

## Examining student acceptance of Procreate in digital art education using the technology acceptance model (TAM)



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### ABSTRACT

This study employs the Technology Acceptance Model (TAM) to explore students' acceptance of Procreate in educational settings, focusing on the relationships between perceived ease of use (PEOU), perceived usefulness (PU), and behavioral intention to use (BIU). A cross-sectional survey was conducted among university students enrolled in art and design programs. Data were collected through an online questionnaire and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0. The findings reveal significant positive relationships among the variables, with PEOU showing strong direct effects on BIU ( $\beta = 0.494$ ,  $p < 0.001$ ) and PU ( $\beta = 0.500$ ,  $p < 0.001$ ), while PU also positively influenced BIU ( $\beta = 0.205$ ,  $p < 0.001$ ). The model demonstrated a good fit (SRMR = 0.038, NFI = 0.947) and high reliability (Cronbach's alpha > 0.90 for all constructs), confirming the framework's robustness. These results contribute to understanding technology adoption in creative education and provide practical implications for educators, software developers, and institutional decision-makers. The study underscores the importance of usability in educational technology design, suggesting that prioritizing user-friendly interfaces can enhance student engagement and adoption of digital art tools.

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### 1. Introduction

The integration of art education with engaging modern design and art tools has redefined the creative education paradigm. As shown by [Hua and Yu \(2024\)](#), the distribution and deployment of advanced tools such as digital design programs and graphic tablets have had a relatively large effect on students' learning experiences. This exemplification is further supported by [González-Zamar and Abad-Segura \(2021\)](#), who buttressed the extensive integration of tools at a faster rate during their period of analysis, explaining that these tools enable greater levels of self-reflection and autonomy from the students' perspectives. The above tools include Procreate, a widely used digital illustration application that enables artistic and educational freedom for both students and teachers on an iPad

([McCreedy, 2021](#)). The question of how well students accept and adopt these tools is critical to their efficient implementation and pedagogical effectiveness, as more schools begin embedding various digital tools and apps into the curricula.

The technology acceptance model (TAM) put forth by [Davis \(1989\)](#) has been shown to be most useful in understanding the general acceptance of technology by users in a variety of situations. The model further suggests that perceived ease of use and perceived usefulness are the basic factors that drive the acceptance and continued usage of technology ([Davis, 1989](#)). While TAM has been extensively studied in educational contexts like learning management systems and mobile learning applications, its application to creative digital tools presents unique considerations. Previous studies have examined TAM in relation to creative software such as Adobe Photoshop ([Purnomo, 2023](#)), Illustrator ([Ridho et al., 2022](#)), and Sketchbook ([Rosa et al., 2020](#)), revealing that creative tools may have distinct acceptance patterns due to their emphasis on artistic expression and intuitive interaction. This pattern aligns with [González-Zamar and Abad-Segura's \(2021\)](#) findings on digital design in artistic education, where they noted that creative tools

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enable greater levels of self-reflection and autonomy from students' perspectives. However, there remains a significant gap in understanding how students accept and adopt iPad-based creative tools like Procreate, which differ fundamentally in their touch-based interface and educational integration approach from traditional desktop creative software.

This study focuses on Procreate as a result of its particular place within the geospatial digital art educational framework. Unlike conventional desktop creative applications, which are usually accompanied by cumbersome workflows and intricate user interfaces, Procreate grants unbridled pedagogical and andragogical liberty to instructors and learners alike on an iPad (McCready, 2021). As Hua and Yu (2024) illustrated, the unification of art education with Procreate, an advanced design instrument, has transformed the creative education paradigm. It lets students perform digital creation in a manner closer to traditional art but with the digital media's benefits. These traits make Procreate a prime candidate for studying the acceptance of technologies in educational settings that emphasize creativity, where artistic expression and technological functionality need to converge harmoniously.

As digital art tools assume a greater educational role in tertiary art and design institutions, educators are expected to successfully use these technologies in their teaching without any negative impact on their acceptance of them. Despite the increased pedagogical and professional use of Procreate, its factors of acceptance by students are still poorly studied. It is vital to be aware of what these determinants are for appropriate strategies to be designed and the educational advantage of the digital art tools to be leveraged.

Consequently, this study seeks to analyze the dynamics between ease of use, usefulness, and acceptance of Procreate in education by students on the basis of the Technology Acceptance Model. In this context, the study aims to understand these relationships in such a way that it offers useful advice to teachers, administrators, and even software developers with respect to improving the use of digital art tools in education and improving student learning.

## 2. Literature review

### 2.1. TAM applications in educational technology

The TAM has gained enormous significance as an analytical model of factors affecting the integration of technology in the educational environment, especially in relation to its two major components: Perceived ease of use and perceived usefulness (Granić and Marangunić, 2019). Considering the fact that educational technologies have evolved, researchers have amended and tailored the original structure of the model to fit the particulars of the educational setting.

