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Assessing the impact of interactive multimedia learning platforms on dance education outcomes

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ABSTRACT

This study examined the use of interactive multimedia learning platforms in dance education, guided by the Technology Acceptance Model (TAM) and Self-Efficacy Theory. The research used Structural Equation Modelling (SEM) with a random sample of 362 students from four schools in Beijing. It aimed to explore the relationship between perceived usefulness (PU), perceived ease of use (PEOU), attitudes towards these platforms, and the impact of self-efficacy on performance and learning. The results showed that PU and PEOU significantly improved students' attitudes, which in turn enhanced their self-efficacy and performance. The study suggests that multimedia platforms are more effective than traditional teaching methods in improving learning outcomes, engagement, and satisfaction in dance education. These findings contribute to the growing body of research on educational technology in the arts, highlighting the importance of integrating technological advancements with psychological factors when developing digital learning environments. This study stands out by combining TAM with Self-Efficacy Theory in the context of dance education, providing a comprehensive understanding of the cognitive and emotional factors that affect technology acceptance and learning outcomes. It addresses the challenges and benefits of using multimedia in a physically demanding field like dance, which has not been extensively researched. However, the study is limited by its focus on a specific region and demographic group. Future research should include a broader range of participants to ensure the findings are applicable to various contexts. Despite some limitations, this study offers valuable insights for designing more effective multimedia-based learning systems for dance and other fine arts.

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1. Introduction

In the contemporary educational sphere, the integration of technology into learning environments is becoming increasingly prominent. Dance education, traditionally reliant on face-to-face instruction, is undergoing a significant transformation with the introduction of interactive multimedia learning platforms. Clark and Mayer (2023) highlighted the unique opportunity these platforms offer to enhance the learning experience in this artistic discipline by integrating elements such as video, audio, and interactive features. This study aimed to evaluate the efficacy of these platforms in dance education, particularly focusing on their impact on learning outcomes, student engagement, and overall satisfaction.

The adoption of digital tools in arts education, especially in a field as physically oriented as dance, marks a significant shift. Juntunen (2020) noted the potential of interactive multimedia learning platforms to revolutionize dance education by offering a unique blend of sensory engagement, a feature that traditional methods may lack. Pulatbek (2023) further discussed these platforms' capacity to provide instant feedback and diverse perspectives, making them intriguing subjects for study in the context of dance education.

Central to this research are the following questions critical to understanding the impact of multimedia platforms: Do they enhance learning outcomes in dance education compared with traditional methods? How do they affect student engagement? Are there measurable differences in satisfaction levels between students learning dance

through multimedia platforms and those learning through in-person instruction?

This study utilized a quantitative approach to explore the specific relationships between the following key variables: Perceived usefulness (PU), perceived ease of use (PEOU), attitude towards use, self-efficacy, and performance in learning. We investigated how learners' perceptions of the usefulness and ease of use of multimedia platforms influence their attitudes towards these platforms, how this attitude impacts their self-efficacy in using the platforms, and, ultimately, how this self-efficacy affects their performance in dance education. By grounding these explorations in the broader context of multimedia learning, this study suggests that interactive, multimodal educational tools can lead to more effective learning experiences.

This study is unique because of its originality in introducing multimedia learning through a reflective dance education course. It acknowledges the inherent challenge of implementing multimedia learning in a sector that has traditionally avoided incorporating digital technology. Interactive multimedia can propose innovative instructional approaches for dance educators. Hence, the research can be innovative and revolutionary as it may provide empirical evidence regarding the advantages of these technologies, ultimately resulting in improved methodologies. The outcomes of this research constitute a substantial contribution to the advancement of educational technologies and the field of dance pedagogy. The outcomes of this research have significant implications for the educational environment as they can provide new ideas or techniques that can influence future developments. Therefore, it not only identifies a deficiency in current knowledge but also subtly suggests the use of multimedia technology to encourage active participation in the study of the arts.

2. Literature review

2.1. Overview of multimedia learning platforms

Multimedia learning platforms have been developed to accommodate various methods of teaching, including traditional, hybrid, and completely online courses. Kalinowska et al. (2021) highlighted the efficacy of multimedia in language acquisition, specifically in the instruction of Polish, emphasizing its versatility in accommodating various teaching methods. The flexibility to adapt is a crucial advantage of multimedia platforms, as they may effectively meet various educational requirements and preferences.

Advancements in technology have also played a crucial role in shaping these platforms. Herczeg et al. (2019) introduced the concept of ambient learning spaces (ALS), which utilize digital interactive media to facilitate both individual and group learning. This approach underscores the potential of multimedia platforms to create dynamic and engaging learning environments. Conversely, this study may be biased towards a positive outlook on ALS without sufficiently considering the practical challenges of implementing such advanced technologies in under-resourced educational settings.

