

Understanding Students' Intentions Towards Utilizing Metaverse Information Systems in Music Education: Examining Mediating Role of Student Attitude

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Abstract

Metaverse information system with the use of technology has transformed the learning environments of educational institutions; though putting up a challenge to the users' intentions to engage with metaverse systems. This research aimed to understand user intentions to utilize metaverse information systems in music education. Using a self-administered survey questionnaire, data was collected from 350 music education students, choosing a purposive sampling technique, and employing a deductive quantitative approach and cross-sectional research design. The Partial Least Square (PLS)-Structural Equation Modeling (SEM) technique results show that musical ability self, ideal musical self, and adaptive musical self positively significantly impact the metaverse information system of Chinese universities music education students. In the same vein, information quality also has a positive and significant impact on metaverse information systems. Further results show that student attitude is partially mediated among information quality, future learning intention, technology optimization, adaptive musical self, musical ability self, ideal musical self, and metaverse information systems of Chinese music education students. The study with these findings extends the understanding of metaverse information systems with the mediating effect of students' attitude in Chinese university music education students. The study would practically help educators and system designers to focus on enhancing both musical and information quality aspects to optimize metaverse platforms for better engagement and outcomes.

Keywords

Metaverse Information System (MIS), Information Quality, Music Education, Chinese Students.

1. Introduction

The metaverse information system provides a modification of individuals towards utilizing technology to increase their immersive experiences that excel in traditional learning environments (Lin; Liu, 2024). As these systems develop, they play a crucial role in enhancing engagement, collaboration, and accessibility in various domains (Moreira Classe *et al.*, 2023) like education. The metaverse offered innovative platforms where users experienced interactive learning which enabled them to visualize and experiment with previously impossible methods (Upadhyay *et al.*, 2023). This shift is particularly significant as educational institutions seek to adapt to rapidly changing technological landscapes which emphasizes the need for research that explores the determinants of users' intentions to engage with metaverse systems, particularly among students in specialized fields like music education (Lin; Liu, 2024). As metaverse information system is an important factor, therefore, in music education the integration of metaverse information systems holds great potential to revolutionize teaching and learning methods. The metaverse could provide a rich,



interactive environment that enhances musical instruction by offering virtual instruments, and real-time feedback mechanisms (Moreira Classe *et al.*, 2023). Such immersive experiences could facilitate a deeper understanding of musical concepts, enhance creativity, and cultivate a sense of community among learners that is essential for developing musical skills (Tukur *et al.*, 2024). As students navigate through these interactive platforms then their intentions to engage with metaverse systems will likely be influenced by various factors, such as their musical self-perception in their educational system (Lin *et al.*, 2023). Along with the musical self, information quality also plays an integral role in increasing the intention of an individual toward the metaverse information system (Alkhwaldi, 2023).

Other authors also enforced that the intention of an individual could be enhanced when their attitude is effectively changed (Chan *et al.*, 2023). This is the reason, why understanding these variables is critical for leveraging the metaverse information system through changing attitudes of students in music education effectively. Studies have cited that through enhancing musical self-concept factors like the ideal musical self, students can develop a positive self-image that not only boosts their confidence but also increases an enthusiastic approach toward engaging with metaverse platforms (Fiedler; Spychiger, 2017; Murlen; Pranoto, 2023). When students view their musical identity positively, they are more likely to adopt a favorable attitude toward technology which facilitates a greater willingness to explore and utilize innovative learning tools (Marlen *et al.*, 2023). Equally, another musical self-concept factor which is the musical ability self also encourages students to recognize and appreciate their skills, which can lead to improved self-efficacy (Fiedler; Spychiger, 2017). This heightened sense of capability increases a positive attitude toward new technologies, as students are more inclined to perceive challenges as opportunities for growth rather than obstacles (Sun; Guo, 2024). In the same vein, another musical self-concept factor like adaptive musical self also played a vital role where students who are flexible and open to change are more likely to approach metaverse information systems with a constructive attitude, viewing them as valuable resources for their educational journey (Christabelle; Widuri, 2024).

In addition, focusing on future learning intentions also encourages an individual in a forward-thinking mindset which could lead students to perceive metaverse platforms which as essential tools for their educational advancement (Alkhwaldi, 2023). This proactive attitude could significantly enhance their engagement and utilization of these systems (Alkhwaldi, 2023). In addition, recognizing the importance of technology optimization could also influence attitudes positively, as students are more likely to adopt a favorable perspective when they perceive these systems as advanced and user-friendly (Zheng *et al.*, 2024). Lastly, the information quality also contributes to shaping attitudes; when students believe the content provided through metaverse systems is reliable and valuable then they are more inclined to engage actively with these platforms (Ahn, 2024; Alkhwaldi, 2023). After seeking the significance of previous factors, the current study focused on understanding students' intentions toward Utilizing Metaverse information systems in music education.

Along with the significance of various interested areas for the adoption of metaverse information systems in education, empirical studies still have various gaps, relating to their application in music education. Firstly, extant studies have mainly explored the general factors that are influencing technology acceptance, while often they overlook the specific dynamics of musical self-perception, such as the ideal musical self, musical ability self, and adaptive musical self (Chanda *et al.*, 2024; Liu; Park, 2024). Furthermore, there is limited research on the mediating role of attitudes in the relationship between these musical self-perceptions and the intention to engage with metaverse systems where the mediating effect of attitude on other factors, which is critical for understanding the psychological factors driving technology adoption (Marlen *et al.*, 2023). Secondly, while constructs like future learning intention, technology optimization, and information quality self are recognized as important in technology adoption literature, their specific relevance to music education remains underexplored in one model which indicates a need for empirical studies that assess how these factors influence students' engagement with metaverse platforms (Aburbeian *et al.*, 2022; Al-Adwan *et al.*, 2023). Finally, studies often fail to integrate these various constructs comprehensively, leaving a gap in understanding the relationship between musical self-perception, information quality, and technological factors that collectively shape students' intentions, thereby hindering the development of more effective educational models (Wang; Shin, 2022). Moreover, extant studies also majorly focused on other countries while having limited attention on music education students in Chinese public sector universities. Therefore, considering these gaps, current study focused on understanding students' intentions towards utilizing metaverse information systems in music education.