Yet, in contrast to previous arguments, new evidence has illustrated the broad utilization of the model over its adjustment. An example is the Educational Technology Acceptance Model (EdTAM), which extends the generic TAM by integrating different expectations of the two groups of users, teachers and students. This modification has worked exceedingly well in analyzing technology use and acceptance models in education, at least in relation to the adoption of educational games (Frøsig, 2023). It was against this background that Kemp et al. (2024) introduced the Extended Educational Technology Acceptance Model (EETAM), where new variables such as constructive student involvement, constructive feedback, and relaxation of students are also incorporated. Their work demonstrated the great importance of such factors for the perception of the usefulness and usability of technologies in their applicability in the context of virtual classrooms.

TAM's applicability was empirically confirmed by Scherer et al. (2019) as well in education, but after conducting a structural equation modeling meta-analysis in Pakistan. Scherer et al. (2019) addressed specifically how teachers adopt digital technologies and other factors that assist them. In their work, more recent infections with COVID-19 are reported to have utilized Women in STEM's three-tier analytical model with blended teaching or even cloud computing. For instance, Porkodi and Tabash (2024) noted that technology acceptance toward students prevailing in a blended environment can be accounted for by perceived ease of use and perceived usefulness. Abdulrasul et al. (2023) further extended the applicability of the TAM to the case of teachers in the Arab world using cloud computing technologies.

The flexibility of the model was also corroborated in regard to its use in new technological implementations such as mobile learning. In the new age of integration, a growing number of papers focused on the adoption of artificial intelligence and blockchain technologies in an educational context (Ali et al., 2024). Such practices prove that restructuring of TAM in order to include different technologies does not invalidate its main theoretical framework.

In art and design education specifically, TAM applications reveal distinctive patterns centered on creative expression and tactile engagement. González-Zamar and Abad-Segura (2021) found that digital design tools in artistic education generate unique acceptance patterns driven by intuitive interaction and creative autonomy. Similarly, McCready (2021) noted that in digital art education, students' acceptance of tools like Procreate is strongly influenced by how well the technology emulates traditional artistic practices while adding digital advantages. These insights suggest that when applying TAM to creative educational contexts, conventional constructs may require adaptation to reflect discipline-specific values and creative processes.

## 2.2. Hypothesis development

### 2.2.1. Relationship between perceived ease of use and perceived usefulness

The Technology Acceptance Model has been helpful in analyzing the correlation between perceived ease of use and perceived usefulness. [Dhingra and Mudgal \(2019\)](#) stated that both the PEOU and PU form an integral part of users' acceptance of a technology and its usage. Meanwhile, as [Dhingra and Mudgal \(2019\)](#) have stated, [Machdar \(2016\)](#) and [Raksadigiri and Wahyuni \(2020\)](#) have shown that when the technology is easy to use, people are more likely to accept its usefulness in their work.

The aforementioned relationship was also confirmed in real-life situations with different technologies. [Sheppard and Vibert \(2019\)](#) explored whether the PEOU had an effect on PU in educational settings while finding that the task-technology fit acts as a moderator. The PEOU was found to be advantageous for users in helping them regard technology as useful for educational contexts. [Eze et al. \(2021\)](#), on the other hand, found PEOU and PU to be partial mediators in the relation of support received by teachers while implementing ICTs and the subsequent use of the tools and the teachers.

The link between PEOU and PU has been proven within several technological paradigms. Assessments regarding the crowdsourcing platforms produced some highly significant correlations between these variables ([Amir et al., 2020](#)); further, the research dedicated to electronic customer relationship management practices found that PEOU and PU are indeed the moderators of technology acceptance ([Anaam et al., 2023](#)). In addition, within the framework of the online pedagogy, these factors were found to moderate the self-efficacy of learners for subsequent adoption of learning management systems bias ([Panergayo and Aliazas, 2021](#)).

In view of the extensive theoretical and professional documentation available in support of the assertion that a connection between PEOU and PU exists in many technological contexts, including educational organizations, the following hypothesis is put forward:

**H1:** Perceived Ease of Use has a positive effect on Perceived Usefulness of Procreate in educational settings.

### 2.2.2. Relationship between perceived ease of use and behavioral intention to use

Numerous studies have examined the connection between PEOU and behavioral intention to use (BIU) within the technology adoption domain. Various studies have focused on technology domains and have confirmed that the PEOU is particularly important in determining a user's intention to accept and utilize technology. When users regard a technology as user-friendly, there is a likelihood that

they will have a favorable intention to use the technology ([Widiar et al., 2023](#); [Amir et al., 2020](#)).

This ongoing relationship has also been demonstrated by evidence from the use of different technological applications. With respect to crowdsourcing platforms, [Amir et al. \(2020\)](#) reported that behavioral intention was positively affected by PEOU and thus suggested the significance of user-centered design for these technologies. Furthermore, [Widiar et al. \(2023\)](#), in their research on mobile banking users, reported the same finding: That the PEOU matters for behavioral intentions not independently but together with perceived usefulness and trust.