Moreover, He et al. (2018) discussed the significance of multimedia recommendation technologies in personalizing learning experiences, a feature that is increasingly essential in contemporary education. However, reliance on algorithms to personalize learning could introduce biases, particularly if the datasets used to train these algorithms are not representative of diverse student populations.

Implementing multimedia in teaching presents numerous challenges. A study by Juan and Yahaya (2019) noted issues such as an overreliance on digital tools and distractions stemming from poorly designed courseware, emphasizing the need for careful implementation and design of multimedia elements in education. This concern signals a gap between technological capabilities and their effective pedagogical application. Two scholars provide a critical counterpoint to the often-optimistic portrayal of multimedia platforms, suggesting that poor design and implementation can negate potential benefits.

Innovations in multimedia technologies have also extended to virtual educational environments. Priadko et al. (2022) explored modern multimedia technologies, noting their role in enhancing traditional educational functions and introducing innovative features such as learning analytics. Similarly, Persia et al. (2020) demonstrated that incorporating multimedia elements such as educational videos and smart text can significantly bolster student performance, suggesting the tangible benefits of multimedia in learning outcomes.

The potential of multimedia platforms extends beyond conventional educational settings. Rose et al. (2022) explored the use of virtual reality (VR) in multimedia learning, especially during the COVID-19 pandemic, highlighting its effectiveness in providing practical learning experiences under constrained conditions. Liao (2021) examined the application of platforms such as TikTok in physical education, revealing their capacity to increase engagement and teaching quality. This expansion into unconventional platforms indicates the versatility of multimedia in adapting to various educational contexts. However, the short-form content typical of platforms like TikTok may not be conducive to deep learning, suggesting a need for careful consideration of the types of multimedia used. Finally, the critical role of multimedia e-learning during global crises, such as the COVID-19 pandemic, was underscored by Matthew et al. (2022). Their research highlighted how multimedia learning platforms were instrumental in ensuring the continuity of education in developing nations during lockdowns, illustrating their importance in crisis-resilient education systems. It is clear from the above literature review that the current literature indicates the broad and

evolving application of multimedia learning platforms across diverse educational contexts. Although they offer substantial benefits in terms of adaptability, engagement, and learning outcomes, challenges in implementation and design persist.

2.2. Multimedia learning platforms in dance education

The use of multimedia learning platforms in dance education has shown great promise in improving traditional teaching methods, and some researchers have investigated this area. Ren (2017) provided an insightful analysis of the application of computer technology in dance teaching. The study highlighted the role of computer audio technology in enhancing dance education, particularly by providing suitable music accompaniment. In addition, computer networks were used for their capacity to improve traditional teaching methods, overcome spatial and temporal limitations, and enrich the learning experience with a blend of visual, audio, and interactive content. Ren's work suggests that integrating computer technology in dance education can create a more dynamic and engaging learning environment, yet it does not deeply explore the potential cognitive overload that may accompany the use of multiple forms of media.

Similarly, Huang (2020b) examined the use of multimedia courseware in Chinese folk dance classes. The study revealed that multimedia courseware could convey a rich breadth of knowledge, influencing traditional teaching methodologies. However, the authors also acknowledged the limitations of such courseware in dance education, suggesting a balanced approach to its implementation. This perspective is crucial because it highlights the risk of over-reliance on multimedia, which could detract from the hands-on, physical nature of dance training. The study prompts a discussion about the need for multimedia tools to complement rather than replace traditional teaching methods, ensuring that the physicality and artistry of dance remain central to the educational experience.

Leijen et al. (2008) focused on the experiences of students in an international distance education program for dance delivered via e-learning. The findings emphasized the critical role of teacher guidance and feedback in such environments, especially for practical assignments. This study highlights the importance of human elements in technology-enhanced learning, particularly in disciplines such as dance, which traditionally rely heavily on instructor-led training. The balance between technology and human interaction is a recurring theme in the literature, pointing to the need for technology to support, rather than supplant, the essential role of the instructor.

According to the research they conducted, Dania et al. (2013) assessed the effects of a novel computer multimedia program called Labankido© on novice dance learners. Designed according to Mayer's Multimedia Learning Theory and using Labanotation symbols, the application showed promise in teaching basic movement concepts. This study demonstrates the effective application of multimedia tools in dance education and aligns it with modern educational theories. However, the study may be limited by its focus on beginner students, suggesting the need for further research into how such tools can support more advanced levels of dance training.

