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PAPER

Examining the Factors Influencing Students' Satisfaction with Hackathon for IT Projects

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ABSTRACT

Education-related hackathons provide a dynamic and participatory method of teaching where students take an active role and become inventors and problem solvers. It encourages teamwork, critical thinking, and the use of technology, preparing students for the demands of the workforce of the twenty-first century. Although it has played a significant role in changing enterprises and society at large, its impact on academia has not yet been adequately examined. Studying the factors influencing student satisfaction with the use of hackathons for teaching and learning is crucial and pertinent given that South African educational institutions are still in the early phases of employing hackathons. The study sought to determine the factors that contributed to students' satisfaction with hackathons for IT project. To achieve the goal, a model incorporating the self-efficacy and satisfaction constructs with TAM variables (perceived usefulness (PU), perceived ease of use (PEOU), and behavioral intention (BI)) was developed. To test the model, an online questionnaire-based survey was carried out on 180 IT students who had taken part in a hackathon. Exploratory factor analysis was performed to assess the validity of the results, while Cronbach's alpha was used to assess reliability. The hypothesis in the suggested model was verified by using correlation to assess relationships between the constructs, while linear regressions were utilized to assess influences between variables. The Pearson correlation result showed that self-efficacy and behavioral intention have a moderately positive and statistically significant relationship with student satisfaction when using hackathon for IT projects, and the regression analysis revealed that students' use of hackathons for IT projects is positively influenced by perceived usefulness and self-efficacy. The study identified factors that were positively correlated with and impacted students' satisfaction with the use of hackathon for IT projects, which forms the primary contribution of this research work. By enabling a form of social learning where knowledge is created among students, the use of hackathon for IT projects will help change the learning environment from a teacher-centered to a learner-centered one.

KEYWORDS

information technology (IT), projects, hackathon, factor analysis, student satisfaction

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1 INTRODUCTION

Hackathons are intense, team-based activities where people from all backgrounds and skill sets get together to work on problems and develop creative solutions [1]. "Hackathon" is a mashup of the phrase's "hack" and "marathon." The OpenBSD group, which planned a multi-day programming event, coined the phrase for the first time in 1999 [2–3]. However, the idea of a collaborative event to solve issues dates to the 1960s, when MIT computer scientists planned a programming competition to address programming issues [4]. The emergence of open-source software and the growth of the IT sector helped the idea become more well-known in the 2000s. With several hackathons held annually throughout the world, they have become increasingly popular as a platform for fostering invention and teamwork, which has been employed in a variety of settings, including business, politics, and education [5–6]. Hackathons are important for a variety of reasons. First and foremost, they offer an opportunity for people to work on actual issues and create workable solutions. Hackathons foster the kinds of innovative thinking, creativity, and problem-solving that are necessary in today's workforce. Second, hackathons give participants a chance to connect and work with people from all fields and backgrounds. This encourages interdisciplinary learning by enabling the exchange of concepts and information. Thirdly, hackathons offer an avenue for people to obtain real-world experience and hone their talents [7].

Academic hackathons are slowly growing in acceptance, particularly in higher education. They give students a platform to encourage innovation, entrepreneurship, creativity, and problem-solving skills [8]. Additionally, it gives students the chance to practice their skills and apply their theoretical knowledge to real-world issues. Students can benefit from this practical experience since it enables them to hone their skills and obtain a deeper knowledge of the subject they are studying [9]. In recent years, a lot of institutions have started hosting hackathons to encourage student creativity, teamwork, and hands-on learning. Students have the chance to improve their problem-solving, creativity, and teamwork abilities through hackathons in the classroom [2]. These activities give students the chance to collaborate in teams, often with people from different disciplines, to create solutions to pressing problems. Students can learn from one another in this collaborative setting, creating a sense of community. Education-related hackathons give students a stage to present their talents and get noticed. It also provides students a chance to network with experts in their field of study [10]. These events often have a jury of judges who assess the students' projects and provide feedback. Students may benefit from this feedback since it enables them to develop their abilities and receive credit for their efforts [11].