Various PEOU-related factors are responsible for consumer behavioral intent, which forms the mediators of PEOU. For example, in studies on online food delivery services coupled with learning management systems, PEOU was found to favor behavioral intent both directly and as a mediator of perceived usefulness ([Chiu et al., 2024](#); [Panergayo and Aliazas, 2021](#)). The study also showed that, in social media transaction issues, PEOU strengthened the mediating effect of financial electronic banking convenience on behavioral intention.

Nonetheless, it is important to highlight the fact that moderators such as contextual elements might strengthen the effect. Research by [Wiprayoga et al. \(2023\)](#) also confirmed that the PEOU influences behavioral intentions, shedding light on perceived usefulness and attitude components. However, during the COVID-19 pandemic, [Gutierrez-Aguilar et al. \(2022\)](#) reported that university students, after everything, felt the direct impact, even though the context did not seem much about how people felt about PEOU, suggesting that situational variables could be boundaries of this relationship.

Drawing from the empirical perspective that PEOU relates to behavioral intentions in a number of fields, including education, we propose the following hypothesis:

**H2:** Perceived Ease of Use has a positive effect on Behavioral Intention to Use Procreate in educational settings.

### 2.2.3. Relationship between perceived usefulness and behavioral intention to use

In an educational context, [Panergayo and Aliazas \(2021\)](#) reported that, in the case of learning management systems, however, students' intentions to use these systems were explained in large part by PU's role as a mediator of other factors influenced by self-efficacy in learning online.

The correlation between PU and behavioral intentions is equally important and has also been studied for many other technological platforms. For example, on crowdsourcing platforms, [Amir et al. \(2020\)](#) established that there is a strong positive association between PU and behavioral intentions in the acceptance of new technology and asserted that the role of PU is vital in the acceptance process. In

mobile learning, for example, [Kumar et al. \(2020\)](#) reported that PU is a predictor of the behavioral intention to use technology in learning and that experienced teachers moderate this relationship.

According to previous studies, it is important to note that perceptions of usefulness may assist social factors or norms in achieving the desired behavioral intention. For example, [Pratiwi et al. \(2023\)](#) suggested that in the case of travel applications, PUs, along with ease of use and consumer trust, generate a greater intention to use the application. This is also confirmed by [Putra et al. \(2023\)](#), whose study showed that for mobile applications, both perceived usefulness and ease of use are important predictors of the intention to perform the behavior.

PU has been remarkably useful in predicting people's behavioral intentions in adopting educational technologies in unfavorable situations. During the COVID-19 pandemic, e-learning has become a solution and alternative to classical teaching, where [Dash and Chakraborty \(2021\)](#) reported that PU has a direct relationship with satisfaction and behavioral intentions in a significant way, which means that technology acceptance in the midst of a crisis is paramount. Furthermore, [Widiar et al. \(2023\)](#), on the other hand, showed that PU also plays a role together with trust in the relationship between perceived ease of use and behavioral intention in the context of mobile banking, suggesting its importance in improving long-term usage.

Considering the vast amount of literature made available that includes theoretical and empirical relationships between PU and behavioral intentions with respect to different technologies, particularly education, the following hypothesis can be formulated:

**H3:** Perceived Usefulness has a positive effect on Behavioral Intention to Use Procreate in educational settings.

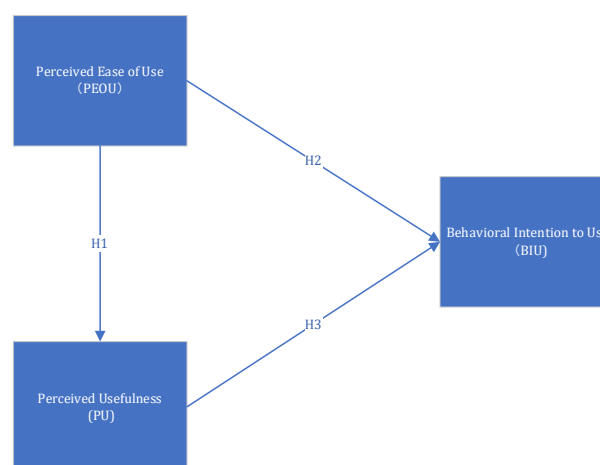
### 2.3. Proposed conceptual framework

The conceptual framework in [Fig. 1](#) outlines three main relationships as follows:

- First, PEOU is expected to be a positive predictor of PU (H1), which has been recorded in PEOU of many other tools and teaching technologies. Some scholars' evidence research confirms that when end-users are able to master a technology easily during operation, the technology is seen as useful in completing their tasks ([Machdar, 2016](#); [Raksadigiri and Wahyuni, 2020](#)). This trend has been especially marked in educational settings, where the usefulness perception of technology comes first, while the ease of use perception comes after, if the technology targets educational activity ([Sheppard and Vibert, 2019](#)).
- Second, it is anticipated that the PEOU has a positive relationship with the BIU (H2). This relationship is supported by several researchers

who argue that TEI is able to influence technology adoption across a range of technologies ([Widiar et al., 2023](#); [Amir et al., 2020](#)). In relation to education, the PEOU has been found to mediate behavioral intentions in both direct and indirect manners ([Panergayo and Aliazas, 2021](#)).