Another innovative approach was presented by Brown and Meulenbroek (2022) with "Dance-the-Music," a computational platform using spatiotemporal motion templates for teaching dance steps. The platform's use of recognition algorithms for real-time performance monitoring indicated the evolving role of technology in supporting dance education, particularly in facilitating the learning of basic step models. In addition, Warburton (2022) called for additional research focusing on the cognitive aspects of technologically supported instruction in dance. They advocated the design of multimedia products based on modern theories of multimedia learning, highlighting a gap in the current research landscape regarding the cognitive impact of multimedia in dance education. This call to action underscores the importance of understanding how multimedia tools affect cognitive load and learning efficiency, ensuring that these tools enhance rather than hinder the learning process.

The studies discussed collectively paint a picture of a field in transition, with multimedia learning platforms offering innovative ways to engage students and enhance teaching methodologies. They also signal the need for a balanced and well-considered approach to the integration of technology into dance education, considering both its potential and limitations. While multimedia tools can provide significant benefits, their implementation must be carefully designed to support the physical, cognitive, and artistic dimensions of dance education.

2.3. Theoretical foundations and frameworks

To evaluate the efficacy of interactive multimedia learning platforms in dance education, this study adopts an integrative approach, amalgamating the insights of the Technology Acceptance Model (TAM) and Self-Efficacy Theory. This synthesis provides a nuanced understanding of technology acceptance and delves into the behavioral and performance implications of these educational tools.

The TAM, conceived by Davis (1987) in the late 1980s, stands out as a seminal framework for understanding user acceptance and usage of technology. It offers critical insights into the cognitive processes underlying technology adoption, making it particularly relevant in diverse fields, including education. As shown in Fig. 1, two constructs central to the TAM are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU refers to the degree to which an individual believes that using a particular technology enhances his or her performance. In the context of dance education, this translates to students' beliefs about

the effectiveness of multimedia learning platforms in improving their dance skills. PEOU, on the other hand, denotes the degree to which an individual perceives the technology as easy to use, encompassing aspects such as user interface simplicity and navigational intuitiveness.

An additional construct from the TAM, Attitude towards Using, is pivotal in this study. It encapsulates learners' overall affective reactions to using multimedia learning platforms. This construct effectively bridges perceptions of PU and PEOU with the likelihood of platform adoption, offering a comprehensive perspective on the factors influencing technology acceptance in the dance education domain.

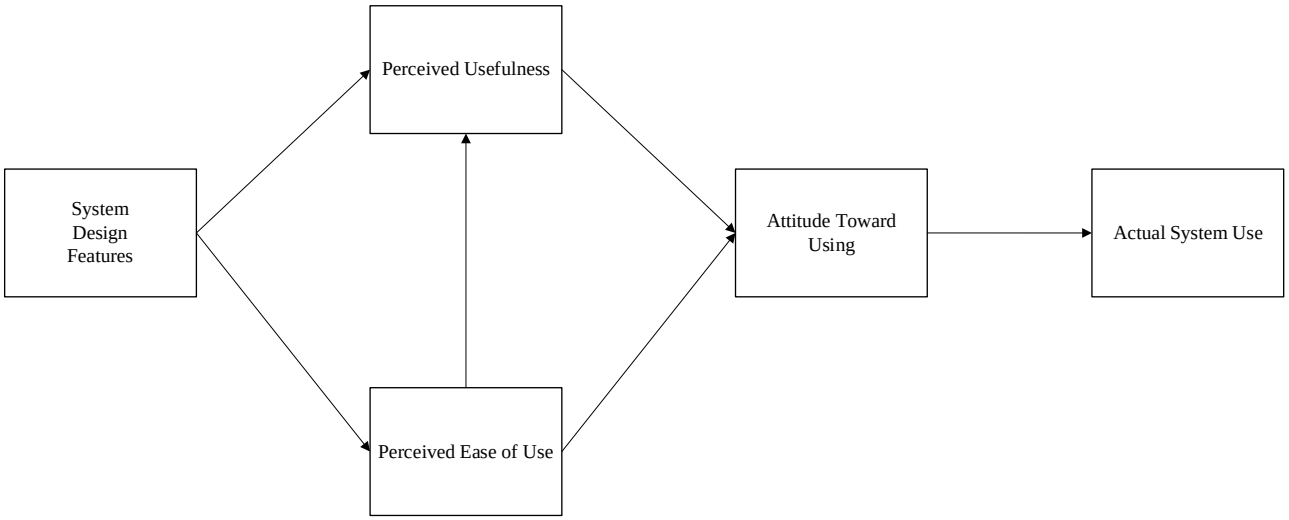

Fig. 1: Technology acceptance model (Davis, 1987)

In addition to the Technology Acceptance Model, Bandura and Adams's (1977) Self-Efficacy Theory provides a crucial viewpoint on learners' confidence in their ability to properly utilize multimedia platforms for dance teaching. According to Bandura and Adams's (1977) social cognitive paradigm, self-efficacy, which is the belief in one's own capability to complete a task, has a substantial impact on how individuals approach and interact with problems, such as acquiring new skills. Lopez-Garrido (2023) conducted a study that examined self-efficacy theory. The theory is reevaluated, and new ideas on psychological motivation are presented, as shown in Fig. 2.