The study with this specific objective holds the significance of the study to fill a critical gap in the understanding of how musical self-perceptions, information quality and other future learning, and technology optimization influence students' intentions toward metaverse information systems in music education through attitude. Through exploring the nuanced relationships this research contributed that study variables significantly increased engagement with innovative educational technologies. Furthermore, the investigation into the mediating role of student attitudes also offers valuable insights into how increasing positive perceptions can enhance students' willingness to embrace metaverse platforms. This study not only contributes to the existing literature on technology adoption in education but also emphasizes the importance of approaches in music education that consider students' unique musical identities and self-perceptions. The study also contributes to helping policymakers and educationists to increase the culture of music in educational institutions, to enhance the greater attention of students towards utilizing metaverse information systems that could increase the educational institution's competitive advantage in the international market.

2. Literature Review and Hypothesis Development

The ideal musical self is described as a person's inspirational vision of someone who would like to learn music or be a musician (Hwang; Lee, 2022). The Ideal musical self is a good effort where learners will be willing to get any means of learning that are associated with their learning goals (Lee; Kim, 2023). About a metaverse information system, ideal musical learners will perceive the platforms as a means to an end to further their objective thus raising their intention to use the metaverse platforms as an information system (Lee; Kim, 2023). O'Neill (2012) also studied that beneficiaries with ambitions for a suitable musical vocation are eager to use a digital learning environment (Maurlen; Pranoto, 2023). Maurlen and Pranoto (2023) also extended this idea by highlighting that, the clarity of the student's ideal musical self was positively related to engagement with technology-mediated education. According to Park and You (2024), the students who were more active in using technology as a medium for achieving their goals were those who have their ideal self in music. Based on the above discussion, it is hypothesized that:

H1: Ideal musical self has a significant impact on intention to use metaverse information system.

Musical ability self refers to the student's assessment of their current musical skills and competencies. It involves the way where they estimate their capability in music making and this may in eliminate their attitude towards utilizing learning technology (Sun; Guo, 2024). Musical self-efficacy concerning their music skills influences their receptiveness to embrace new learning technologies (Rosli; Saleh, 2024). Another reason could be, that if someone has musical ability then he may feel more confident over the functioning of a metaverse system since music increases perceived competence, and thus has higher chances of using the metaverse system and that increased self-estimated learning potentials are related to the use of more sophisticated learning resources (Park; You, 2024). In addition, Ball (2022) also found that confidence in musical skills affected the use of technology-based learning strategies at the earliest stage. In this regard, Li (2023) specifically encouraged the notion of musical self-efficacy as the factor that played a role in learners' choice to incorporate technology into both formal and informal learning settings of music. They also argued that further research could be explored in other countries to know the variation in findings. Therefore, study formulated the following hypothesis:

H2: Musical ability self has a significant impact on intention to use metaverse information system.

Adaptive musical self could be defined in terms of adaptability which means a student's potential to adapt and develop a new technology environment (Al-kfairy et al., 2024). In a rapidly growing digital society, adaptability becomes important for students to reach their potential in emerging virtual learning environments such as the metaverse (Rosli; Saleh, 2024). From the study of Roy et al. (2023), it could be inferred that learners with adaptive musical self are better placed to adopt technology into their learning processes and hence have the intention to adopt the metaverse as a mode of learning music. According to Maqableh et al. (2024) those students who changed their learning approaches in music to suit the available technology were more likely to embrace such technologies. Extending this, Rosli and Saleh (2024) showed that students who are considered 'adaptive' were more effective at transferring to digital software. Salloum et al. (2023) determined that it is the students with indeed fluid musical selves who are likely to have a stronger intention to adapt to use virtual learning spaces. Based on the previous discussion, the study has formulated the following research hypothesis:

H3: Adaptive musical self has a significant impact on intention to use metaverse information system.

Furthermore, intention for future learning implies the ability of a student to learn and improve his performance (Al-Adwan et al., 2023). The results further show that the perceived usefulness of future learning is truly significant and useful for students who are much more motivated to accept tools to support continual education (Al-Adwan et al., 2023). When considering students who are part of a metaverse information system, this audience is most probably going to see the platform as a way to complement their learning process (Ren et al., 2022). In addition, Rosli and Saleh (2024) established that students who had the intention to learn music in the following year would engage in the use of advanced educational technologies. Similarly, Aburbeian et al. (2022) further supported that future learning intention was the determining factor of the adoption of virtual learning tools. Roy et al. (2023) results also pointed to the fact that students with long-term learning goals embraced the environments of a metaverse information system. To confirm these findings, it is hypothesized that:

H4: Future learning intention has a significant impact on the intention to use metaverse information systems.