- Third, it has been assumed that PU influences BIU in a positive direction (H3). Users who would view the productivity of the technology are likely to want to use it, which has been said before in studies such as [Kumar et al. \(2020\)](#) and [Dash and Chakraborty \(2021\)](#). In such a case, from the educators' point of view, however, this has been the most relevant interaction regarding the educational technologies ([Panergayo and Aliazas, 2021](#)).



**Fig. 1:** Conceptual framework

## 3. Methodology

### 3.1. Research design

This study employs a mixed-methods approach, primarily utilizing quantitative measures through a cross-sectional survey design, supplemented by qualitative open-ended responses. The quantitative component facilitates the validation of hypothesized relationships within the conceptual framework and supports generalization to larger populations ([Imenda, 2014](#)). The complementary qualitative component provides deeper insights into students' lived experiences with Procreate, capturing nuanced perspectives that might not emerge through structured quantitative measures alone.

A cross-sectional research design was selected because it enables the collection of information about students' perceptions and intentions toward using Procreate at a single point in time. This design is particularly useful for studies on technology acceptance, as it allows researchers to investigate current attitudes and behavioral intentions without the confounding effects of time that are often present in longitudinal research. Furthermore, cross-sectional studies are generally more affordable and less time-consuming, making them a practical and suitable choice for examining the adoption of technology within educational environments.



### 3.2. Population and sample

Procreate study's target audience is undergraduate students enrolled in art and design programs, specifically digital art, graphic design, and illustration programs that incorporate the use of Procreate in their practical classes.

This study integrates purposive sampling as it achieves the goal of only including individuals who have core-related experience with the use of Procreate in an educational background. The requirements for inclusion were as follows:

1. Individuals who are enrolled in art and design courses.
2. Have used Procreate for a minimum duration of one semester.
3. Gender does not matter; however, individuals aged 18 or over are to be included as participants.
4. Individuals are to voluntarily participate in the study.

The determination of the sample size was done while keeping the recommendations of the various SEM studies in mind. Hair et al. (2017) asserted that when estimating Minimum Efficacy Level (MEL) for structural equation modeling, one must consider the level of complexity of the model; for a model with three or fewer constructs, the MEL should be at least between 100-150 respondents. Kline (2023) determined that the ideal sample size for structural equation modeling is anything greater than 200, as it allows for accurate estimation of parameters and

sufficient statistical power. Everything seems to fall into place with Tang et al.'s (2023) study on the utilization of multimedia and teacher effectiveness, where a technology acceptance model-based analysis was conducted for over 400 teachers through a questionnaire. Because of this, the authors design requires that the sample size is between 200-400.

### 3.3. Research instrument

This study employed both quantitative and qualitative research instruments to capture a comprehensive understanding of students' acceptance of Procreate. The primary quantitative instrument was a questionnaire developed by adapting validated scales from previous studies to measure three main constructs: PEOU, PU, and BIU, as shown in Table 1. All items were measured via a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). To ensure content validity, all the items were adapted to specifically reference Procreate while maintaining the core meaning of the original items. The questionnaire underwent pilot testing with a small group of educators to assess clarity, comprehensibility, and internal consistency.

The final questionnaire consists of 16 items distributed across three constructs: Six items assessing PU; six items evaluating PEOU, both adopted from Davis et al. (1989), Seligman (2001), and Tang et al. (2023); and four items measuring BIU, adopted from Tsai (2012).