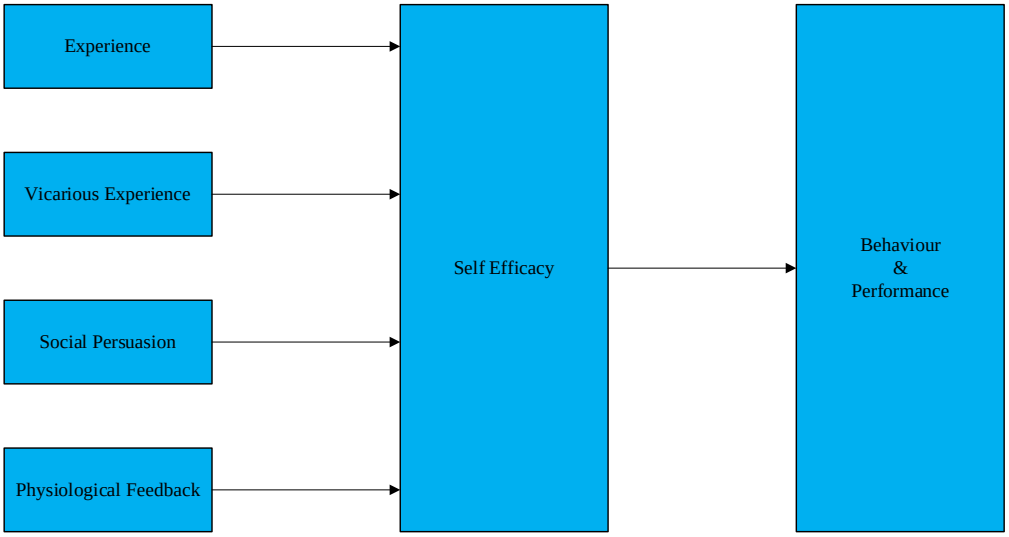

Fig. 2: Bandura's self-efficacy theory of motivation in psychology (Lopez-Garrido, 2023)

In the context of this study, self-efficacy encompasses not only the technical aspects of using multimedia platforms but also extends to learners' confidence in their capacity to learn and perform dance through digital media. It is a critical factor that determines how learners interact with educational technology, how they persist despite challenges, and how they perform overall in dance education. Thus, self-efficacy forms a vital link between the technological attributes of multimedia learning platforms and behavioral outcomes in dance, providing a comprehensive lens through which to evaluate the efficacy of these platforms in enhancing dance education.

This study aimed to assess the efficacy of interactive multimedia learning platforms in dance education by employing an integrated theoretical framework that merges TAM and self-efficacy

theory. The model proposes a structured pathway in which the independent variables PU and PEOU from the TAM significantly shape learners' attitudes towards use, which then influences their self-efficacy and ultimately affects their performance in dance education. In this framework, as shown in Fig. 3, PU and PEOU are the initial cognitive variables that determine learners' perceptions of multimedia platforms. These perceptions are anticipated to directly affect the first mediating variable, Attitude towards Use, reflecting learners' overall emotional and affective responses to the technology. Subsequently, this attitude is hypothesized to influence the second mediating variable, Self-Efficacy, as per Bandura's theory. This represents the learners' belief in their competence in effectively utilizing the platform to enhance their dance education.

The endpoint in this model is the dependent variable, Performance, which is characterized by learners' actual engagement with the multimedia learning platform and their consequent learning achievements in dance. The research hypothesis delineates a sequential influence, asserting that positive perceptions of PU and PEOU enhance attitudes towards use, which in turn boosts self-efficacy, leading to improved performance. Therefore, learners who perceive the platform as beneficial and user-friendly are likely to develop a favorable attitude towards its use and greater confidence in their ability to learn dance, culminating in superior educational outcomes.