Since the hackathon's primary goal is to provide students with the opportunity to collaborate with others and pick up new skills, students can practice their theoretical knowledge and put their problem-solving abilities to use by participating in hackathons [12]. It is expected that their popularity will increase in the years to come. Although students' satisfaction with the hackathon experience is a key factor in determining its success, the use of hackathons for IT projects in higher education is still in its infancy. Many students and faculty members are unaware of the advantages of hackathons or how to participate in them. Students are more likely to make hackathons a regular activity if they believe they have gained anything of value from the experience.

This study attempts to investigate the factors that influence students' satisfaction with the use of hackathons for IT projects. Several studies employ the technology acceptance model (TAM) to comprehend and predict users' information system acceptability as well as their likelihood of adopting the system [13–14]. This research therefore uses the TAM by integrating the TAM with the constructs of SS and SE. Like other studies that examined whether TAM is a reliable indicator of user satisfaction with information technology in diverse settings where usage is required, it was found to be significant [15–16]. This will provide a strong theoretical foundation for investigating the adoption of hackathons. As a result, the TAM is a model that will aid the study's efforts to ascertain how students would embrace and use hackathons for IT projects.

2 CONCEPTUAL MODEL DEVELOPMENT

Hackathons as a form of technology necessitate collaboration and participation from multiple stakeholders. It is important to investigate the factors that influence the use of hackathons in different contexts, including education. The extensive adoption of the TAM, which the author [17] developed to describe how users perceive and embrace technology, as well as the numerous empirical studies that have proven it to be a reliable predictor of system usage and acceptance [13]. PU and PEOU are the two main characteristics that affect technology adoption, according to TAM [17]. The adoption of educational technology, such as e-books, mobile learning apps, and online learning platforms, has been studied in several studies using TAM to examine the factors that drive acceptance. For instance, [18] found that PU and simplicity of use have a substantial impact on students' intentions to utilize mobile learning apps. A study [19] found that relative advantage, PU, PE, and self-efficacy are factors that influence hackathon uptake for learning IT programming.

According to several studies, factors influencing the adoption of hackathons in the classroom include the accessibility of resources, participation rates, the hackathon's relevance to students' academic objectives, and the level of engagement and cooperation among participants [20–21]. Additionally, [22] posits that the level of interaction between instructors and students, as well as the platform's usability and material quality, all have an impact on how satisfied students are with their course. Despite this acceptability, it neglects to pay attention to user satisfaction when assessing technology usage. According to several studies, highly motivated students are more likely to take part in hackathons [21]. Students who have a strong motivation to participate in the hackathon are more likely to find satisfaction in the event and to make it a regular activity.

Consequently, the TAM, along with the satisfaction and self-efficacy constructs, is a model that will aid the study in determining how students would accept and apply a hackathon for IT projects. This is in line with earlier studies on TAM that looked at whether the model accurately captured user satisfaction with information technology in settings where usage is required and found it to be significant [15–16].

2.1 Proposed model and hypothesis development

Due to its growing empirical backing, TAM has become widely used for predicting the adoption of any new technology [17], [23]. The analysis of the factors influencing students' satisfaction with hackathons for IT projects forms the foundation of our research strategy. To build our model, we consider self-efficacy, PU, and PEOU, BI, and satisfaction (see Figure 1). One may learn more about how students perceive the hackathon for IT projects and how to make improvements to it to boost participation and satisfaction by collecting data on the constructs. The information can also be used to compare how well various technologies and approaches work to increase student engagement in IT courses.

