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Understanding the Competency Levels of Art-Based Students in Utilising Technological Tools for Learning: A Case of a Digital Art Students

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ABSTRACT

Using technology as a pedagogical teaching tool is a well-established concept, with numerous studies demonstrating its effectiveness in enhancing learning outcomes. However, few studies have explored the connection between technology and the proficiency of art-based students utilising technology for the purpose of designing and creating digital media, such as video games, comics, and animations. This study explored how facilitating conditions, prior access, and technology usage influenced the competency level of students. A quantitative descriptive approach was used to collect data from 119 students who voluntarily participated by completing an online questionnaire. Structural equation modelling was utilised to process the data obtained from the questionnaire results. The findings indicated that both computer self-efficacy and facilitating conditions had a positive effect on the perceived ease of use within a technological learning environment. This, in turn, influenced the competency of digital art students in utilising technology. Past exposure to technology influenced digital art students' openness to experimenting with new game design and animation technologies in the technology playroom.

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INTRODUCTION

Competency levels have been a widely discussed aspect in South African universities. Academic research on the use of technology traces back to the early innovations of the IBM Centre for Research. They developed a system for teaching scientific methods and linguistic skills (Garrison, 2011).

Various technologies utilised in higher education include online learning platforms such as Ulwazi and Canvas, registration systems, fee management systems, and teaching tools like Airtame (Randle, 2024a; Timotheou & Hennessy, 2021). Art students, including those studying game design and animation, use specialised tools such as the Unity engine for game design development, Krita and Blender for animation design, AR/VR goggles for interactivity, electronic drawing pads for animation design, and computers for coding to enhance game design.

Recent studies have indicated the importance of technical abilities for all students, including arts students (Asrifan et al., 2025; Liao & Cao, 2025). Furthermore, the studies have highlighted the need to include technical abilities to stimulate critical thinking, creativity, and innovation among art-based students. Research on competency levels for students has primarily focused on science students, while limited or no studies have examined the competency levels of arts students (Asrifan et al., 2025). This necessitates understanding the competency levels of arts and creative students with respect to the technologies required to compete effectively in the creative space, especially given the ever-changing nature of these technologies. These technical abilities are significant as they enable students to use generative artificial intelligence as a tool or an aid when developing their art and creative works.

South Africa has a history of unequal resource distribution and varying levels of learning abilities among its population. The primary reason for this shortfall can be attributed to students' limited exposure to technology before they enter university (Adikwu et al., 2017; Faloye et al., 2020). Research studies indicate that the low level of competence may be attributed to two main factors: families lacking the financial means to acquire the necessary technological tools for education, and learners not being enrolled in schools that support technological learning (Jantjies, 2020; Makhado & Tshisikhawe, 2021).

Numerous studies have demonstrated the substantial and beneficial influence of technology tools in enhancing learning and teaching within higher education institutions (Faloye & Faniran, 2023; Khlaif & Salha, 2022; Ramaila & Molwele, 2022). Technologies such as Ulwazi enable real-time learning and facilitate two-way communication between lecturers and students, while also promoting pedagogical activities (Faloye & Faniran, 2023).

The literature suggests that certain groups of South African students only start using computers when they enter university in their first year (Faloye et al., 2020). Universities have made significant efforts to address issues related to the lack of resources by providing students with laptops through initiatives such as the National Student Financial Aid Scheme. However, a grouped approach might not adequately alleviate the specific needs and challenges encountered by individual learners and students. Competence is crucial for students in animation and game design to effectively use the various devices and technologies intended to help them become skilled game designers or animators. Therefore, higher education institutions in South Africa need to assess students' competency levels in using these tools.

Technological devices, such as mobile phones, are used as educational tools for students in higher education, as they facilitate easy learning and meet students' immediate educational requirements (Lee et al., 2020; Randle, 2024b). The widespread availability of mobile devices has prompted higher education institutions to ensure compatibility of their web systems with such tools (Al-Adwan et al., 2018). However, mobile devices have limitations, such as the size of the screen and battery life capabilities, that can hinder their effectiveness for teaching at the university level.

