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Effects of Student Learning Outcomes and Teaching Approaches on Perceived Quality of Digital Technology Integration in Music Education

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ABSTRACT

This research examines the impact of Student Learning Outcomes (SLO) and Ways of Technology Integration (WI) on the Perceived Quality of Digital Technology Integration (DTI) in music education among students at a professional art college. Following the Technological Pedagogical Content Knowledge (TPACK), a primary quantitative design with a deductive approach was used. A survey questionnaire was administered to 150 participants selected by convenience sampling method which measured their demographic information along with the research variables using items on a Likert scale. According to descriptive analysis, students perceive technology as highly beneficial for skill development, engagement and learning efficiency. SLO and WI were positively correlated with DTI, and regression analyses suggested SLO and WI were strong predictors of DTI, explaining its variance. The findings show that using digital tools effectively enhances the students' learning outcomes and their perception towards the quality of technology when it is well-aligned with pedagogy and objectives. The importance of a structured approach to the teaching and the role of the teacher and the engagement of children became evident from the study. The findings offer useful insights for teachers and institutions looking to implement digital changes for improving learning experiences.

Keywords*:* Student Learning Outcomes, Technology Integration, Digital Music Education, Perceived Quality, Music Pedagogy, Educational Technology

I. INTRODUCTION

As the world of education continues to change, it is becoming increasingly central that popular music in professional art colleges is being enhanced through the integration of digital technology. The way in which students write, perform and learn music is rapidly changing due to software, devices and the Web. For instance, the global online music education market is on a sharp rise as over 63% of music learners currently prefer virtual classes as opposed to traditional classroom formats according to market research (Global Growth Insights, 2025). Simultaneously, there was a great increase in the uptake of Virtual Audio Workstations (DAWs). A survey carried out reported that 71% of music educators were using DAWs in their classrooms in 2020. This was a stark increase from 44% DAW usage reported five years prior (Number Analytics, 2025). The changes not only show the technological and pedagogical advances, but also the students who use digital instruments in their creative and educational settings. The current research investigates a small but neglected group; students at vocational art colleges studying popular music with contacts to digital music technologies. These contemporary students, equipped with the latest technology, learn how to make, produce, and engage in music as opposed to just learning performance or theory like the traditional conservatory model (Don, Garvey &Sadeghpour, 2023). Valuable experience data can be obtained from understanding how they learn, how they think about technology, and what outcomes their digital practices produce. By centering students' voice, the research intends to depict what effect does technology-integration has on students' learning outcomes and their perception of quality. This integration is not without challenges. Many professional music programs suffer from systemic issues currently, despite the increasing use of technical equipment (Liu, 2024). These issues range from not having enough budget for high-end audio equipment, not training the teachers for the same, to mismatch in curriculum design and students' creative practices. These challenges can hamper the use of digital technology to improve learning. Although technology can democratize music making opportunities, it can also create inequalities whereby not all students have access to the software, the hardware, or the mentorship to take advantage of this opportunity (Adu-Gilmore, 2023). The monetary and structural restrictions of art colleges affect less exposed students or students with less availability more

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

which further affects them and their learning outcomes and satisfaction with digitalization.

This research investigates how student learning outcomes affect and influence the methods of integrating new technologies as well as the perceived quality of such integration. While many individuals and institutions express a general enthusiasm for digital transformation in education, they typically do not have systematic insight into whether such transformations benefit students in terms of their musical learning and creativity, as well as their satisfaction with the institution (Fernández*et al.* 2023). It remains uncertain whether students' skills are genuinely improving with the use of technology, or if they are simply more engaged because it is new. Moreover, some methods like digital audio workstations, online tutorials and collaboration methods prove to demonstrate greater effectiveness than other methods of integration (Zhang, 2025). The students' evaluations of the level of integration of technology in their education provide key information regarding whether music education technology has contributed to or inhibited meaningful learning.