Technology optimization which provides a learning platform should be customized or be made sensitive to the needs of music learners (Chen, 2024). This implies that when a technology is made to be sensitive towards utilizing learning especially music learning students are more likely to adopt the technology (Rahman et al., 2023). The effectiveness of the metaverse information system also increases its utility for formal learning since it presents the potential for a tiered approach to delivering information to the student (Wijayanto et al., 2023). Abbasi et al. (2024) concluded that the level of satisfaction with the possibility of further learning was higher and the intention to further use the tested technology was higher with the possibility of customizing the platform based on students' needs. Furthermore, Chen (2024) showed that instructional technology that matched the learning preferences of individuals enhanced learning of music.

According to **Çelik and Ayaz** (2024), the understanding students have in relation to the appropriateness of the technologies was a significant ideal determining their intention toward metaverse information systems. Therefore, based on previous discussion, it is hypothesized that:

H5: Technology optimization has a significant impact on the intention to use metaverse information systems.

Information quality is the extent of relevance, accuracy, and usefulness of the information that is delivered by the learning system (**Rasheed; Rashid**, 2024). They also argued that information quality is very important to increase the intention towards utilizing metaverse information systems. When students acknowledge the usefulness of the information coming from the metaverse system concerning their music learning needs, they will adapt to use the system (**Alfaisal et al.**, 2024). Based on the aforementioned related literature, **Ahn** (2024) also identified that information quality played a crucial role in the extent of engagement with the intended use metaverse system. **Sediyaningsih et al.** (2023) also noted that the more relevant the information being provided, the higher is the students' interest in using technology in learning. **Rasheed and Rashid** (2024) also noted that perceived information quality improves user satisfaction to increase the students' intention to persevere with the platform. These studies show that information quality is an important factor in increasing the intention of individuals toward a metaverse system. Therefore, the study necessitated to test the following research hypothesis:

H6: Information quality self has a significant impact on the intention to use a metaverse information system

As ideal musical ability increases the intention towards utilizing using metaverse information system. extant study argues that musical self-perception also influences another effect (**Kim; Lee**, 2023). In line with this, it is important to have the role of students' attitude as a mediating variable because where there is a positive attitude towards utilizing innovation, the chances of using the technology are high among students (**Marlen et al.**, 2023). **Chan et al.** (2023) have attempted to find out how students' perception of musicians as they would want to be in the future impacts their inclination to embrace technology in learning. They argued that students with ideal musical self at a high level demonstrate positive attitudes thus improving their intention to use digital platforms. **Al-kfairy et al.** (2024) also prove that if students consider musical self-promises and keep a positive attitude towards utilizing that specific perspective, a positive shift in using technology-focused learning platforms will be achieved. Furthermore, **Mirza et al.** (2024) also established that student attitude is an important outcome that creates an ideal musical identity and the usage of technology. Thus, based on previous studies, it is hypothesized that:

H7: Ideal musical self has a significant impact on the intention to use metaverse information system with the mediating effect of student attitude.

Musical ability increases the intention toward using a metaverse information system. Studies also argued that musical ability and metaverse information systems could be tested in other contexts. This argument is supported by the study (**Sun; Guo**, 2024), which showed that musical ability self affects the intention toward the metaverse information system through student attitude (**Rosli; Saleh**, 2024). Furthermore, it was found that where students have a positive self-efficacy towards their music abilities, coupled with positive technological attitude, their intention to utilize inventive education technologies also increases (**Sun; Guo**, 2024). **Mirza et al.** (2024) also found that technology was more likely to be used by students with high musical self-efficacy and also argue that the same could be tested with other relationships. **Yoon and Nam** (2024) also conducted a study and found positive attitudes concerning musical skills were significantly correlated to the use of multimedia platforms. In addition, **Hassaan** (2024) demonstrated favorable perceptions toward technology usage were requisite to make high levels of musical self-efficacy, leading to meaningful utilization of digital technologies. Hence, based on these findings, it is hypothesized that:

H8: Musical ability self has a significant impact on the intention to use metaverse information system with the mediating effect of student attitude.

Adaptive musical self means indeed the learning attitude that characterizes a student in the process of musical learning (**Hassaan**, 2024). It is the attitude that introduces an effect of a new idea toward how adaptive learners approach new technologies (**Rosli; Saleh**, 2024). Specifically, a positive attitude toward innovation makes those with adaptive musical selves more likely to embrace the likes of the metaverse (**Rosli; Saleh**, 2024). **Chan et al.** (2023) also examined that learners' adaptability in musical learning impacted student attitude toward technological tools for learning and revealing that the positive attitude toward technologies influenced engaging use of technologies positively. In addition, **Rosli and Saleh** (2024) also demonstrated that students who have adaptive musical identities and positive attitudes toward such technology as the metaverse, they are more likely to use technological platforms. **Christabelle and Widuri** (2024) also conducted a study and found high adaptive musical ability showed more favorable attitudes toward using technology, which in students' technology adoption behavior. Similarly, **Rosli and Saleh** (2024) also found that musical understanding increases the attitude and the willingness to embrace the metaverse platforms. Based on sych findings, it is hypothesized that:

H9: Adaptive musical self has a significant impact on the intention to use metaverse information system with the mediating effect of student attitude.

Future learning positively and significantly impacts the intention toward use metaverse information systems. In the same vein, future learning intention also increases the attitude of the individual (Herget *et al.*, 2022). These studies bring an understanding of the fact that attitudes can fill the future learning goals gap from their actual adoption of these platforms. Chan *et al.* (2023) also demonstrate that future learning has a positive and significant impact on metaverse information and they also argue that their relationship could be tested with another mediating effect. Similarly, Chan *et al.* (2023) also showed that future learning has a significant impact on attitude and they also argued that it increases the impact on metaverse information systems. Chan *et al.* (2023) recognized that retention intention, a sub-dimension of future learning, was positively inclined with each student's attitude towards utilizing technology and as such his or her readiness to enter into the immersive education platform. Al-kfairy *et al.* (2024) reveal that teacher attitude plays an important role where students with positive attitudes towards utilizing technology are more likely to incorporate the technology. They also further argue that further research could be explored on other emerging economies. Based on these studies, it is hypothesized that:

H10: Future learning intention has a significant impact on the intention to use metaverse information systems with the mediating effect of student attitude.