Noted elements that focus on these include behavioural intention, facilitating conditions, and price (Ahmed et al., 2017; Kwon et al.,2019). The need was identified to explore how technology is utilised in higher education, as there is limited understanding of students' perspectives (Pimmer et al., 2016; Venkatesh et al., 2012). Previous research has examined the different types of technology for learning, along with various influencing factors, such as individual factors (Karaca et al., 2013), contextual factors (Bernacki et al., 2020), and perceived usefulness (Zhai & Shi, 2020).

Several devices are being used more frequently as instructional tools for learning, providing students with increased mobility and freedom (Heflin et al., 2017; Mâță et al., 2021; Nakra, 2021). These technologies enable imaginative and innovative approaches to education (Heflin et al., 2017; Mâță et al., 2021; Nakra, 2021).

Aburub and Alnawas (2019) focused on the adoption of mobile device technology using structural equation modelling. Their research found that perceived use was of significant influence on attitudes regarding the mobile technology integration. Abu-Al-Aish and Love (2013) applied the Unified Theory for Acceptance and Utilisation of Technology (UTAUT) in their study to identify several key factors that affect the usage of mobile technology in higher education. These factors included the influence of instructors, ease of use, quality of service, and individual innovation. Qteishat (2013) demonstrated that factors such as patronisation and attitude also had an influence on students' utilisation of mobile technology for learning. Kim

(2017) investigated readiness to accept technology for teaching in China. The study findings revealed that students were more inclined to embrace mobile technology for learning when they perceived a relative advantage (Kim et al., 2017; Hu et al., 2020; Chang, 2012; Venkatesh et al., 2012).

Based on the previous studies, none have addressed the needs of art students who use technology for developing video games and animations, which are critical aspects to explore. Additionally, the studies neglected to consider the distinct South African perspective, which highlights how inadequate pre-existing skills or limited access to technology can affect the learning and proficiency of higher education students.

RESEARCH METHOD

This research employed a descriptive analysis approach, which is beneficial as it allows researchers to describe the elements of the specific scenario or phenomenon under observation (Bhattacherjee, 2012; Faloye et al., 2020). Another advantage of descriptive analysis is its ability to provide information regarding the key elements that are pertinent to the phenomenon under discussion.

The study focused on 119 respondents from the digital arts programmes at a public university in South Africa. To eliminate the possibility of sampling bias, a probability sampling technique was used (Bhattacherjee, 2012; Razali et al., 2025). Table 2 presents the demographic statistics of the respondents, including gender, race, age, year of study, gameplay stage, the device used, level of competency, and technology access.

Figure 1 presents a flow chart that clearly illustrates the study methodology. A literature review was conducted to gain an understanding of the existing literature, which facilitated the development of the problem statement. This further led to the determination of the research and study method, which included the utilisation of a questionnaire based on a case study. Once the data was collected, it was analysed using structured equation modelling, which led to the findings.

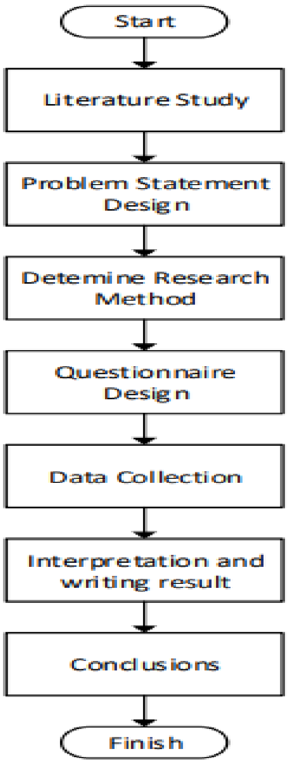

Figure 1. Flow chart of the research used in the study

Theoretical Underpinning

Table 1 presents the technologies and theories used in previous studies that support technology acceptance. These theories are inadequate because they fail to consider the constructs and variables that are essential for studying students' computer self-efficacy. An extended version of the research includes essential constructs for investigating the technical skills required by students.

