective norms, and behavioral intention, which included a brief explanation of the

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BCP and SCP. Since they have experience with both programming approaches in their first, second, and current third semesters, these respondents are third-semester Certificate of Information Technology students in Community Colleges throughout Malaysia in Session 1 2023/2024. Following the questionnaires and goal of this paper, they will produce survey work to a high standard, which is a standard at which the results will be regarded as credible (Kelley et al., 2003).

The questionnaires are replicated and adopted from Buabeng-Andoh (2018). A set of twenty-three items, employing a Likert scale ranging from (1) Strongly Disagree to (7) Strongly Agree, including (4) Neither Agree nor Disagree, (5) Somewhat Agree, (6) Agree, and (7) Disagree, was distributed for the survey. Following this, the inferential analysis will primarily focus on PU, PEU, A, SN, and BN. The study population, drawn from the *Jabatan Pendidikan Politeknik dan Kolej Komuniti* database (https://www.mypolycc.edu.my/), comprises 336 individuals. However, adhering to the minimum acceptable sample size criteria of 181 or more (Krejcie et al., 1996), 256 responses were collected from third-semester Certificate of Information Technology students at Community Colleges throughout Malaysia in Session 1 of 2023/2024. The sampling method utilized a simple random sampling procedure (Krejcie et al., 1996).

Data analysis

The information obtained from the surveys was examined using the Statistical Package for the Social Sciences (SPSS 23.0). Using SPSS, descriptive analysis was performed to find the mean and standard deviation of each variable item (Griffith, 2010). For additional analysis, the component-based SEM or PLS-SEM (Partial Least Squares-Structural Equation Modelling) technique was applied with Smart PLS software. PLS-SEM was used since the goal of the study is to investigate how independent variables, or factors, affect the dependent variable or operational achievement. PLS-SEM data analysis is split into two sections. Testing the measure's goodness of fit, as determined by validity and reliability analyses, is the initial test step. The second step of the structural model's hypothesis testing entails determining the impact of the independent factors on the dependent variable by looking at the values of the t-value and groove coefficient (Hair, 2014; Hair et al., 2019).

RESEARCH FINDINGS

Assessment of measurement model

In SMART PLS-SEM, two measurement phases are necessary. The structural model is evaluated after the measurement model, which evaluates the measurement's validity and reliability.

Validity and Reliability Tests

For the validity and reliability test, a total of 256 questionnaires were gathered and analyzed using PLS-SEM (Hair et al., 2016). Both approaches demonstrated that the constructs met the 0.7 and above criteria, indicating their reliability (Hair et al., 2019). By assessing the external loading, composite reliability (CR), and extracted average variance (AVE), which were analyzed using Cronbach's alpha and composite reliability, the convergent validity was determined. Every external load was found to be greater than 0.50, the AVE values to be greater than 0.50, and the CR values to be greater than 0.70. As a result, the constructs' validity is sufficient. The validity and reliability of each construct are displayed in Table 1.

Table 1: Construct Validity and Reliability

	Indicators	Outer Loading	Cronbach's Alpha	Composite Reliability	AVE
Perceived Usefulness (PU)	PU1	0.872	0.936	0.937	0.839
	PU2	0.935			
	PU3	0.938			
	PU4	0.918			
Perceived Ease of Use (PEU)	PEU1	0.840	0.891	0.893	0.696
	PEU2	0.798			
	PEU3	0.843			
	PEU4	0.847			
	PEU5	0.840			
Attitude (A)	A1	0.892	0.904	0.907	0.839
	A2	0.931			
	A3	0.924			
Subjective Norm (SN)	SN1	0.918	0.934	0.935	0.884
	SN2	0.961			
	SN3	0.941			
Behavioural Norm (BN)	BN1	0.950	0.947	0.947	0.904
	BN2	0.955			
	BN3	0.948			

This study found that the reliability of all indicators was achieved for Cronbach's alpha between 0.947 and 0.891, where the reliability of the questions provided reached a maximum limit of threshold 0.708. The composite reliability identified that all indicators reached between 0.947 and 0.893. Average Variance Extracted (AVE) obtained 0.696 to 0.904, which surpassed the base level of 0.5. Moreover, discriminant validity was evaluated to demonstrate the necessity of each construct and to ensure all constructs do not overlap.

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Table 2: Discriminant Validity – Fornell and Larcker creation

	A	BN	PEU	PU	SN
A	0.916				
BN	0.839	0.951			
PEU	0.837	0.794	0.834		
PU	0.767	0.729	0.833	0.916	
SN	0.841	0.839	0.786	0.686	0.940

Table 2 reports the constructs' discriminant validity using the Fornell-Larcker criterion. The square root of each construct's AVE should exceed its highest correlation with any other construct (Fornell & Larcker, 1981; Hair et al., 2017; Hair et al., 2019; Henseler et al., 2014).