Self-efficacy. Self-efficacy reflects one's views about their capacity to carry out the actions necessary to achieve predetermined performances [24–25]. When participating in hackathons, studies have linked higher levels of self-efficacy to better learning results [20, 26]. For instance, as stated in [27], self-efficacy is a crucial factor in comprehending the collaborative approach. However, some studies have found a link between computer self-efficacy and student satisfaction [28]. In this study, the term "self-efficacy" for hackathons is used to describe users' belief in their own abilities to use hackathons for IT projects. This belief may have an impact on students' satisfaction with the use of hackathons for IT projects [29–30].

H_{C1}: *There is a positive relationship between self-efficacy and student satisfaction in the use of hackathon for IT projects.*
H_{R1}: *There is a significant influence between self-efficacy and student satisfaction in the use of hackathon for IT projects.*

Perceived usefulness. A person's subjective assessment of whether using new technology is beneficial is known as perceived usefulness [17]. According to research, it is significantly influenced by a user's intent to utilize a system [14]. PU in the context of this study is defined as the extent to which a student thinks that using a hackathon would improve their performance in IT projects, which have a substantial impact on learning outcomes and learners' satisfaction [31].

One can measure improvements in outcomes by looking at the effectiveness and efficiency of the learning process. Several empirical investigations have demonstrated the positive effect of this factor on the usage of ITs [14], [17], [32]. This study employs a hackathon approach to examine how PU influences students' satisfaction with IT projects and how much they believe in their own ability to succeed academically in a collaborative environment [17], [33].

H_{C2}: *There is a positive relationship between perceived usefulness and student satisfaction in the use of hackathon for IT projects.*
H_{R2}: *There is a significant influence between perceived usefulness and student satisfaction in the use of hackathon for IT projects.*

Perceived ease of use. According to [17], PEOU refers to how easily a person perceives using a specific new technology to be. Based on the TAM and these e-learning implementations, our study defines hackathon ease of use as the extent to which students find using the hackathon for IT projects to be simple. The ability to master various crucial skills utilizing hackathons serves as an excellent demonstration of how learners assess ease of use [23], [33]. Previous research has shown that the most significant variables that influence PEOU are computer self-efficacy, perceived enjoyment, and computer anxiety [23], [31], [33].

H_{C3}: *There is a positive relationship between perceived ease of use and student satisfaction in the use of hackathon for IT projects.*
H_{R3}: *There is a significant influence between perceived ease of use and student satisfaction in the use of hackathon for IT projects.*

Behavioral intention. As stated in [32], BI relates to the learners' decision to employ technology to support their learning. This suggests that students would employ hackathons for IT projects in the future, and how much they think doing so improves their behavioral goals and possible academic success in a collaborative learning environment. Students are more likely to participate in the learning activities provided by these technologies and have a positive learning experience when they have a strong intention to use them [14], [17], [32]. Therefore, it is presumed in this study that the hackathon can improve students' academic achievement through BI to use. High levels of continuing intention and user satisfaction were shown to be the most likely items for both PU and ease of use [34].

H_{C4}: *There is a positive relationship between behavioral Intention and student satisfaction in the use of hackathon for IT projects.*
H_{R4}: *There is a significant influence between behavioral Intention and student satisfaction in the use of hackathon for IT projects.*

Student satisfaction. According to [35], satisfaction is the emotion of pleasure or disappointment that results from comparing the performance to anticipation. It is a short-term mindset brought on by an appraisal of the educational experience, services, and resources that students either entirely or partially use [36]. Studies have been done in education to determine the variables that affect student satisfaction [30], [35], [36]. The factors influencing satisfaction in the learning process include student and instructor behaviors, abilities, self-efficacy, demographic traits, course flexibility, course structure and design, peer interaction, and perception of the instructor [30]. Learner satisfaction was positively impacted by the variety of evaluations, course flexibility, social interactions, system quality, and perceived utility [31]. [37] found that interactions between students and staff or faculty, the reputation of the educational institution, and PU and application-specific computer self-efficacy all had a positive impact on students' satisfaction.