Table 1. Technologies and theories employed by various studies

Theoretical Model	Description	Constructs
Technology Acceptance Model (Marangunić & Granić, 2015)	Simulate the process through which consumers adopt and employ technology.	• Perceived ease of use • Perceived usefulness
Diffusion of Innovation Theory (Murray, 2009)	Identifies the factors that influence the probability of individuals within a social system adopting a new concept, product, or behaviour.	• Complexity • Trialability • Compatibility • Observability • Relative advantage

Figure 2 displays the proposed model for this article, which forms part of a larger model. The facilitating conditions construct focuses on the enabling factors that users perceive to promote their use of technology (Terzis & Economides, 2011). This study used the construct to investigate whether students had or felt they had the required resources and tools for engaging with technological learning in digital arts, with a specific focus on video game development and animation. These constructs are a crucial factor in understanding how students interact with digital arts technologies (Compeau et al., 2015). The study aimed to assess whether students perceived themselves as capable of using computers and other computing devices independently or if they required assistance.

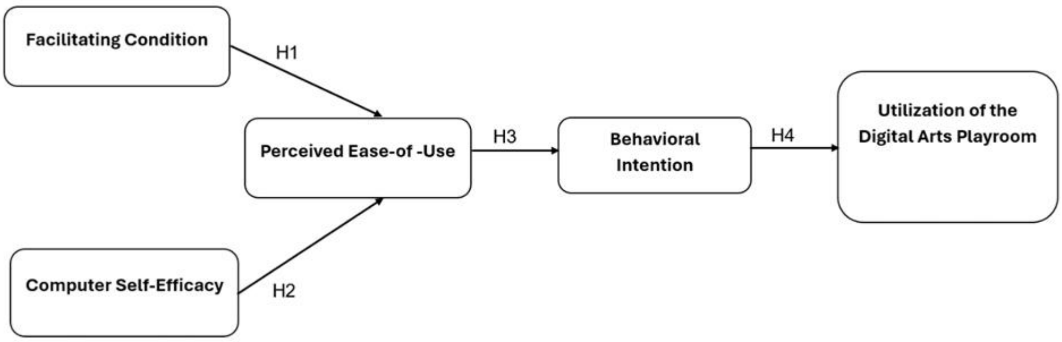

Figure 2. Conceptual model for understanding the competency levels of digital art students

RESULTS AND DISCUSSION

Result

This study was designed as a cross-sectional study with the intention of collecting data from 119 students enrolled in a public university. Table 2 presents the demographic statistics of the respondents, including gender, race, age, year of study, gameplay stage, the device used, level of competency, and technology access.

Table 2. Demographic profile

	Demographics	Frequency	Percentage	Cumulative Percentage
Gender	Male	76	63.9	63.9

	Demographics	Frequency	Percentage	Cumulative Percentage
	Female	43	36.1	36.1
	Total	119	100.0	
Race	Black	84	70.6	70.6
	White	35	29.4	29.4
	Total	119	100.0	
Age	Less than 18 years	38	31.9	31.9
	18–20 years	51	42.9	74.8
	30–36 years	22	18.5	93.3
	More than 36 years	8	6.7	100.0
	Total	119	100.0	
Years of study	First year	36	30.3	30.3
	Second year	50	42.0	72.3
	Third year	7	5.9	78.2
	Fourth year	18	15.1	93.3
	Master's degree	8	6.7	100.0
	Total	119	100.0	
Gameplay stage	5 to 7 years old	13	10.9	10.9
	7 to 9 years old	48	40.3	51.3
	10 to 15 years old	21	17.6	68.9
	15 to 20 years old	37	31.1	100.0
	Total	119	100.0	
Device used	Mobile phone	65	54.6	54.6
	Tablet PC	14	11.8	66.4
	PlayStation device	40	33.6	100.0
	Total	119	100.0	
Level of competency	Novice	14	11.8	11.8
	Competent	94	79.0	90.8
	Expert	11	9.2	100.0
	Total	119	100.0	
Technology access	Yes	107	89.9	89.9
	No	12	10.1	10.1
	Total	119	100.0	

Reliability Analysis

A reliability test was conducted before evaluating the measurement model. The primary objective of carrying out a reliability test is to assess the questionnaire's level of consistency using Cronbach's alpha (Hair et al., 2019; Hall et al., 2022). Recent research defines a questionnaire as reliable when the Cronbach's alpha value is higher than 0.7 (Hair et al., 2023). The Cronbach's alpha was 0.729, which not only met but also exceeded the threshold of 0.7. The value was obtained for 52 standardised items, indicating consistency across standardised scores.