Technology optimization also increases the intention towards utilizing metaverse information systems. The students who believe that technology is adapted to their learning needs will adapt it depending on the attitude they have towards utilizing such a technology (Lin; Liu, 2024). In another study, it was also found that technology optimization increases the positive attitude of the individual (Alkhwaldi, 2023). Further study also tested the impact of technology optimization on students' actual intentions to use the digital tools and realized that a positive attitude towards utilizing optimized technology explained the extent to which the technological intentions were realized (Haitham; Gouher, 2024). In line with the technology acceptance model, customization and optimization of technology enhanced favorable attitudes and consequently may cause the student to adopt new learning platforms. Alkhwaldi (2024) found out that students with positive attitudes towards utilizing well-optimized technology were more disposed to engage in activities that involved virtual space such as the metaverse. They also argue that further research could be explored on other countries with other relationships to increase the variations in the results. Hence, this study formulated the following research hypothesis:

H11: Technology optimization has a significant impact on the intention to use metaverse information systems with the mediating effect of student attitude.

As discussed earlier, information quality positively and significantly influences the metaverse intentions. Information quality also positively and significantly increases the individual attitude (Farhadpoor; Dezfuli, 2021). The same findings predicted by Chanda *et al.* (2024) that better quality information on technology will lead to a better positive attitude towards utilizing technology and thus increases the possibility of using technology like metaverse for learning purposes. In the past, Alkhwaldi (2023) studied the relationship between information quality and students' favorable attitude towards utilizing technology which showed that favorable attitude increased from improving the information quality which leads to improve the metaverse information system. Similarly, Al-Adwan *et al.* (2023) confirmed the positive relationship between information quality and students' attitudes toward the use of technology, as well as their intention to extend the use of digital learning environments. Chanda *et al.* (2024) further conducted study and found that attitude is a significant predictor of information quality and they further argue that their relationship could be tested in other contexts in future studies. Thus, based on previous studies, it is hypothesized that:

H12: Information quality self has a significant impact on the intention to use metaverse information systems with the mediating effect of student attitude.

Figure 1 summarizes the relationships between the constructs of the study, highlighting the hypotheses framed.

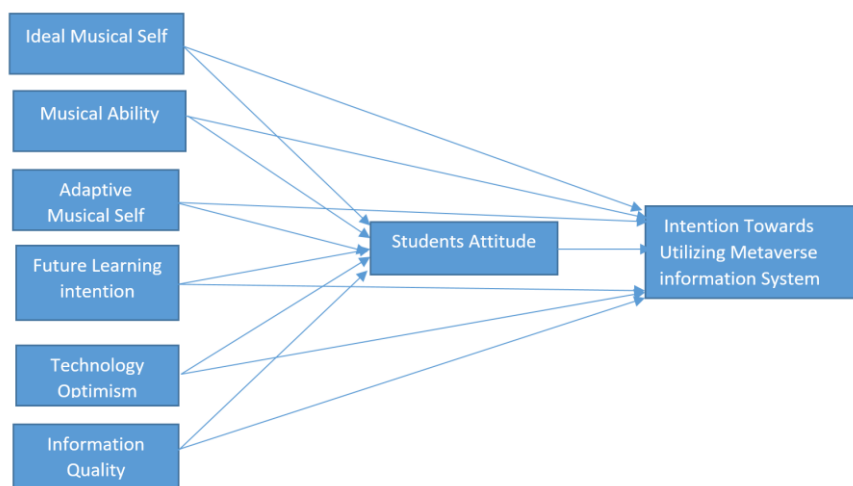


Figure 1: Conceptual Framework.

3. Research Methods

3.1. Research Design

The study aimed to understand students' Intentions towards utilizing metaverse information systems in music education. To test the study hypotheses, a cross-sectional research design was used instead of a longitudinal one because of its efficiency and time-effectiveness. A cross sectional research also allows for data collection at a single point in time, making it ideal for capturing a snapshot of the current state of variables (Rindfleisch *et al.*, 2008). This design is particularly useful when the aim is to assess relationships or trends without the need for long-term tracking, which can be more costly and time-consuming. Additionally, the study adopted a positivist approach where quantitative methods were employed, providing the advantage of objectivity and statistical rigor. Quantitative methods allow for the collection of numerical data, enabling the researcher to perform precise measurements, generalize findings, and identify patterns or correlations among variables (Lin, 1998).

3.2. Research Instrument for Data Collection

The research Instrument was adopted from the previous study where it was already tested. The musical self-concept was measured on three dimensions. Among these, musical ability, ideal musical self and adaptive musical self was measured by four items each, adapted from the study (Fiedler; Spychiger, 2017). Furthermore, the students attitude was measured by 3 items adopted from the study (Rosli; Saleh, 2024). Future learning intention and technology optimization were measured by 4 items each retrieved from the study (Rosli; Saleh, 2024). The construct information quality was measured by 5 items adapted from the study of (Gorla *et al.*, 2010). Lastly, intention towards utilizing a metaverse information system was measured by 5 items adapted from the study (Rosli; Saleh, 2024). All these items were measured on 5-point Likert scale where 1 ranked for strongly disagree and 5 for strongly agree.