**Table 1: Questionnaire measurement items**

Construct	Original items	Adopted items for this study	Reference
Perceived usefulness (PU)	Using multimedia technology in ECE would enable me to accomplish tasks more quickly.	PU-1. Using Procreate would enable me to accomplish teaching tasks more quickly.	Davis et al. (1989)
	Using multimedia technology would improve my job performance.	PU-2. Using Procreate would improve my teaching performance.	
	Using multimedia technology would increase my productivity.	PU-3. Using Procreate would increase my productivity in teaching.	Seligman (2001)
	Using multimedia technology would enhance my effectiveness on the job.	PU-4. Using Procreate would enhance my effectiveness in teaching.	
	Using multimedia technology would make it easier to do my job.	PU-5. Using Procreate would make it easier to do my teaching job.	Tang et al. (2023)
	I would find multimedia technology useful in my job.	PU-6. I would find Procreate useful in my teaching.	
Perceived ease of use (PEOU)	Learning to operate multimedia technology would be easy for me.	PEOU-1. Learning to operate Procreate would be easy for me.	Davis et al. (1989)
	I would find it easy to get multimedia technology to do what I want it to do.	PEOU-2. I would find it easy to get Procreate to do what I want it to do.	
	My interaction with multimedia technology would be clear and understandable.	PEOU-3. My interaction with Procreate would be clear and understandable.	Seligman (2001)
	I would find multimedia technology to be flexible in interacting with.	PEOU-4. I would find Procreate to be flexible to interact with.	
	It would be easy for me to become skillful at using multimedia technology.	PEOU-5. It would be easy for me to become skillful at using Procreate.	Tang et al. (2023)
Behavioral intention to use (BIU)	I would find multimedia technology easy to use.	PEOU-6. I would find Procreate easy to use.	
	I intend to use e-books to connect information.	BIU-1. I intend to use Procreate in my future teaching activities.	Tsai (2012)
	I want to use the services provided by e-books.	BIU-2. I want to use the features provided by Procreate.	
	I want to use the information from e-books.	BIU-3. I plan to use Procreate regularly in my teaching.	
	I am willing to download application programs for e-books.	BIU-4. I am willing to learn and explore new features of Procreate.	

To complement the quantitative data and provide deeper insights into students' experiences with Procreate, open-ended response questions were included in the survey. These questions were designed to elicit rich descriptions of students' perceptions, challenges, and experiences that might

not be fully captured through Likert-scale responses alone. From the larger quantitative sample, 10 participants (6 females, 4 males) with experience levels ranging from one semester to three years of Procreate usage were selected through purposive sampling to ensure representation across different

specializations and experience levels. Their responses to these questions were analyzed using thematic analysis to identify patterns and insights

that complement the quantitative findings. The complete set of open-ended response questions is provided in [Table 2](#).

**Table 2: Open-ended response questions**

Question number	Questions
1	How would you describe your overall experience using Procreate in your coursework?
2	What specific features or aspects of Procreate do you find most useful for your creative work in class?
3	What challenges or difficulties have you encountered when using Procreate for your educational projects?
4	How does using Procreate compare to other digital art tools you have used in your coursework?
5	In what ways has using Procreate influenced your creative process or artistic development?
6	What recommendations would you suggest to improve how Procreate is integrated into your courses?

### 3.4. Data collection procedure

The survey was conducted for a duration of six weeks, and this period was chosen strategically within the semester when Procreate was heavily integrated within the coursework. The creation and dissemination of the questionnaire was managed through Wenjuan Net (wenjuan.com), a platform that is used for online surveys within academic research. The website facilitated an easy interface for the initiation of the survey and for the participants who were required to respond to the survey, as the services were available on mobile phones, tablets, and computers. The link to the survey was posted on the university's learning management system and official student emails of the university associated with art and design.

Starting with the online questionnaire was a package that comprised an informed consent document. These materials included articulation of the reason for the study, a statement indicating the voluntary nature of the participation, measures about confidentiality to be observed, instructions for completing the questionnaires, contact information of the research team, and a signed informed consent form. Through the portal of the online survey, the participants were able to obtain sufficient information, such as how their data would be used and their rights in the research process.

As previously mentioned in section 3.3, the survey contained quantitative sections utilizing the Likert scale as well as qualitative open-ended questions. For the qualitative portion of the study, participants were asked to respond to open-ended questions after completing corresponding quantitative sections to provide further insight. This analysis was conducted on a sample of 10 participants who were selected from the initial pool of respondents. These participants were chosen based on their detailed and elaborate responses provided to the open-ended questions. This selection strategy included equal distribution of 6 female and 4 male participants, alongside varying levels of experience, which ranged from one semester to three years of Procreate usage. Participants were instructed to answer questions in detail, which proved beneficial for the study, as there was ample qualitative data to support the quantitative findings.

The data collection performed through the internet ensured the integration of various quality control measures to ensure the accuracy of the data

collected. Features such as mandatory question completion, logical skip patterns, and response validation were facilitated on the Wenjuan Net platform to maintain the integrity of the data. It was possible to monitor the patient response rate to the survey with the help of analytics in accordance with the real-time response of the platform, which enabled one to determine the sample size and assess how close one was to achieving this target. Communication through the university was used to remind students to partake in the survey while ensuring that the involvement of students was voluntary, as explained previously.

To reduce potential bias, each participant used their specific IP address and cookies to restrict them to one completion of the survey; this was done on the platform. The language used to explain the process to the respondents ensured that their response status was not related to their mark or academic standing. The built-in validation services of the platform, in collaboration with the communication that was clear communication, enabled a degree of assurance of accurate and complete responses.

Regular data analysis was performed for the data collected with the help of the metrics provided by Wenjuan Net. For the qualitative data, responses were downloaded and organized by question for thematic analysis. The qualitative responses were analyzed separately from the quantitative data and then integrated during the interpretation phase to provide a more comprehensive understanding of student acceptance of Procreate. The data protection measures taken by the institution and research ethics committee ensured strong adherence to the platform. Furthermore, the basic functions of the platform enabled a smooth transfer of data response for thorough analysis, and all the data were retained safely.