Assessment of Measurement Model

Validity and reliability tests were conducted in this study to evaluate the measurement. A substantial body of literature indicates that factor loading, composite reliability, and average variance extracted (AVE) are commonly used for performing validity and reliability tests (Alhwaiti, 2023; Benzidia et al., 2021; Hair et al., 2019; Shiferaw & Mehari, 2019). In order for the results of the validity and reliability tests to be deemed acceptable, the factor loading and composite reliability values should exceed 0.7, and the AVE value should be above 0.5 (Hair et al., 2019). As reflected in Table 3, all the factor loadings, composite reliability, and AVE values met the criteria.

Table 3. Measurement model

Variable	Items	Factor loading	Composite Reliability	AVE
Facilitating condition (FC)	FC1	0.780	0.836	0.758
	FC2	0.862		
	FC3	0.705		
	FC4	0.925		
Computer self-efficacy (CSE)	CSE1	0.852	0.815	0.738
	CSE2	0.752		
	CSE3	0.745		
	CSE4	0.819		
Perceived ease of use (PEU)	PEU1	0.875	0.865	0.744
	PEU2	0.745		
	PEU3	0.792		
	PEU4	0.778		
Behavioural intention (BEI)	BEI1	0.875	0.765	0.804
	BEI2	0.894		
	BEI3	0.725		
Utilisation of the digital arts playroom (UDAP)	UDAP1			
	UDAP2			
	UDAP3			
	UDAP4			

After conducting tests, we utilized heterotrait-monotrait and Fornell–Larcker criteria to assess discriminant validity (Dirgiatmo, 2023; Fornell & Larcker, 1981; Henseler et al., 2015; Yusoff et al., 2020). According to the data presented in Table 4, the heterotrait-monotrait values were below 0.8, indicating that discriminant validity was achieved for all variables (Dirgiatmo, 2023).

Table 4. Heterotrait-monotrait values

	FC[a]	CSE[b]	PEU[c]	BEI[d]	UDPA[e]
FC[a]					
CSE[b]	0.328				
PEU[c]	0.247	0.547			
BEI[d]	0.448	0.326	0.457	0.269	
UDPA[e]	0.595	0.621	0.366	0.555	0.624

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Furthermore, Table 5 shows that critical analysis of the data (Dirgiatmo, 2023; Henseler et al., 2015).

Table 5. Fornell and Larcker values

	FC[a]	CSE[b]	PEU[c]	BEI[d]
FC[a]	**0.733**			
CSE[b]	0.271	**0.778**		
PEU[c]	−0.389	0.466	**0.839**	
BEI[d]	0.468	0.240	−0.118	
UDPA[e]	0.433	−0.224	0.040	**0.759**

Assessment of the Structural Equation Model

Following the discriminant validity test, this study employed structured equation modelling, a widely accepted method for hypothesis testing (Owoseni & Twinomurinzi, 2018), which is supported by prior academic studies (Agrawal & Madaan, 2023; Kikawa et al., 2022; Sarstedt et al. 2020; Sinaga et al. 2024). Figure 3 provides a detailed image of the results.