3.3. Sampling and Population

The population of the study comprised students pursuing music education. The music education students were selected because they are directly involved in the subject matter, making this population ideal for evaluating the effectiveness and potential of metaverse information systems in their specialized field of study. This group is particularly relevant as the integration of such advanced technologies could significantly impact how they engage with music education in digital environments. The non-probability purposive sampling technique was used, allowing the selection of participants who were most relevant to the study's objectives (Schreuder *et al.*, 2001). Out of the 450 distributed questionnaires, 350 were returned, representing a response rate of approximately 78%. The high response rate adds strength to the data quality, but the non-probability sampling technique limits the generalizability of the findings to the broader population (Nulty, 2008).

3.4. Data Analysis

The data was analyzed in two sections, the first section was analyzed through SPSS software where screening tests and descriptive analysis were conducted. In the second phase, hypotheses were tested using Smart PLS software.

4. Results

4.1. Demographic Characteristics

Table 1: Demographic Characteristics.

Demographic Variable	Frequency	Percentage
Gender		
Male	200	57.14%
Female	150	42.86%
Age Group		
18-22 years	140	40.00%
23-27 years	100	28.57%
28-32 years	70	20.00%
33+ years	40	11.43%
Education Level		
Bachelor's	180	51.43%
Master's	120	34.29%
PhD	50	14.29%
Type of University		
Public University (Undergrad)	350	100.00%
Experience with Technology		
Beginner	80	22.86%
Intermediate	160	45.71%
Advanced	110	31.43%

Out of the total sample of 350 respondents, a majority were male (57.14%) compared to female respondents (42.86%).

In their age distribution, the largest group comprised individuals aged 18-22 years (40.00%), followed by those aged 23-27 years (28.57%), indicating a predominance of younger participants. Educationally, the majority held a Bachelor's degree (51.43%), while 34.29% had completed a Master's, and 14.29% possessed a PhD, showcasing a well-educated population. Additionally, the type of university attended reveals that a significant proportion of respondents were enrolled in public undergraduate programs (42.86%) and public Master's programs (37.14%). Finally, in assessing technological experience, the sample skewed towards intermediate users (45.71%), indicating a generally competent familiarity with technology among the respondents. These demographic findings are presented in Table 1.

4.2. Descriptive Statistics

It is evident from the descriptive findings that participants generally held positive perceptions across all constructs viz., Ideal Musical Self (IMS), Adaptive Musical Self (AMS), Musical Ability (MUA), Future Learnings Intention (FLI), Technology Optimization (TEO), Information Quality (INQ), Attitude (ATT), and Intention To Use Metaverse Information System (INTIS). This positivity is reflected in the mean scores, which are above the midpoint (3) of the 5-point Likert scale. The highest mean score is for INQ1 (3.51), suggesting strong agreement regarding the inquiry aspect of the constructs. Conversely, ATTI1 has the lowest mean score (2.969), indicating slightly less positive attitude towards utilizing this particular aspect. The median scores align closely with the mean, reinforcing the overall positive sentiment while demonstrating variability in responses across different items. These results are shown in Table.2

Table 2: Descriptive Statistics.

Variable	Mean	Median	Scale (min)	Scale (max)
FLI1	3.286	4	1	5
FLI2	3.194	3	1	5
FLI3	3.194	3	1	5
TEO1	2.959	3	1	5
TEO2	3.245	3	1	5
TEO3	2.98	3	1	5
TEO4	3.092	3	1	5
INQ1	3.51	4	1	5
INQ2	3.214	4	1	5
INQ3	3.408	4	1	5
INQ4	3.061	3	1	5
INQ5	3.122	3	1	5
MUA1	3.235	3	1	5
MUA2	3.214	4	1	5
MUA3	3.214	3	1	5
MUA4	2.969	3	1	5
IMS1	3.459	4	1	5
IMS2	3.286	4	1	5
IMS3	3.51	4	1	5
IMS4	3.418	4	1	5
AMS1	3.367	3	1	5
AMS2	3.276	3	1	5
AMS3	3.224	4	1	5
AMS4	3.092	3	1	5
ATTI1	2.969	3	1	5
ATTI2	3.276	4	1	5
ATTI3	3.204	4	1	5
INTIS1	3.439	4	1	5
INTIS2	3.388	4	1	5
INTIS3	3.367	4	1	5
INTIS4	3.622	4	1	5
INTIS5	3.582	4	1	5

Note: IMS-Ideal Musical Self, AMS-Adaptive Musical Self, MUA-Musical Ability, FL-Future Learnings, TEO-Technology Optimization, INQ-Information Quality, ATT-Attitude, INTIS-Intention to Use Metaverse Information System.

4.3. Measurement Model

The hypothesis was tested in two models namely measurement and structural. The measurement model was assessed through Partial Least Square (PLS)-Structural Equation Modeling (SEM) using Smart PLS 4. The measurement model is usually assessed from factor loadings, alpha, composite reliability (CR), and average variance extracted (AVE) (Hair *et al.*, 2017). Among these factor loadings, threshold value of all constructs and relationships was found greater than 0.5, which explains that the construct fulfills the requirement of loadings (Haji-Othman; Yusuff, 2022). Furthermore, the Cronbach's Alpha of all items exceeds the recommended threshold of 0.70 for all constructs, which indicates high internal consistency (Hair *et al.*, 2020). The CR values assess the reliability of the construct indicators, which also shows favorable results with all values above 0.70, confirming the robustness of the constructs (Haji-Othman; Yusuff, 2022). Furthermore, AVE values were also acceptable because they exceeded the benchmark of 0.50, indicating that the constructs adequately captured the variance associated with their respective indicators, thus supporting convergent

validity (Hair *et al.*, 2017). These findings are depicted in Table 3 and Figure 2.