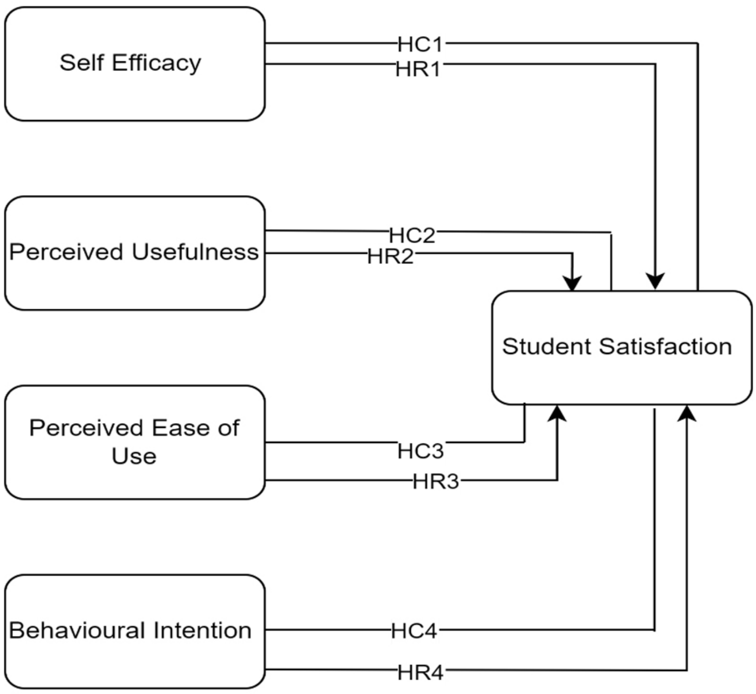

Fig. 1. Proposed hackathon satisfaction model

3 RESEARCH METHODOLOGY

3.1 Study design

A quantitative survey using a questionnaire was undertaken with South African IT students as the target audience to examine the determinants of students' satisfaction with the use of hackathons for IT projects. The survey asked questions regarding the demographics of the students as well as their perceptions of the hackathon's usefulness, self-efficacy, PEOU, BI, and students' satisfaction with the hackathon experience. The sample method utilized was convenience sampling, which entails including study participants from a target group who are easy for researchers to reach. 180 responses were gathered after the poll was distributed online using a survey platform. The replies were recorded on a Likert scale of 1 to 5, where 1 stood for "strongly disagree" and 5 for "strongly agree." Only students who had registered for the semester had access to the online survey platform. To avoid duplicate submissions, respondents were only permitted to complete the survey once, and all responses were anonymous. Details about the students are reported in Table 1 below. The survey data was evaluated statistically to determine the factors influencing students' satisfaction with hackathons for IT projects.

3.2 Data analysis

The data were investigated using several statistical tests at various stages, including factor analysis, correlation, and regression, using the Jamovi software 2.3.21. EFA was originally used to evaluate the quality and dependability of the data. To display the original data structure and better comprehend the structure that supports the received data, the EFA seeks to study fewer dimensions [38]. The eigenvalues and total explained variance of the components were considered to ensure a proper correlation in the EFA. The Kaiser-Meyer-Olkin (KMO) test was used to determine the suitability of the sample, and Bartlett's sphericity test was used to assess the factorability of the correlation matrix. The validity of the questionnaire's capability to consistently measure the indicated characteristics was established using Cronbach's value. Pearson correlation analysis was performed to examine the strength and direction of the linear relationship between the factors [39]. Furthermore, regression analysis explores the relationship between the variables and assists in establishing the direction and strength of the relationship between a dependent variable and one or more independent variables [40]. By quantifying the relationship, we can identify the determinant factors of students' satisfaction with using hackathons for IT projects. Researchers can choose the most suitable model by using regression analysis to assess the goodness of fit of their models. R-squared, adjusted R-squared, and p-values, among other statistical indicators, offer insights into the accuracy and significance of the model. Researchers can examine various models and select the one with the strongest statistical features and the ability to best explain the observed data.