Assessment of Structural Model

The subsequent process is the assessment of the structural model. The bootstrapping technique was employed for hypothesis testing. Smart PLS 4.0 was used to generate the t value (Henseler et al., 2014), and this enables this study to examine the statistical significance of the causal correlations in the structural model of this study, as shown in Table 5. In PLS-SEM, the "popular critical t values for a two-tailed test are 1.65 ($\alpha = 0.10$), 1.96 ($\alpha = 0.05$), or 2.57 ($\alpha = 0.01$)" (Hair, 2014).

Table 3: Bootstrapping result path coefficient (direct effect)

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
A -> BN	0.428	0.486	2.576	0.166	0.868
A -> SN	0.914	0.915	0.025	36.965	0.000
PEU -> A	0.930	0.928	0.036	25.673	0.000
PEU -> BN	0.048	-0.018	3.589	0.013	0.989
PU -> BN	0.079	0.125	2.064	0.038	0.970
PU -> PEU	0.911	0.911	0.043	21.238	0.000
SN -> BN	0.402	0.366	0.980	0.410	0.682

The bootstrapping algorithm was employed with a re-sampling of 500 samples. The path coefficient and the t-value were assessed using Smart PLS 3.2.6 (Ringle et al., 2015), which demonstrates the statistical significance of the correlations among the constructs in the model. In PLS-SEM, "the popular critical value of t for a two-tailed test is 1.65 ($\alpha = 0.10$), 1.96 ($\alpha = 0.05$), or 2.57 ($\alpha = 0.01$)" (Hair, 2014; Hair et al., 2019).

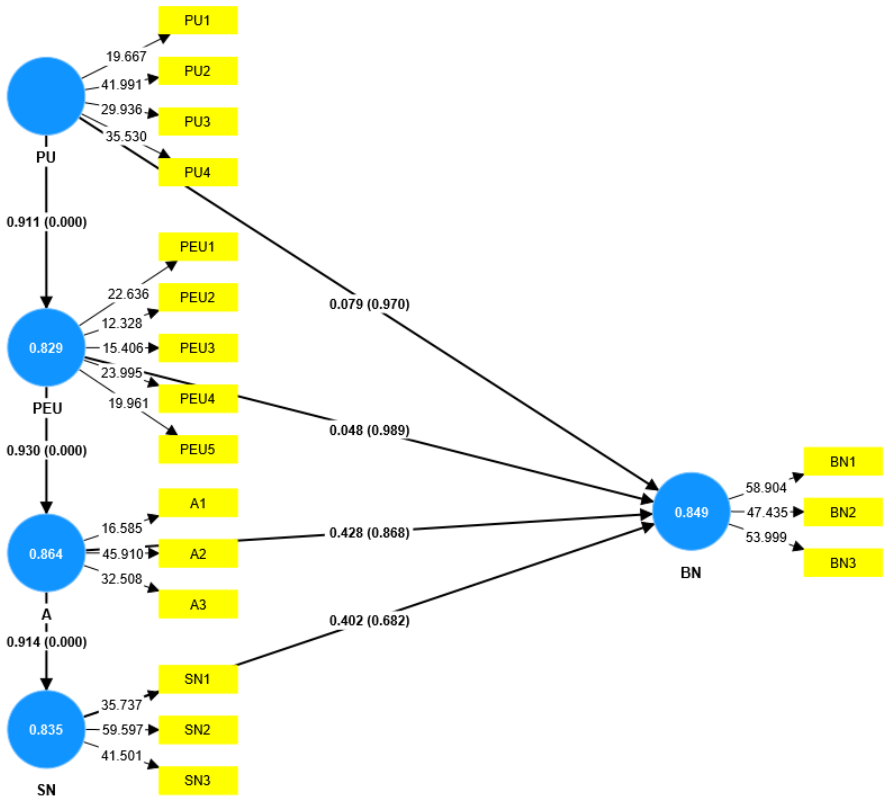

Figure 4: Bootstrapping result (direct effect)

Table 3 and Figure 4 illustrate the bootstrapping results, which indicate the sign values of the causal relationship among the constructed indicators. At 5% interest intervals (t-Value> = 1.96), Perceived Usefulness (PU) → Behavioural Norm (BN) (t = 0.970); Perceived of Ease Use (PEU) → Behavioural Norm (BN) (t = 0.989); Attitude (A) → Behavioural Norm (BN) (t = 0.868); Subjective Norm (SN) → Behavioural Norm (BN) (t=0.682); Perceived Usefulness (PU) → Perceived Ease of Use (PEU) (t = 0.000); Perceived Ease of Use (PEU) → Attitude (A) (t = 0.000); Attitude (A) → Subjective Norm (SN) (t = 0.000).

The postulated hypotheses are supported as the results determined that there is a significant relationship between perceived usefulness and perceived ease of use, between perceived ease of use, and between attitude and subjective norm.