### 3.5. Data analysis

The data analysis employed SmartPLS 4 software to conduct partial least squares structural equation modeling. A two-stage analytical approach was implemented to assess both the measurement and structural models. The measurement model assessment evaluated reliability and validity through multiple indicators. Individual item reliability was examined through factor loadings (threshold > 0.7). Internal consistency was assessed via Cronbach's

alpha and the composite reliability measures rho<sub>a</sub> and rho<sub>c</sub> (threshold > 0.7). Convergent validity was determined through the average variance extracted (AVE > 0.5). The structural model assessment examined path coefficient significance through bootstrapping with 5,000 resamples, generating t-statistics and p-values. The model fit was examined via the standardized root mean square residual (SRMR < 0.08), chi-square test, and the normed fit index (NFI > 0.90). Total effects analysis was conducted to examine both direct and indirect relationships between the constructs.

In terms of qualitative data, open-ended responses were first examined using thematic analysis, which is best defined as focusing on pattern identification within the data set. This process begins by familiarization with the responses, during which relevant statements are assigned codes, and these codes are structured into broader conceptual themes. The TAM models were utilized to analyze the relationships between the themes as well as the qualitative findings to determine whether they complemented, refuted, or developed the findings from the quantitative data.

#### 4. Results

The data indicated 343 valid responses were obtained, with 202 (58.9%) men and 141 (41.1%) women participating. Most responders were between the ages of 18 and 22, which represents the usual undergraduate population. All participants had prior experience with digital arts, either through formal coursework or practical interaction, which enabled them to provide informed assessments of Procreate's function in education.

As shown in Table 3, the path coefficient analysis indicated substantial correlations among the important constructs. The correlation between PEOU and BIU was strong ( $\beta = 0.494$ ), indicating that students who found Procreate easy to use were more likely to adopt it. PEOU had a significant impact on PU ( $\beta = 0.500$ ,  $p < 0.001$ ), indicating that students who assessed Procreate as user-friendly were more likely to find it useful. The PU-BIU association had a modest effect ( $\beta = 0.205$ ,  $p < 0.001$ ), demonstrating that perceived usefulness positively influenced students' behavioral intention, but its impact was lower than ease of use.

**Table 3:** Path coefficients

	Path coefficients
Perceived ease of use -> behavioral intention to use	0.494
Perceived ease of use -> perceived usefulness	0.500
Perceived usefulness -> behavioral intention to use	0.205

As shown in Table 4, PEOU exhibited a strong total effect on BIU, with a coefficient of 0.597, indicating its substantial overall influence through both direct and indirect pathways. The total effect of PEOU on PU remained consistent, with a path coefficient of 0.500, confirming the direct nature of

this relationship. PU maintained its moderate influence on BIU, with a total effect of 0.205, suggesting that while usefulness contributes to behavioral intention, ease of use emerged as the more influential factor in determining students' intention to use Procreate.

**Table 4:** Total effects of the structural model

	Total effects
Perceived ease of use -> behavioral intention to use	0.597
Perceived ease of use -> perceived usefulness	0.500
Perceived usefulness -> behavioral intention to use	0.205

The outer loading analysis presented in Table 5 reveals strong indicator reliability across all constructs. All four indicators for BIU exhibited robust loadings (0.864-0.905), with BIU-2 reaching the highest value (0.905), confirming precise measurement of students' adoption intentions. The six indicators for PEOU showed similar strength

(0.833-0.880), with PEOU-2 achieving the highest loading (0.880). For PU, the six indicators demonstrated equally strong performance (0.846-0.893), with PU-2 exhibiting the maximum value (0.893). All indicators exceeded the recommended 0.7 threshold, establishing high measurement validity across the model.

**Table 5:** Outer loadings of the measurement items

	Outer loadings
BIU-1 <- behavioral intention to use	0.864
BIU-2 <- behavioral intention to use	0.905
BIU-3 <- behavioral intention to use	0.869
BIU-4 <- behavioral intention to use	0.884
PEOU-1 <- perceived ease of use	0.861
PEOU-2 <- perceived ease of use	0.880
PEOU-3 <- perceived ease of use	0.860
PEOU-4 <- perceived ease of use	0.858
PEOU-5 <- perceived ease of use	0.857
PEOU-6 <- perceived ease of use	0.833
PU-1 <- perceived usefulness	0.877
PU-2 <- perceived usefulness	0.893
PU-3 <- perceived usefulness	0.871
PU-4 <- perceived usefulness	0.881
PU-5 <- perceived usefulness	0.846
PU-6 <- perceived usefulness	0.856

The hypothesis tests, as shown in Table 6, found substantial evidence for all three postulated relationships. The correlation between PEOU and PU was verified ( $\beta = 0.500$ ,  $t = 8.708$ ,  $p < 0.001$ ), demonstrating that students who view Procreate as user-friendly are more likely to consider it advantageous for their learning. The PEOU-BIU

association was statistically significant ( $\beta = 0.494$ ,  $t = 8.536$ ,  $p < 0.001$ ), indicating that ease of use is a key factor in students' desire to adopt Procreate. The PU-BIU association was statistically significant ( $\beta = 0.205$ ,  $t = 3.668$ ,  $p < 0.001$ ), indicating that perceived usefulness contributes to behavioral intention, but with a lesser influence than ease of use.