Table 3: Convergent Validity.

Construct	Cronbach's Alpha	CR	AVE
IMS	0.894	0.927	0.762
AMS	0.915	0.946	0.855
MUA	0.91	0.941	0.843
FLI	0.884	0.920	0.741
TEO	0.897	0.906	0.662
INQ	0.921	0.942	0.766
ATT	0.93	0.949	0.824
INTIS	0.869	0.892	0.676

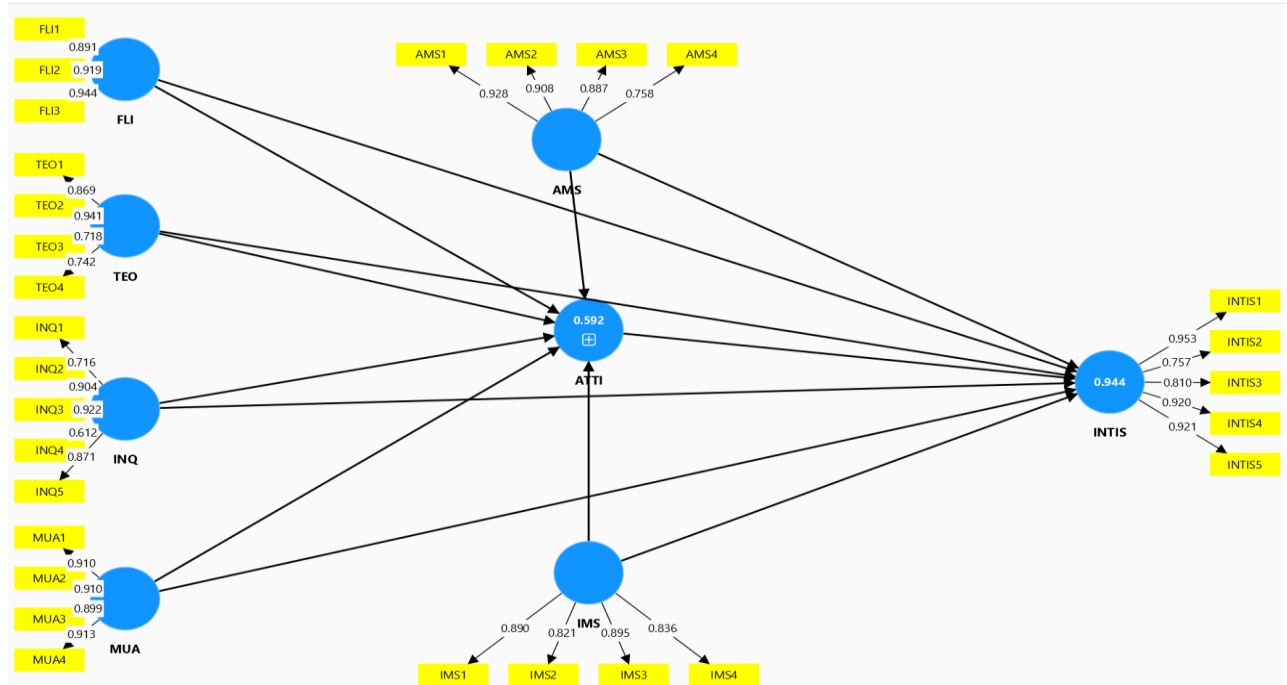


Figure 2: Factor Loadings.

4.4. Discriminant Validity

Furthermore, discriminant validity indicated that each construct demonstrates adequate separation from one another, reinforcing the validity of the measurement model. According to the Fornell-Larcker criterion, discriminant validity is established when the square root of the Average Variance Extracted (AVE) for each construct exceeds the correlations between that construct and any other construct in the model (Hair *et al.*, 2017). In this analysis, the diagonal elements, representing the square roots of the AVE exceed the corresponding off-diagonal correlation values. This confirms that each construct captures unique variance not shared with other constructs, thus supporting the theoretical distinctions among constructs such as Ideal Musical Self, Musical Ability Self, and others in the context of metaverse information systems. These findings align with established guidelines for assessing discriminant validity and emphasize the robustness of the constructs used in this study (Henseler *et al.*, 2015). The discriminant validity results are shown in Table 4.

Table 4: Discriminant Validity.

Construct	1	2	3	4	5	6	7	8
IMS	0.873							
AMS	0.616	0.924						
MUA	0.186	0.262	0.918					
FLI	0.726	0.718	0.1	0.861				
TEO	0.274	0.161	0.41	0.174	0.814			
INQ	0.729	0.657	0.108	0.346	0.208	0.875		
ATT	0.254	0.248	0.435	0.137	0.471	0.157	0.908	
INTIS	0.181	0.120	0.669	0.064	0.441	0.092	0.347	0.822

4.5. Structural Model

The hypotheses were tested through the structural model using 5000 resampling techniques. The results reveal significant direct relationships between the independent variables and the intention toward using metaverse information systems among Chinese music education students. Ideal musical self ($\beta = 0.375$, $t = 5.435$), musical ability

self ($\beta = 0.340$, $t = 4.658$), and adaptive musical self ($\beta = 0.356$, $t = 5.313$), were found making positive and significant impact on students' intention to use the metaverse system. Similarly, future learning intention also shows a positive and significant ($\beta = 0.393$, $t = 6.046$) impact on the intention to use metaverse information systems. Furthermore, technology optimization ($\beta = 0.301$, $t = 3.810$) and information quality self-efficacy ($\beta = 0.370$, $t = 5.286$) also positively and significantly influence students' intention to use meta-verse information systems.