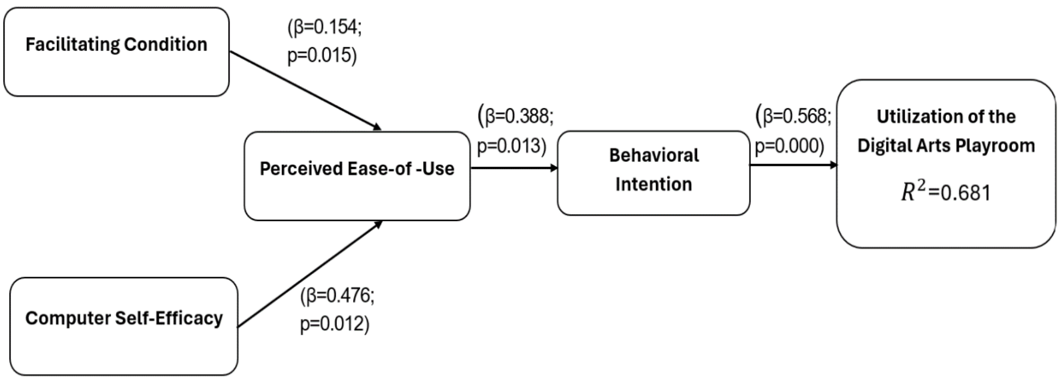

Figure 3. Test results of the research model

Table 6 shows that all four hypotheses (H1, H2, H3, H4) are supported, as their p-values are below 0.05.

Table 6. Structural model path analysis

Hypothesis	Relationship	Std. Beta (β)	T-value	P-value	Decision
H1	FC[a] –> PEU[b]	0.154	1.448	0.015	Supported
H2	CSE[c] – PEU[b]	0.476	0.257	0.012	Supported
H3	PEU[b] –> BEI[d]	0.388	1.066	0.013	Supported
H4	BEI[d] –> UDPA[e]	0.568	0.257	0.000	Supported

Notes: $^{*}p < 0.05$ / $^{**}p < 0.01$

Discussion

Firstly, H1 is supported. These findings are consistent with Yakubu and Dasuki's (2019) discovery that facilitating conditions positively influence use. Other studies that have gotten similar results include healthcare (Wang et al., 2020), artificial intelligence (Alhwaiti, 2023), education (Alyoussef, 2021), mobile marketing (Eneizan et al., 2019), and cloud computing (Khayer et al., 2020). This finding aligns with the studies by Dingel (2024) and Liu (2015) that utilised UTAUT as a theoretical lens.

Secondly, the study results validate that computer self-efficacy (β = 0.476; p = 0.012) has a positive effect on students' utilisation of the digital arts playroom; therefore, H2 is supported. This result aligns with Thongsri (2020), who found that computer self-efficacy plays a substantial role in the adoption of e-learning in China. These results are similar to other studies regarding the role of self-efficacy, all of which indicate its positive effect on student engagement (Chen et al., 2024; Qureshi et al., 2023; Randle, 2024c).

Thirdly, the study found a good effect on students' utilisation of the digital arts playroom; therefore, H3 is supported. This is supported by previous studies, such as the one by Chatterjee and Kar (2020), which found that ease of use had an impact on social media adoption in India. Furthermore, this is consistent with respect to other studies (Alshurafat et al., 2021), e-shopping (Saleem et al., 2022), artificial intelligence (Na et al., 2022), and mobile technology (Naicker & Van der Merwe, 2018), all of which indicate a good relationship between ease of use and students' utilisation of Digital technology. Furthermore, this supports the notion from UTAUT that there is a relationship between the two elements.

This perspective is further supported by several theories, including UTAUT and the Technology Acceptance Model, which indicate that these constructs are essential for understanding the usage of technology (Chao, 2019; Wang et al, 2022; Jang & Cho, 2022; Nain, 2021; Sun & Gao, 2020).

CONCLUSION

This study successfully identified the key factors to consider when integrating technology into university environments. The implications of these findings indicate that for effective integration, students' self-efficacy and facilitating conditions are key factors in improving their competency levels. Moreover, stakeholders must ensure that students possess the required competency levels to optimise their learning experiences. Future research will focus on assessing the competency levels of non-art-based students and comparing them to those of art students. This will help us understand the differences and similarities between the two groups. Further studies should also focus on investigating similar research in both non-academic settings and online learning environments. Other limitations include the exclusive focus on a university that has a dedicated digital arts playroom for game design and animation development.

ETHICAL CLEARANCE

Ethical clearance was obtained from the university to distribute online questionnaires to participating students with ethics protocol number H23/11/24.

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