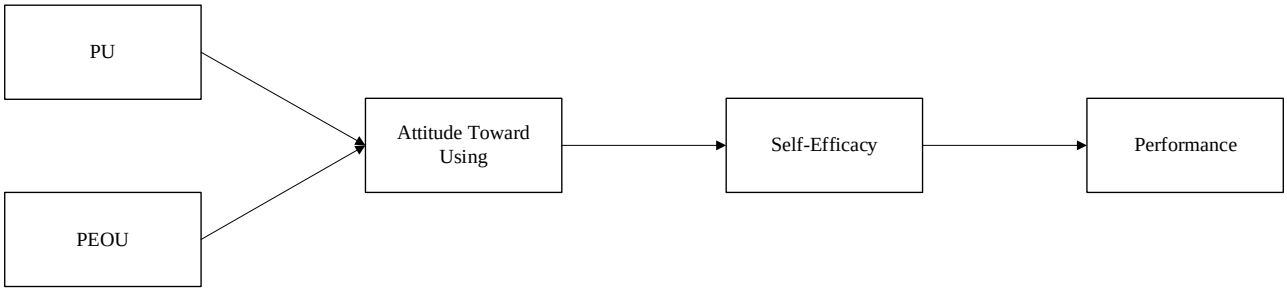

Fig. 3: Research framework

This comprehensive approach not only enhances the understanding of the elements influencing the use of technology in dance education but also reveals the complex interrelationships among learners' views, attitudes, self-confidence, and educational accomplishments. This study provides an opportunity to extensively examine the relationship between the acceptance of technology and one's belief in one's own ability to use it, specifically in the context of digital learning platforms for dance. It offers useful insights into how these platforms might be improved to provide better educational experiences. Guided by the theoretical framework and research model, the following research hypotheses were formulated:

- H1: The PU of interactive multimedia learning platforms in dance education positively influences learners' attitudes towards using these platforms.
- H2: The PEOU of interactive multimedia learning platforms in dance education positively influences learners' attitudes towards using these platforms.
- H3: Learners' attitudes towards using interactive multimedia learning platforms in dance education positively influence their self-efficacy.
- H4: Learners' self-efficacies in using interactive multimedia learning platforms for dance education positively influence their performance in learning dance through these platforms.

3. Methodology

This study utilized a quantitative technique to assess the effectiveness of interactive multimedia learning platforms in dance education. The methodology was designed to systematically investigate the relationships between the variables derived from the Technology Acceptance Model and Self-Efficacy Theory.

3.1. Questionnaire items

This study's research design was structured to assess the efficacy of interactive multimedia learning platforms in dance education. A detailed analysis of variables, informed by the literature, guided the development of questionnaire items for data collection. The design incorporated five key variables: PU, PEOU, Attitude towards Use, Self-Efficacy, and Performance in Learning Dance, as shown in Table 1.

3.2. Instruments

The primary data collection instrument was a structured questionnaire with items measured using a 5-point Likert scale ranging from strongly disagree to strongly agree. The data were collected through an online survey (Wenjuanxing platform; wjx.cn) distributed to the participants. Informed consent was obtained, and the confidentiality of the responses was maintained.

3.3. Sample size

The study utilized a sample of 362 students who participated in dance classes or possessed relevant expertise in this domain; these students were selected from four schools in Beijing. This sample

size was carefully chosen to ensure the robustness of the SEM analysis, adhering to the guidelines suggested in the relevant literature. Kline (2023) recommended a minimum sample size of 200 for conducting SEM to achieve stable and reliable results.

Table 1: Questionnaire items

Variables	Reference items	This study items
PU	1) Perceived usefulness positively affects learning motivation (Huang, 2020a) 2) Perceived usefulness influences behavioral intention towards e-learning (Yuen and Ma, 2008) 3) Perceived usefulness enhances learning satisfaction (Huang, 2020a)	1) The multimedia platform improves my learning in dance education 2) Using the multimedia platform increases my productivity in learning dance 3) I find the multimedia platform useful for understanding dance concepts
PEOU	1) Perceived ease of use positively affects learning attitude (Huang, 2020a) 2) Perceived ease of use influences students' behavioral intention towards blended e-learning (Liao and Huang, 2009) 3) Ease of use leads to better technology acceptance (Yuen and Ma, 2008)	1) I find it easy to navigate through the multimedia platform 2) Learning how to use a multimedia platform is easy for me 3) I can easily find what I need on the multimedia platform for dance education
Attitude towards using (Attitude)	1) Attitude towards e-learning technology is influenced by perceived ease of use and usefulness (Yuen and Ma, 2008) 2) Positive attitude towards e-learning platforms leads to higher acceptance (Huang, 2020a)	1) I have a positive attitude towards using multimedia platforms for dance education. 2) I feel motivated to use multimedia learning platforms to learn dance
Self-Efficacy	1) Self-efficacy has significant, positive effects on perceived usefulness (Wang and Tseng, 2010) 2) Self-efficacy influences students' perceived ease of use (Seok-Yong et al., 2006) 3) High self-efficacy leads to better performance (Wang and Tseng, 2010)	1) I am confident in my ability to use the multimedia platform for dance education 2) I feel capable of mastering the skills taught on the multimedia platform. 3) I believe that I can effectively use the multimedia platform to improve my dance skills
Performance in learning dance (Performance)	1) Self-efficacy positively impacts learning performance (Wang and Tseng, 2010) 2) Performance is enhanced by effective use of e-learning platforms (Huang, 2020a)	1) My ability to perform dance moves has improved using the multimedia platform 2) I can see a noticeable improvement in my dance skills since using the multimedia platform 3) I achieve better results in dance learning when using the multimedia platform

Hair et al. (2011) further emphasized the need for a larger sample size to increase the statistical power of the analysis. Similarly, Tabachnick and Fidell (2019) advocated a sample size of 300 or more to ensure adequacy for most multivariate procedures, balancing between statistical power and practical data collection considerations. These guidelines were instrumental in determining the sample size for this study, allowing for a comprehensive and reliable analysis of the relationships between the TAM and Self-Efficacy constructs.