The questions mentioned are especially urgent for the group under investigation, namely students in professional art colleges specializing in popular music. Numerous researchers aim to pursue jobs as professional producers or independent artists, often blurring the lines between education and industry. If their education does not permits high-quality integration of technology, therefore, these institutions risk preparing them for neither academic rigor nor the music business. If educators do not understand how students view and benefit from technology, they will likely waste money investing in digital tools that do not align with student requirements (Wang, 2025). This study aims to discover the mentioned gap by looking at student learning outcomes (SLO), ways of technology integration (WI), and perceived quality of digital technology integration (DTI). The results of the research help to inform educators, designers of curriculum, and institutional leaders as to which integration approaches are most effective and meaningful. It also allowed the students to share their experiences, which assisted in creating pedagogy and an arts future for digital music education in art colleges. The objectives of this study are specifically crafted to elicit a focused inquiry and generate meaningful information from the data collected:

Objectives

- To examine the effect of Student Learning Outcomes (SLO) on the Perceived Quality of Digital Technology Integration (DTI) in music education.
- To determine the effect of Teaching Approaches (WI) on the Perceived Quality of Digital Technology Integration (DTI) in music education.

This study will inform teachers, curriculum designers and educational leaders in the field of music. This study offers suggestions for improving the efficiency of digital pedagogy in professional art colleges. It examines the link between student learning outcomes and technology use pattern and their perceived quality of use of digital technology. Teachers will identify the integration practices which they will find useful in developing learning experiences and enhancing creativeness. The study helps organizations allocate resources, identify training needs and adopt technologies. This also promotes the growth of digital music education, allowing students to get quality education.

II. LITERATURE REVIEW

Theoretical Underpinning

This study is grounded in Technological Pedagogical Content Knowledge framework (TPACK). It is widely recognized as a powerful framework for helping to understand how the interaction of teaching approaches and technology use can enhance student learning. The TPACK framework considers the connection among content, pedagogy, technology, and students (Tseng *et al.* 2022). For music education, the inclusion of digital instruments, production software, and online collaborative platforms into teaching and learning makes TPACK something to look for in music education. As for this system framework, this is able to assess how teaching methods and the adoption of digital technology to enhance learning reflects the quality of learning as perceived by students (Cipta*et al.* 2024). Through the construction of items that enable measurement through a survey, TPACK has allowed for the quantitative examination of relations, instructional methods, technology use, and student learning. It also brought attention to the necessity of pedagogically informed integration, that technology should support meaningful music learning and not just be another accessory. TPACK has been directly aligned with the research context as this model offers a conceptual and practical framework to analyse how the instructional strategies and student outcomes probably influence the perceived quality of digital technology integration in music education making it appropriate for this research.

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

Empirical Review on Perceived Quality of Digital Technology Integration (DTI)

Studies are increasingly showing that it is not just the use of digital technology that influences perceptions and achievement of students but quality of integration. Research of Michałko*et al.* (2022) showed that integration is perceived as stronger when technology is embedded meaningfully into practice and not used often. In relation to music education, where learning entails composition, performance and practical students, the digital richness of the educational tool is particularly important, as per Gül (2023). Students assess digital tools not only for their functions but also for engagement, creativity, and understanding of music concepts. In spite of extensive usage of the tools, various empirical studies highlight shallow integration. According to Han (2022), technology is often used as a substitute for something instead of doing something differently. For example, when students use digital tools and recording software just to document analogue processes, it does not enhance their learning outcomes or perceptions of quality. Zheng (2022) stated that the high use is not sufficient to ensure students see technology integration as effective and useful. The design of how technology is used and taught is particularly important in a professional music setting.

The manner in which the instructor teaches will also determine quality. As observed by Yao & Li (2023), when the teacher's use of technology in class work is intentional and is based on the understanding of teaching and learning, then students' evaluation of technology improves substantially. On the other hand, having poorly structured integration that is misaligned with learning goals or instructional strategies is typically perceived as low quality, even with advanced tools. The mere existence of a digital audio workstation, virtual instruments, and online collaboration does not suffice. As per Li & Sun (2023), in music education, their application must facilitate the creative process, coordinate the band, and develop skills to be considered high-quality. The perceived quality of students can be affected by the following moderators: infrastructure, teacher competence, support system. Libo&Musib (2024) showed that when technology is available, students' perception of integration quality is hampered by lack of guidance, insufficient training or inappropriate resources. In music education this may include insufficient access to specialist software, poor practice facilities or the teacher not being familiar with the technology involved in production. These factors stress that perceived quality is contextual and cannot be evaluated on the basis of technology or function.