4 RESULT

The outcome of the analysis of data is presented below.

4.1 Demographic profile

According to the study's demographics, shown in Table 1, the respondents are disproportionately male (61%) and students between the ages of 22 and 26 (70%) who consistently use computers on a daily and weekly basis (82%). Except for fourth-year students, the academic level of the study's participants is essentially evenly dispersed. Since they are majoring in information technology and frequently utilize computers, most students think they are equipped to participate in hackathons. Future studies must consider some balance between the genders of participants in a hackathon.

Table 1. Demographics profile

Grouping		n	Percentage
Gender	Male	109	61
	Female	71	39
Age	15–21	22	12
	22–26	126	70
	27–31	24	13
	31+	8	5
Computer Usage	Daily	73	40
	Weekly	76	42
	Monthly	14	14
	None	8	4
Academic Level	1st Year	56	31
	2nd Year	62	36
	3rd Year	42	22
	4th Year	20	11

4.2 EFA assessment

Factor analysis seeks to accurately portray the information found in the variables by substituting the variables with a handful of common factors. The data were initially subjected to exploratory factor analysis (EFA) to validate the SE, BI PEOU, PU, and student satisfaction constructs. The KMO index of 0.855, which is more than the standard threshold of 0.60, was used to assess the applicability of EFA [41]. This indicates that the data were sufficiently connected and that a factorial analysis was viable. The Bartlett's test of sphericity is significant, indicating that the scale's items do in fact interact with one another significantly (chi-square = 2163, df = 171, $p < 0.001$). Our need to extract five components—BI, PU, PEOU, SS, and SE—was shown by the initial analysis of the principal components. It was responsible for 66.3% of the total variance. For loading onto the BI that did not line up with other self-efficacy items, item SE1 was eliminated from the model. According to the communalities of the original measures, which ranged from 0.627 to 0.911, the variance of the original values was effectively represented by these five components.

The second factorial study, which was conducted after establishing that the data were suitable for factor analysis, produced a KMO index of 0.848, indicating that the data were sufficiently correlated and that a factorial analysis was possible (chi-square = 2040, df = 153, $p < 0.001$). The factors were extracted using principal axis factoring. A five-factor solution was obtained, which explained 67.6% of the total variance. The popular Oblimin Rotation Method was then applied to rotate the retrieved factors. Table 2 displays the findings of the most recent analysis of primary axis factoring components. They demonstrate that each variable's factor loading surpasses 0.4 [42], demonstrating the sufficient validity of the items measured.

Table 2. Factor loading matrix with Oblimin rotation

	Factor					Cumulative %	Cronbach α	Communalities
	1	2	3	4	5			
BI1	0.913					17.1	0.92	0.898
BI2	0.69							0.898
BI3	0.848							0.907
BI4	0.755							0.911
PU1		0.75				32.2	0.884	0.871
PU2		0.858						0.857
PU3		0.776						0.911
PU4		0.801						0.904
PEOU1			0.655			45.9	0.852	0.722
PEOU2			0.781					0.637
PEOU3			0.897					0.627
PEOU4			0.776					0.695
SS1				0.738		57	0.834	0.8
SS2				0.7				0.868
SS3				0.891				0.755
SE2					0.658	67.6	0.842	0.896
SE3					0.808			0.857
SE4					0.671			0.897

Note: 'Principal axis factoring' extraction method was used in combination with an 'Oblimin' rotation.

Finally, Cronbach's co-efficient alpha (α), the indicator most frequently employed for this kind of analysis, is utilized to establish reliability. [42] suggests that an alpha reliability score of 0.60 or higher is sufficient for any research that is in its early stages. For each of the five variables in our investigation, the Cronbach alpha is higher than 0.8, which is the level at which reliability is deemed acceptable, as shown in Table 2. It shows that the instrument can be regarded as trustworthy and internally coherent.