**Table 6:** Results of hypothesis testing

	Original sample	Sample mean	Standard deviation	T-statistics	P-values
Perceived ease of use -> behavioral intention to use	0.494	0.493	0.058	8.536	0.000
Perceived ease of use -> perceived usefulness	0.500	0.502	0.057	8.708	0.000
Perceived usefulness -> behavioral intention to use	0.205	0.206	0.056	3.668	0.000

As shown in Table 7, BIU exhibited strong internal consistency, with a Cronbach's alpha of 0.904, composite reliability (rho\_a) of 0.907, and composite reliability (rho\_c) of 0.933. The construct also showed strong convergent validity, with an average variance extracted (AVE) of 0.776, which was well above the 0.5 threshold. The PEOU demonstrated excellent reliability measures, with a Cronbach's alpha of 0.929, matching the rho\_a value, and rho\_c of 0.944, along with strong convergent validity (AVE = 0.737). Similarly, PU showed the highest reliability scores, with a Cronbach's alpha of 0.936, a rho\_a of 0.938, and a rho\_c of 0.950,

accompanied by strong convergent validity (AVE = 0.758).

The model fit, as shown in Table 8, indices validated the structural model's robustness. The SRMR value of 0.038, which is significantly below the required threshold of 0.08, indicates a good model fit. The chi-square value of 226.941 and the normed fit index (NFI) of 0.947, which exceeded the 0.90 threshold, showed the model's ability to explain Procreate's acceptance among students. Furthermore, the squared Euclidean distance (d\_ULS = 0.191) and geodesic distance (d\_G = 0.109) supported the model's predictive capability.

**Table 7:** Construct reliability and validity measures

	Cronbach's alpha	rho_a	rho_c	AVE
Behavioral intention to use	0.904	0.907	0.933	0.776
Perceived ease of use	0.929	0.929	0.944	0.737
Perceived usefulness	0.936	0.938	0.950	0.758

**Table 8:** Model fit indices

	Saturated model	Estimated model
SRMR	0.038	0.038
d_ULS	0.191	0.191
d_G	0.109	0.109
Chi-square	226.941	226.941
NFI	0.947	0.947

To complement the quantitative results, thematic analysis was conducted on open-ended responses from 10 purposively selected participants. Table 9

presents the key themes that emerged from this analysis, along with representative quotes and their relationship to the TAM constructs.

**Table 9:** Qualitative themes from student interviews (n = 10)

Theme	Relationship to TAM	Representative quotes	Frequency
Intuitive interface	Supports a strong PEOU-BIU relationship	"Unlike other programs I've used, Procreate feels natural from the first use—it's like drawing on paper but with digital advantages." "The gesture controls make it easy to undo mistakes or adjust work, which makes me more willing to experiment in my projects."	8/10
Feature utility	Elaborates on specific aspects of PU	"Being able to work with multiple layers changed how I approach composition in my assignments." "Creating custom brushes for specific effects has improved my efficiency and the quality of my work."	7/10
Technical limitations	Identifies barriers affecting PU	"File size restrictions sometimes limit complex projects." "Limited animation capabilities compared to desktop software."	5/10
Institutional barriers	Contextual factors beyond TAM	"Not having enough iPads for everyone in class means limited practice time." "Inconsistent access to the latest version affects what techniques we can learn."	4/10
Integration with traditional skills	Potential extension to TAM	"I appreciate that Procreate lets me use the drawing skills I already have while introducing me to digital techniques." "The pencil tools feel close enough to real media that I can transfer my existing techniques."	6/10

## 5. Discussion

This study found a significant positive correlation ( $\beta = 0.494$ ,  $p < 0.001$ ) between PEOU and BIU Procreate, supporting hypothesis 2. This effect was significantly stronger than the PU-BIU association ( $\beta$

= 0.205,  $p < 0.001$ ), which contradicts previous TAM findings where PU often has a stronger influence on technology adoption (Davis, 1989). Qualitative findings further illuminate this relationship, with students frequently citing Procreate's "natural" interface and intuitive gesture controls as primary



adoption motivators. As one student remarked, "It's like drawing on paper but with digital advantages," highlighting how the reduced cognitive barrier between intention and execution uniquely influences technology acceptance in creative contexts. This distinctive character of creative digital tools prioritizes immediate usability and intuitive engagement over long-term utilitarian considerations.