In essence, the literature also suggests that students' own learning outcomes impact their perception of these resources. When students see quantifiable progress in their abilities, creativity, or insights, their perception of the associated technology is more successful. The interplay between learning outcomes and perceived quality is reciprocal, as per CAO (2024). When there is high-quality integration, learning outcomes are improved. When outcomes are positive, students perceive quality similarly. Anthony *et al.* (2025) stressed that perceived quality of digital technology integration is multi-faceted, context-specific, and highly dependent on pedagogic design. Measuring the frequency of student experiences is insufficient to understand them. In the area of music education, this is essentially practical and creative. In relation to its perceived quality, it must reflect how the technology assists in learning, creativity, and collaboration. Research on professional art colleges must judge both teaching and learning outcomes in respect of digital integration in music learning. Digital technology must play a transformational role and not just a decorative one.

Empirical Review on Student Learning Outcomes (SLO)

The Student Learning Outcomes (SLO) are considered the core measurement of education quality for quite a while, students acquiring knowledge, skills, creativity, engagement and more. According to the studied literature, SLO is significantly affected by pedagogical practices and digital technology integration. In the music classroom, where the focus is on developing practical skills, involving creative expression, and performing together, SLO takes on multiple meanings, as highlighted by de Bruin (2022). The learning outcomes of students will showcase the ability to learn through digital writing, performing and production of music. Assessing the effectiveness of the SLO teacher is a crucial indicator. Dighliya (2025) found that better implementation and integration of technology enhance learning outcomes. The research of Bhimavarapu (2025) about higher education suggests that students using video, audio and other interactive digital tools for learning show measurable gains in technical ability and creative output. Using technology can help with learning, but not always. The use of technology in a savior community depends on the learning activity. This means that SLO is highly contingent on context. The

same tools can help students when they are in well-structured environments and are guided by instructors. It will not work if they are in badly designed or unstructured environments (Dorfman, 2022).

Likewise, Libo&Musib (2024) suggested a reciprocal relationship between student learning outcomes and engagement of learners. In music education, students who see clear improvement in skills engage more readily with both learning and technology. On the contrary, Banut&Albulescu (2024) indicated that poor scaffolding with technology and ineffective use of technology may lower engagement and results. Using devices solely for demonstration will not lead the students to experience improvement in performance, composing, collaboration, etc. On the contrary, it will damage their perception of digital technology integration quality. According to de Bruin (2022), a variety of teaching styles impacts the learning experience. Teachers with an effective melody teaching style that utilizes technologies such as real-time audio feedback, digital co-composing, and virtual ensemble rehearsal have higher levels of SLO happening among students, according to Chen &Safian (2024). The fact shows that SLOs should not be entirely dependent on technology by itself but the interface between pedagogy and technological integration. When teaching methods are paired with technology, student outcomes are improved. This underscores the need for professional music education based on pedagogy.

Assessment methods are important and affect perceived learning outcomes. In the field of music education, measurement of learning outcomes is often thought to be more than just knowledge assessment. Research of Shumska*et al.* (2024) indicated that in situations where assessments measure these dimensions, SLOs provide a more valid picture of student learning and thus take account of technical as well as creative learning owing to digital. Research by Wang (2025) showed that SLO also affects how students perceive the quality of digital technology. Students, who achieve high learning outcomes, perceive the technology as effective. Thus, there may be an interdependent relationship. Effective and quality learning leads to a perception that the technology is of good quality. This may in turn motivate learning further and enhance their skill development. As per Lingyu (2024), in professional art colleges, students need to gain mastery of digital music tools as part of their academic and professional trajectories. Karkina*et al.* (2023) presented that Student Learning Outcomes in music education are influenced by the use of digital technology, pedagogical approaches, and the correspondence of learning tasks with assessments. In order to achieve SLO meaningfully, it requires careful instructional design, use of tools in activities, and assessment of both technical and creative aspects. In this research, SLO is pivotal in evaluating the efficiency of teaching methods and use of technology and students' opinions on the quality of the digital technology integration into professional music teaching.

Empirical Review on Ways of Technology Integration (WI)

According to the empirical literature on Ways of Technology Integration (WI), the manner of how technology is used in teaching impacts student engagement and student learning. The literature of Şakalar&Gürel (2024) presented that having access to digital tools does not automatically lead to effective learning. Instead, it is the type of methods and pedagogies to integrate strategies. In the field of music education, WI is especially complicated. It tends to combine traditional musical pedagogy with digital technologies, instruments, recording software, collaborative software, and so on. All of this helps to equip the students with creative and technical skills, as stated by Karkina*et al.* (2023). Peng (2024) presented different integration strategies that circularly produce different outcomes. Substitution approaches, which refer to the use of technology that takes the place of another traditional tool without changing the learning task, have little effect on students' views of the quality of technology integration. In contrast to the substitution strategies given in the SAMR model, augmentation, modification, and redefinition strategies show better engagement, creativity, and skills, as per Dhivya*et al.* (2024). Music students generally have a more positive perception of the quality of technologies used to teach them when they participate in professional music programs that actively incorporate digital instruments, virtual ensemble platforms and interactive composition tools.