Coefficient of Determination (R^2 Value)

The coefficient of determination (R^2 value) is a widely used measurement to assess a structural model. The coefficient signifies the combined effect of an exogenous latent variable on an endogenous latent

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variable. The R^2 values of 0.75, 0.50, or 0.25 for endogenous latent variables are used as the guideline for categories weak, average, and substantial (Hair et al., 2017).

Table 4: R^2 and R^2 adjusted values

Construct	R^2	R^2 adjusted
Perceived Usefulness (PU)	0.830	0.830
Perceived Ease of Use (PEU)	0.829	0.829
Attitude (A)	0.864	0.864
Subjective Norm (SN)	0.835	0.835
Behavioural Norm (BN)	0.849	0.846

Table 4 reported the R^2 values of 0.829, 0.830, 0.835, 0.849, and 0.864. These values indicate that the perceived usefulness variable explains 18% of the variance of the endogenous construct behavioral norm, which is substantial. Hence, substantial influence in this model happens when block code and source code are influenced by perceived usefulness, perceived ease of use, attitude, and subjective norms that influence behavioral norms. A detailed understanding of block code and source code in the study will positively impact behavioral norms. This study identified that 86.4% of the variance of behavioral norms was explained by all independent variables.

DISCUSSION

Various factors contribute to a BCP environment's success. First, syntax is made simpler by employing blocks or icons, which lowers the frequency of syntactic errors. Second, visual components help to clarify semantics and facilitate comprehension of basic programming ideas. Finally, pragmatics is discussed since visual environments show how a program works in particular situations, like how adding data affects how the program operates (Moraiti et al., 2022). With its intuitive UI and simple syntax, BCP makes programming quick and easy to learn, especially for new users and younger students. Unlike conventional SCP languages, BCP introduces code using a range of hues and forms. This method significantly lowers the barrier to entry into programming by enabling novices to create programs by modifying these elements. Relevant research confirms that BCP is a useful computational thinking learning strategy, explaining why its application in education is becoming more and more common. The main benefit of BCP is that it helps students overcome the difficulties they encounter when learning programming language syntax, which makes coding easier for novices (Andersen et al., 2022).

This study emphasizes the effectiveness of TAM in identifying unfavorable attitudes toward technology and its substantial role in comprehending and predicting user acceptance and adoption patterns for emerging technologies (Dziak, 2020). TAM, a straightforward theory, posits that an individual's inclination to use technology is influenced by two key factors: perceived usefulness, reflecting the belief that the technology enhances productivity, and perceived ease of use, indicating

the perceived simplicity of using the technology (Buabeng-Andoh, 2018). The Theory of Planned Behaviour (TPB) proposes that individuals consider three main factors before deciding on a behavior: Attitude towards Behaviour (AB), Subjective Norms (SN), and Perceived Behavioural Control (PBC). AB reflects personal assessment, SN involves social pressures, and PBC considers perceived ease or difficulty. Stronger behavioral intentions increase the likelihood of the behavior occurring. This framework provides insight into the complex interplay between behavioral outcomes and psychological factors (Ajzen, 2011; Buabeng-Andoh, 2018).

The study's findings demonstrated a clear relationship between students' opinions on the BCP and SCP learning comprehension behavioral norms and their assessments of the utility, usability, attitude, and subjective norm. The study's strong R2 effect sizes of 0.864 indicate that behavior availability for BCP consumption was significantly impacted by all the variables linked to PU, PEU, and SN. According to students, BCP is chosen because it is flexible, easy to use, and encourages clear, intelligible two-way communication, allowing all students instant access to instruction and exposure to learning.

Various studies comparing student preferences for BCP and SCP highlight the advantages of BCP, especially at the certificate level, emphasizing its user-friendly nature. However, most of these studies are conducted internationally, necessitating more locally focused research in Malaysia. This study, conducted on third-semester Certificate in Information Technology students in Malaysian community colleges, focuses on the reasons behind their preference for BCP over SCP, particularly exploring the influence of subjective norms and attitudes. The findings provide valuable insights for researchers, educators, and authorities, offering a nuanced understanding of how Malaysian community college students perceive and utilize technology, thus contributing to the broader knowledge of technology adoption in educational settings.

CONCLUSION

The purpose of this study is to determine how students behave in BCP, and the results have confirmed this. The study's limitations concerning the literature review continue to impede the results' potential to be broadly applied. For the factors that are not significant, the study needs more accurate, well-supported literature so that it can be used to carry out further research with succinct findings in the future. The future research suggestion is to conduct similar studies with students in other contexts beyond community colleges in Malaysia to improve generalisability. Additionally, future studies can investigate additional factors that may influence preference for BCP vs SCP beyond the TAM and TPB models applied in this research. Evaluations based on the effectiveness of BCP vs SCP on student learning outcomes need to focus on more than just behavioral intentions.

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