The outcome is consistent with current research on digital tools in education. According to [Panergayo and Aliazas \(2021\)](#) and [González-Zamar and Abad-Segura \(2021\)](#), usability characteristics are more important in digital art instruction than in traditional educational technology. This study also supports [Granić and Marangunić's \(2019\)](#) TAM research, which emphasized the significance of rapid usability in educational technology adoption. Therefore, PEOU has a larger influence in this study.

Furthermore, PEOU has a substantial impact on PU ( $\beta = 0.500$ ,  $p < 0.001$ ), supporting the idea that easy-to-use tools lead to better learning outcomes ([Machdar, 2016](#); [Raksadigiri and Wahyuni, 2020](#)). However, the high PEOU-PU association identified in this study implies that in artistic applications, students' assessment of a tool's usefulness is heavily influenced by its ease of use, which is consistent with the findings of [Hua and Yu \(2024\)](#).

Although PU had a substantial effect on BIU, it was weaker than PEOU ( $\beta = 0.205$ ,  $p < 0.001$ ), which supports H3. This departure from typical TAM models shows that in digital art education, perceived long-term value is more important in driving adoption decisions than immediate usability. [Panergayo and Aliazas \(2021\)](#) found similar results in the context of learning management systems, with ease of use being a stronger predictor of student involvement.

The overall model demonstrated strong predictive power, with PEOU exhibiting both direct and indirect effects on BIU (total effect = 0.597). Model fit indices verified the robustness of the model (SRMR = 0.038, NFI = 0.947), demonstrating its efficiency in explaining Procreate's acceptability in education. These results contribute to extending TAM applications in educational technology research ([Granić and Marangunić, 2019](#)), notably in creative areas.

From a practical standpoint, these findings offer valuable insights for educators, instructional designers, and software developers. Educators should focus on integrating user-friendly digital art tools that allow students to navigate software seamlessly without requiring extensive training. Software developers should prioritize intuitive interfaces and streamlined workflows, as ease of use is the primary driver of adoption. Furthermore, institutional decision-makers should emphasize usability as a key criterion when selecting digital art applications for educational programs. While PU plays a role in adoption, its relatively weaker influence suggests that simply highlighting a tool's benefits is insufficient to drive student

engagement—intuitive design and accessibility should take precedence to enhance learning outcomes and foster long-term technology adoption.

While this research makes significant contributions, certain limitations must be addressed. The cross-sectional methodology limits the ability to capture longitudinal changes in students' impressions of Procreate; future studies should use longitudinal methodologies to follow changing usage patterns. Furthermore, the study's context-specific findings, which focus solely on Procreate in digital art education, highlight the need for further research into other creative tools or comparisons across educational environments. The qualitative findings suggest that the traditional TAM framework could be extended in future research to incorporate creative-specific factors that appear particularly relevant in artistic contexts. For instance, the "Integration with Traditional Skills" theme that emerged in our qualitative analysis suggests that the relationship between traditional artistic practices and digital tools may be an important factor in technology acceptance for creative applications. Similarly, factors related to creative expression and artistic workflow that were mentioned by several participants could provide additional explanatory power specifically relevant to creative educational technology. Finally, potential moderating factors such as prior digital art experience, familiarity with other creative software, and instructor influence should be investigated in future research to gain a more nuanced understanding of technology acceptance in digital education.

## 6. Conclusion

This study used the TAM to investigate students' acceptance of Procreate in digital art instruction. The findings revealed that PEOU is the most important factor influencing BIU, both directly and through its effect on PU. While PU influences adoption, its effect is smaller than PEOU, emphasizing the necessity of intuitive usability in creative education technologies.

Moreover, these findings have significant implications for educational institutions, software developers, and instructors, highlighting the need for user-centered design and usability-focused teaching practices. Educators and developers can improve student engagement and digital learning experiences and foster greater adoption of creative technologies in educational settings by putting ease of use first. To further understand technology acceptability in creative education disciplines, future research should include longitudinal studies, comparative evaluations of various creative tools, and moderating factors.

## List of abbreviations

AVE	Average variance extracted
BIU	Behavioral intention to use
EETAM	Extended educational technology acceptance model

EdTAM	Educational technology acceptance model
H1	Hypothesis 1
H2	Hypothesis 2
H3	Hypothesis 3
ICT	Information and Communication Technology
MEL	Minimum efficacy level
NFI	Normed fit index
PEOU	Perceived ease of use
PLS-SEM	Partial least squares structural equation modeling
PU	Perceived usefulness
SRMR	Standardized root mean square residual
TAM	Technology acceptance model
d_G	Geodesic distance
d_ULS	Squared Euclidean distance

## Compliance with ethical standards

### Ethical considerations

Participation was entirely voluntary, and informed consent was obtained from all respondents prior to data collection. Anonymity and confidentiality were assured, and no identifying personal information was collected.

### Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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