4.3 Pearson correlation

Pearson correlation analysis was conducted to determine the association between students' satisfaction with the hackathon for an IT project. The data set's correlation matrix is shown in Table 3. Pearson's data analysis of self-efficacy and satisfaction revealed a moderate positive and statistically significant correlation ($r = 0.409$, $\rho < 0.001$). An increase in the confidence of students to use hackathon would lead to higher satisfaction in their IT projects. Analysis of BI and satisfaction revealed a moderate positive and statistically significant ($r = 0.40$, $\rho < 0.001$). This shows that an increase in the motivational influence of students to use hackathon would lead to higher satisfaction in their IT projects. The study also found the relationship between PU and satisfaction was positive, moderate in strength and not statistically significant ($r = 0.375$, $\rho > 0.001$). This shows that an increase in the perceived utility of hackathons for students would lead to higher satisfaction in their IT project. Also, the relationship between PEOU and satisfaction was negative, markedly low in strength and not statistically significant ($r = -0.014$, $\rho > 0.001$). Students with the low perceived simplicity of the hackathon reported higher satisfaction.

Table 3. Correlation matrix

	SE	PU	PEOU	BI	SS
Self-Efficacy	–				
Perceived Usefulness	0.409***	–			
Perceived Ease of Use	0.035	0.023	–		
Behavioral Intention	0.714***	0.546***	0.008	–	
Satisfaction	0.409***	0.375	–0.014	0.405***	–

Notes: *p < .05, **p < .01, ***p < .001; 1 = Perceived Usefulness, 2 = Self-Efficacy, 3 = Perceived Ease of Use, 4 = Behavioural Intention, 5 = Student Satisfaction.

4.4 Regression factors

The study used multiple regression analysis to investigate the impact of self-efficacy, PU, PEOU, and BI on student satisfaction with their utilization of the hackathon for IT projects. Using the entry method, the regression model was created. The model is statistically significant at the 0.001 level, $F(4,175) = 19.7$, indicating that the independent factors are significantly related to students' satisfaction with using hackathons for IT projects. The summary of the common regression model displays various correlation values ($R = 0.56$) that illustrate how closely some of the combined independent factors were linked to students' satisfaction (the dependent factor) in using hackathons for IT projects. Also, the adjusted $R^2 = 0.31$ indicates that all the independent factors together explained 30% of the variances in the satisfaction of the students to participate in a hackathon.

Table 4. Model coefficients-satisfaction

Predictor	Estimate	SE	t	p	Stand. Estimate	95% Confidence Interval	
						Lower	Upper
Intercept	1.5555	0.4115	3.780	<.001			
Perceived Usefulness	0.2027	0.0787	2.574	0.011	0.2054	0.0479	0.363
Self-Efficacy	0.2418	0.101	2.393	0.018	0.2289	0.0402	0.418
Perceived Ease of Use	–0.0252	0.068	–0.371	0.711	–0.0248	–0.1566	0.107
Behavioural Intention	0.1224	0.0976	1.255	0.211	0.1291	–0.074	0.332

The causal association between student satisfaction and four research model constructs was identified by the regression analysis. Table 4 provides a summary of the predicted factors, along with each significant value. The results of the regression test show that PEOU ($\rho = 0.711$) and BI ($\rho = 0.211$) are not statistically significant ($\rho > 0.05$). This implies that PEOU and BI do not influence students' BI to use hackathon for IT projects. Moreover, PU ($\rho = 0.011$) and self-efficacy ($\rho = 0.018$) are statistically significant ($\rho < 0.05$), indicating PU and self-efficacy are the factors that has a positive influence on students' satisfaction to use hackathon for IT project. As a result, hypothesis H_1 and H_2 were supported. Figure 2 illustrates a model that has been empirically validated from the result of the correlation and regression result.