3.4. Data analysis

The gathered data were examined using SPSS for fundamental analysis, such as assessing reliability and validity, to ensure the effectiveness of the questionnaire data. For hypothesis testing, SEM was used to examine the relationships between the variables. This analysis helps determine the direct and indirect effects of PU and PEOU on Performance through the mediating variables of Attitude towards Use and Self-Efficacy. The dedicated software that supports the aforementioned technique is the web-based analysis package SPSSPRO.

4. Results

4.1. Demographics

This study involved a focused selection of students with dance expertise from four high schools in Beijing. The objective of this study was to assess the effectiveness of interactive multimedia learning platforms in dance teaching.

The analysis of the study sample, as presented in Table 2, demonstrates a balanced gender distribution. Specifically, there were 174 female and 188 male participants, demonstrating a diverse representation in terms of gender viewpoints on the use of multimedia in dance education. Regarding dance experience, most participants (89 individuals) reported having 1-3 years of experience, suggesting a relatively novice to intermediate level of proficiency in dance. This was closely followed by 83 participants with 7-9 years of experience, indicating a significant representation of more experienced dancers. A considerable number of participants, 70, had less than one year of dance experience, reflecting the inclusion of beginners in the study. Notably, 62 participants had more than ten years of dance experience, providing insights from highly experienced dancers. In terms of experience with multimedia learning platforms, the data showed a varied range of familiarity among the participants. A total of 87 participants had 1-3 years of experience with these platforms, suggesting a moderate level of exposure and familiarity. Interestingly, 78 participants were relatively new to such platforms, having less than a year of experience, 67 participants had 4-6 years, and 72 had more than 7 years of experience, indicating that a substantial segment of the sample had considerable exposure to multimedia learning tools. Notably, 58 participants had never used such platforms, offering a fresh perspective on the initial adoption and perception of multimedia learning in dance education.

Table 2: Demographic information

Category	Years of experience	Gender		Total
		Female	Male	
Dance experience	1-3 years	37(41.6%)	52(58.4%)	89
	10 years or more	32(51.6%)	30(48.4%)	62
	4-6 years	30(51.7%)	28(48.3%)	58
	7-9 years	37(44.6%)	46(55.4%)	83
	Less than 1 year	38(54.3%)	32(45.7%)	70
Platform using experience	1-3 years	43(49.4%)	44(50.6%)	87
	4-6 years	29(43.3%)	38(56.7%)	67
	7 years or more	31(43.1%)	41(56.9%)	72
	Less than 1 year	42(53.8%)	36(46.2%)	78
	Never used	29(50.0%)	29(50.0%)	58

4.2. Reliability and validity

The reliability of the questionnaire used in this study to evaluate the efficacy of interactive multimedia learning platforms in dance education was assessed using Cronbach's alpha coefficient. The Cronbach's alpha coefficient, as shown in Table 3, was 0.947, which was slightly higher than the standardized Cronbach's alpha of 0.943. Both values are significantly greater than the commonly accepted threshold of 0.70 for reliable internal consistency, indicating that the questionnaire items are highly consistent and reliable for measuring the constructs of interest.

For the validity test, Table 4 shows that the Kaiser–Meyer–Olkin (KMO) measure for the study is 0.905, which is well above the commonly recommended threshold of 0.60. The KMO test assesses the suitability of data for factor analysis, and a value close to 1 indicates that the data are highly suitable. A KMO value of 0.905 suggested that the variables in the questionnaire had substantial common variance, indicating that they were well-suited for reliable and valid factor analysis. Bartlett's test of Sphericity returned an approximate chi-square value of 6242.81, with 91 degrees of freedom and a significance level (p-value) of 0.000. The test examines whether the correlation matrix is an identity matrix, which would mean that the variables are unrelated and not suitable for structure detection. A significance level of 0.000 (***), below the 1% threshold, shows that the correlation matrix is not an identity matrix. This result indicates that the variables are related and appropriate for factor analysis. Therefore, the results of both the KMO test and Bartlett's test of Sphericity confirm that the data are suitable for factor analysis in this study.