In terms of mediating effects, the findings show that students attitude plays a significant mediating role among all exogenous and endogenous variables ideal musical self ($\beta = 0.312$, $t = 4.216$), musical ability self ($\beta = 0.283$, $t = 3.538$), and adaptive musical self ($\beta = 0.295$, $t = 4.155$) positively impact intention when mediated by student attitude. This suggests that positive attitudes toward one's musical self-image further strengthen their intention to engage with the metaverse. Similarly, future learning intention ($\beta = 0.321$, $t = 4.721$), technology optimization ($\beta = 0.270$, $t = 3.293$), and information quality self ($\beta = 0.309$, $t = 4.066$) also show significant mediated effects through student attitude. These direct and mediating effect results are presented in Table 5.

Table 5: Results of the Hypotheses.

Hypotheses	(β)	(SE)	T-Statistic	P-Value	Result
IMS → INTIS	0.375	0.069	5.435	0.000	Supported
MUA → INTIS	0.344	0.073	4.658	0.000	Supported
AMS → INTIS	0.356	0.067	5.313	0.000	Supported
FLI → INTIS	0.393	0.065	6.046	0.000	Supported
TEO → INTIS	0.301	0.079	3.81	0.000	Supported
IQS → INTIS	0.373	0.07	5.286	0.000	Supported
Mediating Effect Results					
IMS → ATT → INTIS	0.312	0.074	4.216	0.000	Supported
MUA → ATT → INTIS	0.283	0.08	3.538	0.001	Supported
AMS → ATT → INTIS	0.295	0.071	4.155	0.000	Supported
FLI → ATT → INTIS	0.321	0.068	4.721	0.000	Supported
TEO → ATT → INTIS	0.271	0.082	3.293	0.000	Supported
IQS → ATT → INTIS	0.309	0.076	4.066	0.000	Supported

5. Discussion

This study aimed to understand students' intention towards utilizing metaverse information systems in music education. The data was collected from students pursuing musical education at undergraduate levels in the Chinese universities. The study framed a total of 12 hypotheses, comprising six direct and six indirect hypotheses. Right at the outset, the direct effect results showed that the ideal musical self, made a positive and significant impact on music education students' intention toward utilizing metaverse information systems. The positive impact highlighted that students' who had clear visions about musical capabilities, they were more expected to engage in their metaverse system. The results are consistent with the findings of **Park and You (2024)** who also found that a well-defined ideal self-concept can motivate students to seek out opportunities that facilitate their growth and learning. When students envision a successful future in music, they are more inclined to adopt technologies that support this vision, reinforcing the importance of self-perception in educational technology acceptance especially in the context of Chinese universities. Similarly, individual musical ability showed a positive and significant impact on music education students' intention toward utilizing metaverse information systems. These results show that the Chinese students believed that musical skills with confidence significantly affected the intention to use the metaverse. Students who believe in their existing abilities are more likely to view the metaverse as a useful tool for enhancing their skills. The results are consistent with the findings of **Rosli and Saleh (2024)**, where they also highlighted the importance of self-efficacy in promoting technology adoption, particularly in educational contexts. These results show that Chinese universities should focus on the importance of creating confidence in increasing musical ability which could increase their musical intention towards utilizing metaverse information system.

The adaptive musical self-perception was also found making a positive and significant impact on music education students' intention toward utilizing metaverse information systems. This relationship shows that adaptive musical self-efficacy makes students feel capable of adjusting their musical skills to different contexts, which makes them more inclined to adopt metaverse systems. This adaptability is crucial in a rapidly changing digital environment, where the ability to adjust to new tools and platforms can enhance learning experiences. The results are further in line with the study (**Christabelle; Widuri, 2024**). In another context, future learning intention also made a positive and significant impact on metaverse information systems. These results show that students with clear future learning intentions are more motivated to utilize the metaverse system, as they perceive it as a valuable resource for achieving their educational objectives. The findings are supported by the study (**Al-Adwan et al., 2023**) who also emphasized that students with defined future goals are more likely to embrace educational technologies that align with their aspirations. This shows that Chinese universities should focus on proper clear future learning to increase the students' intentions towards utilizing information systems which is a metaverse. This could increase the acceptability of technology in music education students, especially in China.

Similarly, further results show that technology optimization also makes a positive and significant impact on music

education students' intention toward utilizing metaverse information systems in Chinese universities. These results show that students who perceive that metaverse with the well-designed system are increasing their intentions towards utilizing enhanced information systems in organizations. Therefore, these results emphasize the importance of user-friendly technology in educational settings, as perceived ease of use has been widely documented as a key factor in promoting technology acceptance among students. These results and arguments are further supported by the results of **Al-Adwan et al.** (2023) and **Liu and Park** (2024). Moreover, information quality also has a positive and significant impact on music education students' intention to utilize metaverse information systems in Chinese universities. This relationship shows that students who trust their information assessment skills are more likely to engage with the metaverse system, reflect the critical role of digital literacy in today's educational landscape. As students navigate increasingly complex online environments, the ability to discern high-quality information becomes essential for successful technology adoption. The results are further in line with the findings of **Alkhwaldi** (2023).