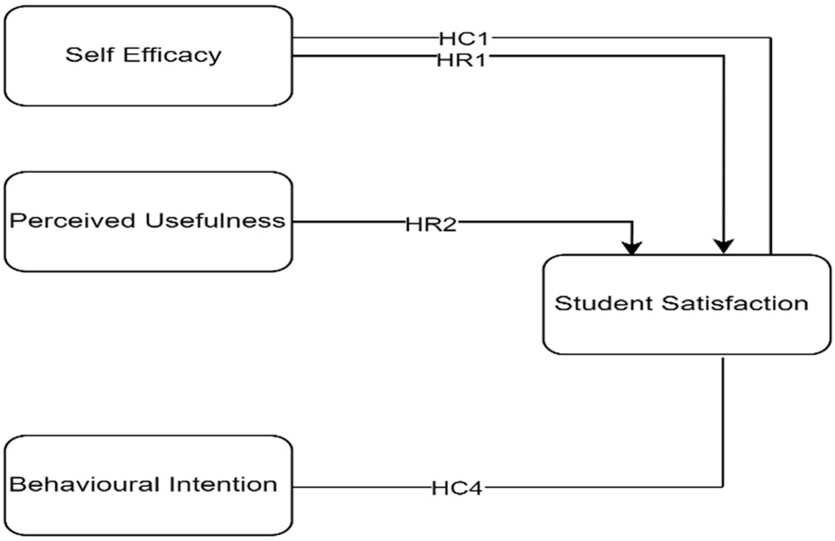

Fig. 2. Final hackathon satisfaction model

5 DISCUSSION AND CONCLUSION

Using self-efficacy, satisfaction, and the components of the technology adoption model, 19 items were identified. The EFA assigned the items to five latent factors. The study's findings show a tendency toward a more student-centered approach and consider how satisfied students are with how participating in hackathons has affected their academic learning. The real usage of an IS system, which determines satisfaction—in this case, the hackathon for IT projects—is defined by Factor 1 (BI). A student's ideas on how the IT hackathon will enhance his or her capacity to carry out academic tasks are reflected in Factor 2 (PU). The level to which a student believes utilizing a technology—in this case, the hackathon for IT projects—will be simple is represented by Factor 3 (PEOU). The student's decision to get and apply an invention to complete a task to profit from it is Factor 4 (SS). Students' opinions of their capacity to meet specified performance standards and exert control over external factors that have an impact on their lives are informed by Factor 5 (SE).

The mean values in Table 2 represent students' opinions on these questions, which shows the significance of their unique personalities. The validity and reliability of each factor were confirmed, as well as the variances that each latent factor could explain. The proposed model was verified to identify the potential relationship between the factors impacting students in use of hackathons for IT projects. The proposed model proved to be significant and satisfied general goodness-of-fit criteria. In this study, the factors that directly influence hackathon uptake are self-efficacy and PU. This agrees with previous research [19], [32]. The study's findings confirm the existence of variables that influence students' satisfaction with using hackathons for IT projects. The relationship between these factors was comprehensively and realistically represented by the model. The use of the hackathon concept gives the authors a forum to talk about the various ideas related to student academic success.

The study's findings shed light on the variables that influence students' satisfaction with using hackathons for IT projects. The findings imply that successful hackathons are more likely to be those that are relevant to students' academic goals, encourage participation and collaboration among participants, and provide high-quality content. The study also emphasizes the significance of academic and administrative support, as well as the accessibility of resources and platform usability, in guaranteeing students' satisfaction with the hackathon experience. The design and implementation of hackathons for IT projects in the academic sector can be informed by these findings to increase student satisfaction and encourage innovation and creativity. In conclusion, PU and self-efficacy affect how satisfied students are with the use of hackathon. Students who believe the hackathon to be beneficial and feel confident in using it will engage in positive social interactions, learn something new, and be more likely to make hackathon their go-to activity.

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