Table 3: Reliability analysis

Cronbach's alpha coefficient	Standardized Cronbach's Alpha coefficient	Number of items	Sample size
0.947	0.943	14	362

Table 4: KMO and Bartlett's tests

KMO value		0.905
Bartlett's test of Sphericity	Approximate chi-square	6242.81
	df	91
	P	0.000***

***: represents significance levels at 1%

4.3. SEM analysis

In our study, SEM analysis was instrumental in examining the relationships among the following specific variables: PU, PEOU, ATU, SE, and Performance in Learning Dance.

By analyzing the SEM data, as shown in Table 5, we found a significant positive relationship between Perceived Usefulness and Attitude towards Use (standardized coefficient=0.656), which strongly supports our first hypothesis (H1). This result indicates that learners' perceptions of the usefulness of multimedia learning platforms significantly influence their attitudes toward using these platforms in dance education. The standardized coefficient reflects a substantial impact, suggesting that PU is a crucial factor in shaping learners' attitudes. Similarly, a significant positive effect of Perceived Ease of Use on Attitude towards Use (standardized coefficient=0.687) was observed, corroborating our second hypothesis (H2). This finding demonstrates that the ease with which learners can use multimedia platforms also plays a significant role in forming attitudes toward these technologies in dance education.

Table 5: Model regression coefficient

Factor (Latent variable)	→	Analysis item (Observed variable)	Unstandardized coefficient	Standardized coefficient	Standard error	Z	P
PU	→	Attitude	0.958	0.656	0.052	18.262	0.000***
PEOU	→	Attitude	0.971	0.687	0.048	20.357	0.000***
Attitude	→	Self-Efficacy	0.9	0.902	0.033	26.977	0.000***
Self-Efficacy	→	Performance	0.858	0.798	0.039	21.844	0.000***

***: represents significance levels at 1%

Furthermore, the data showed that ATU positively influenced SE (standardized coefficient=0.902), confirming our third hypothesis (H3). This substantial correlation suggests that

positive attitudes towards multimedia platforms are closely linked to higher levels of self-efficacy among learners. This strong relationship indicates that fostering favorable attitudes could be key to enhancing learners' confidence in using these platforms effectively. Finally, a strong positive relationship was found between Self-Efficacy and Performance in Learning Dance (standardized coefficient=0.798), which aligns with the fourth hypothesis (H4). This result implies that learners who have greater self-efficacy in using multimedia learning platforms exhibit better performance in dance education. A high coefficient highlights the importance of self-efficacy in achieving educational outcomes. Table 6 shows the results for the fit of the SEM. The chi-square statistic was significant at 306.209 with 72 degrees of freedom, indicating model significance. However, the chi-square/df ratio was slightly greater than the ideal value of 4.253. The goodness-of-fit index (GFI) showed a strong fit at 0.952, whereas the root mean square error of approximation (RMSEA) was moderately acceptable at 0.095. The root mean square residual (RMR) was greater than the preferred value of 0.216. In addition, indices such as the comparative fit index (CFI), normed fit index (NFI), and non-normed fit index (NNFI) were all above 0.9, suggesting a good overall model fit.

Fig. 4 clearly depicts these interrelationships and the hypothesized pathways within our research framework.

Table 6: Indicators of model fit

χ^2	df	P	Chi-square/df Ratio	GFI	RMSEA	RMR	CFI	NFI	NNFI
-	-	>0.05	<3	>0.9	<0.10	<0.05	>0.9	>0.9	>0.9
306.209	72	0.000***	4.253	0.952	0.095	0.216	0.963	0.952	0.953

***: represents significance levels at 1%

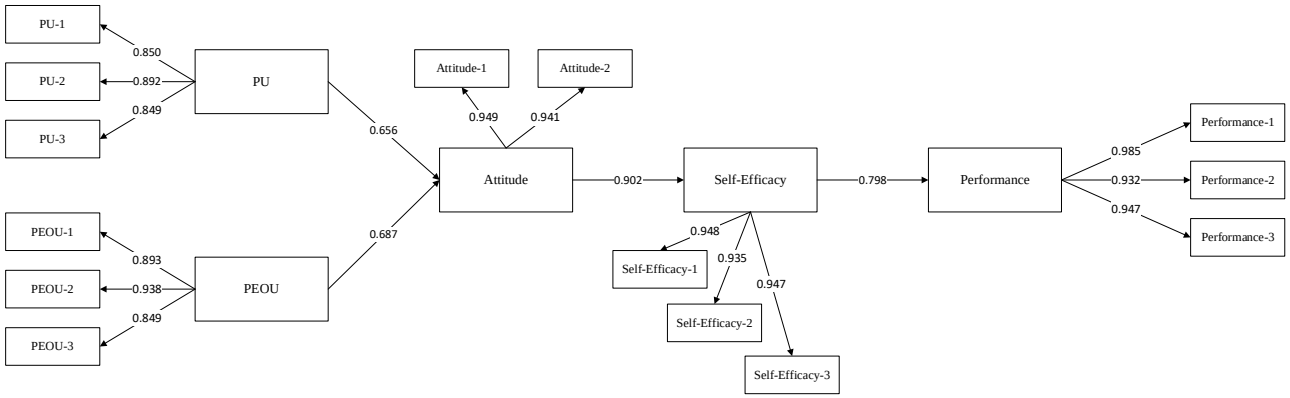

Fig. 4: SEM path diagram

5. Discussion

This study evaluated the efficacy of interactive multimedia learning platforms in dance education, guided by TAM and self-efficacy theory. The findings from our SEM analysis offer significant insights, affirming the interconnectedness of perceived usefulness, ease of use, attitudes towards technology, self-efficacy, and performance in learning dance.