It was also found that the relationship between ideal musical self and intentions towards metaverse information system was partially mediated by music education students' attitude. These findings indicate that Chinese universities students possess a strong ideal self-concept regarding their musical abilities; therefore, tend to have a more favorable attitude toward the metaverse system. This positive attitude in turn enhances their intention to adopt the technology. The study results align with **Mirza et al.** (2024) which posits that individuals are motivated to engage in activities that align with their self-perceptions and aspirations. When students see themselves as capable and aspiring musicians, they are more likely to embrace technologies that support their development, thereby creating a cycle of motivation and intention. Results also reveal that musical ability self, and intention towards utilizing the metaverse information system relationship are positively and significantly mediated by student attitude. The results indicate that students who feel confident in their current musical skills are likely to develop a positive attitude towards utilizing the information metaverse. This attitude subsequently increases their intention to adopt the system, emphasizing the importance of self-perception in shaping technology acceptance. When students believe in their abilities, they are more inclined to explore new technological avenues that promise to enhance their learning experiences, thus reinforcing the connection between self-efficacy and intention. The results are consistent with the findings of **Rosli and Saleh** (2024), where their attitude is also significantly mediated.

Adaptive musical self was also seen influencing positively and significantly the metaverse information systems with the mediating effect of students' attitudes. These findings show that students who are adapting at adjusting their musical skills to various contexts develop a more positive attitude toward utilizing the metaverse information system. This positive attitude strengthens their intention to engage with the technology. The findings are consistent with the study of **Ghali et al.** (2024) and **Rosli and Saleh** (2024) where attitude is partially mediated. However, future learning and intentions toward utilizing metaverse information are also partially mediated by attitude. These results indicate that students who set clear educational goals for their future might develop a positive attitude toward the metaverse, which subsequently enhances their intention to adopt this technology. The result is consistent with the findings of where they also found that if the students are clear about their future learning outcomes, their attitude towards utilizing metaverse information intention increases (**Al-Adwan et al.**, 2023). On the other hand, technology optimization and intention towards utilizing the adoption of metaverse information systems are also partially mediated by students' attitudes. These results show that students who perceive the metaverse as well-designed and functional are more likely to develop a positive attitude toward using it. This positive attitude significantly enhances their intention to adopt the technology. These results are in line with the study of **Chakraborty et al.** (2024), where they also emphasized that technology optimization is an important determinant of technology acceptance.

Finally, information quality was also found making a positive and significant impact on the intention towards utilizing metaverse information systems with the mediating effect of students' attitude. These findings indicate that Chinese have trust their ability to assess the quality of information presented in the metaverse are more likely to form a positive attitude towards utilizing the system. This positive attitude then enhances their intention to adopt the technology, indicating that confidence in information evaluation plays a vital role in technology acceptance. These findings are in line with the study of **Sedyaningsih et al.** (2023), where they also emphasized the importance of digital literacy in today's educational environment, where students must navigate and evaluate vast amounts of information systems.

5.1. Theoretical and Practical Implications

The study holds theoretical and practical implications. Theoretically, this study extended the existing literature on technology adoption in educational contexts, particularly within the realm of music education. By demonstrating the mediating effects of student attitude on the relationships between various music-related efficacy constructs and the intention to use a metaverse information system, this research contributes to the understanding of how music-related efficacy factors and information quality influence metaverse-related information system-related technology acceptance. Specifically, the findings indicate that self-efficacy related to musical identity, ability, adaptability, future learning intentions, and information quality significantly impact students' attitudes, which in turn shape their intentions to engage with innovative educational technologies. This model has been tested for the first time in the context of

Chinese music education, which contributes to the extant literature with a comprehensive framework for understanding the dynamics of music-related efficacy factors and information quality which is enriching the body of knowledge surrounding technology adoption in educational settings. Lastly, theoretically, the study also contributed to a body of literature with empirical findings that could help other researchers conduct their future research with the extended model.

In terms of practical approach, this study is useful to educators, curriculum developers, and technology designers in Chinese music education. By emphasizing the importance of fostering students' self-efficacy and cultivating positive attitudes toward technology, stakeholders can enhance students' willingness to engage with metaverse systems. This entails implementing targeted interventions, such as workshops or training programs that boost students' confidence in their musical abilities and adaptability while promoting a future-oriented mindset. Additionally, ensuring that metaverse systems are user-friendly and optimized for educational purposes can further enhance students' attitudes, leading to higher adoption rates. Through these findings, educators and developers can build an enabling condition that will bring about the adoption of innovative technologies in music education to enhance students' musical learning.

6. Conclusion

The research aimed to understand students' intentions to utilize metaverse information systems in music education. Using a self-administered survey questionnaire data was collected from 350 music education students using purposive sampling. A deductive quantitative approach and cross-sectional research design were employed. The Partial Least Square (PLS)-Structural Equation Modeling (SEM) technique results show that musical ability, ideal musical ability, and adaptive musical self positively and significantly impact the metaverse information system of Chinese university music education students. In the same vein, information quality also has a positive and significant impact on metaverse information systems. Further results show that students' attitude is also partially mediated among information quality, future learning, technology optimization, musical self-concept, and metaverse information systems of Chinese music education students. The study with these findings extends the understanding of metaverse information systems with the mediating effect of students' attitude in Chinese university music education students. The study practically also helps educators and system designers to focus on enhancing both musical and information quality aspects to optimize metaverse platforms for better engagement and outcomes.

Despite these significant findings, the study faced a few limitations that could be addressed in further research. Firstly, the study was limited to one country and findings cannot be generalized, thereby restricting the study's generalizability. Further research could be explored as comparison of two countries where metaverse information system intention could be compared. In addition, study was limited to quantitative research approach where data was collected through a survey instrument. Further research could be explored with a qualitative approach, and data could be collected through focus group and in-depth interviews, to know the variations in the results. Thirdly, the study was limited to examining the mediating effect while there are moderating variables that could moderate the relationship between constructs. Further research could be explored with moderating variable to increase the predicted power of the model.

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