The strong positive relationships between PU and PEOU with Attitude towards Use highlight the critical role of initial perceptions in shaping attitudes toward technology. This finding aligns with prior research indicating that positive perceptions of a technology's utility and user-friendliness can foster favorable attitudes (Huang, 2020b; Yuen and Ma, 2008). In the context of dance education, where the adoption of multimedia platforms is relatively novel, these findings underscore the importance of designing platforms that are not only functionally robust but also user-friendly and relevant to learners' needs.

The substantial influence of Attitude towards Using on Self-Efficacy echoes Bandura's assertion about the impact of affective and psychological states on an individual's belief in their capabilities (Bandura and Adams, 1977). In educational settings, particularly in arts and dance, this finding suggests that fostering positive attitudes toward learning technologies can significantly enhance learners' confidence in using these tools effectively. This has practical implications for educators and platform developers, highlighting the need to create positive user experiences that extend beyond mere functionality.

Furthermore, the strong link between self-efficacy and performance in learning provides empirical support for the role of self-belief in educational achievement, consistent with the findings of previous studies (Wang and Tseng, 2010). This outcome suggests that learners who are confident in their ability to use multimedia platforms are more likely to experience improved learning outcomes in dance. These findings have implications for instructional design in dance education, emphasizing the need to incorporate elements, such as personalized feedback and adjustable difficulty levels, into multimedia platforms to boost learners' self-efficacy.

However, the study also revealed areas for improvement, as indicated by the moderate RMSEA

and higher RMR values in the SEM analysis. These aspects suggest that while the model fits the data well overall, specific elements of the platform or user experience could be refined to further enhance the effectiveness of multimedia learning tools in dance education. This study has several limitations, particularly in terms of geographic and demographic selection. The sample was limited to a specific region and demographic group, which may have affected the generalizability of the findings. Future research should include a more diverse and representative sample to enhance the applicability of the results across different contexts.

In summary, this study contributes to the growing body of literature on the use of technology in arts education, providing empirical evidence of the pathways through which multimedia learning platforms impact learning in dance. The findings highlight the need for an integrated approach that considers both technological aspects and psychological factors when designing and implementing effective multimedia learning environments. As technology continues to evolve, these insights will be invaluable in guiding future developments in digital learning tools for dance and other artistic disciplines.

6. Conclusion

This study confirmed that both PU and PEOU have a significant influence on learners' attitudes towards using multimedia platforms, which in turn notably affects their self-efficacy and, subsequently, their performance in learning. This sequence of influences corroborates the view that learners' cognitive perceptions of technology and their affective responses play a pivotal role in determining educational outcomes in dance education.

Responding to the central research questions, the findings suggest that compared with traditional methods, interactive multimedia learning platforms enhance learning outcomes in dance education. The data indicate that the use of these platforms positively influences student engagement, as reflected in the improved attitudes and self-efficacy concerning the use of technology in learning dance. Furthermore, the study points to measurable differences in satisfaction levels, with learners showing enhanced satisfaction and performance when using multimedia platforms as opposed to conventional in-person instruction. This is evidenced by the strong relationships among the variables PU, PEOU, Attitude towards Use, Self-Efficacy, and Performance in Learning Dance.

However, areas for improvement were identified, as indicated by the moderate RMSEA and higher RMR values in the SEM analysis. These findings suggest that while multimedia platforms are effective, there is potential for further enhancement in their design and implementation.

Finally, the integration of interactive multimedia platforms in dance education represents a promising avenue for enhancing the learning experience. By effectively leveraging the dynamics of technology acceptance and self-efficacy, educators and developers can create more engaging and effective learning environments. This study not only validates the positive impact of multimedia learning platforms on dance education but also opens avenues for future research to further refine and understand the use of technology in the arts. The insights gained contribute significantly to the discourse on educational technology in the arts, paving the way for the continued evolution of digital learning tools in this field.

Compliance with ethical standards

Ethical considerations

Informed consent was obtained from all participants, ensuring awareness of the study's purpose and their right to withdraw at any time. Data were anonymized to protect confidentiality, and the study adhered to UCSI University's ethical guidelines.

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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