The integration of technology in the classroom relies heavily on the pedagogical knowledge of teachers. When teachers learn about digital tools in a structured way, and they use this technology purposefully in their teaching, WI is more effective, as stated by Liu &Weng (2023). Instructors help students with tasks like downloading a digital audio workstation, setting up a file and using a virtual instrument while writing a composition, and making an online collaborative project. On the other hand, Dwivedi (2022)

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

emphasised, unless purposeful and teacher-supported, such projects tend to frustrate students, who are more likely to deem the quality of the digital technology integrated low, notwithstanding the high-tech nature of the tools. Another important finding from the literature of Wang (2024) is that WI is highly context-specific. Strategies for integration that succeed in one context may fail in other contexts if they do not take students' previous knowledge, access and learning preferences into account. In music education, it is not only the technical infrastructure, like digital studios and software licenses, but also the creative workflows, performance expectations and collaborative requirements that define what learning means in professional art colleges, as conveyed by Fornhammar&Hyytiäinen (2025). The studies explain that effective writing instruction requires alignment to curriculum goals and task characteristics.

According to Don, Garvey &Sadeghpour (2023), the most effective WI strategies are the ones that get students working on meaningful tasks. Among the first to be embraced was digital music composition, which prompted the creation of digital instruments. According to Liu (2024), the involvement of students in pedagogically sound technology activities can enhance perceptions of quality and the efficiency of learning. It reinforces the idea that WI is not simply about making use of a tool. Instead, WI is about designing learning experiences that employ technology to facilitate creativity, skill acquisition, and collaboration. Empirical literature of Adu-Gilmore (2023) suggested that there is a relationship between WI and student learning outcomes. Thoroughly comprehending how students view technology is essential in avoiding ineffective methodologies that may hinder students from perceiving technology as a learning tool. Therefore, WI must be carefully designed both to achieve the educational goal and facilitate the subjective evaluation of the quality of technology by students.

Conceptual Framework

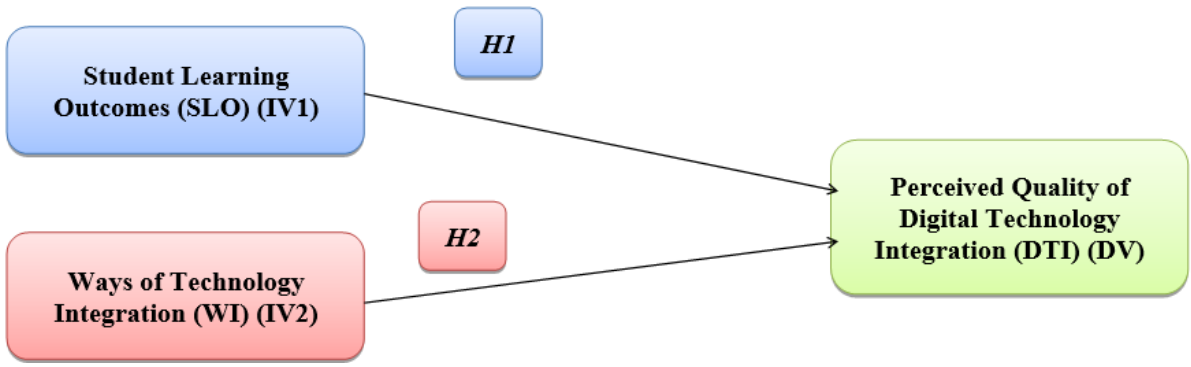

Figure 1: Conceptual Framework

This Study's conceptual framework is adapted from TPACK (Technological Pedagogical Content Knowledge). TPACK emphasizes the importance of teaching strategies, technology integration, and learning outcomes of students. In this model, the Student Learning Outcomes (SLO) and Teaching Approaches (WI) are the independent variables and the Perceived Quality of the Digital Technology Integration (DTI) is the dependent variable. The framework is designed to illustrate the interaction between students' learning achievement, their teachers' practices and digital technology in music studies SLO is likely to significantly influence student opinion on technological quality, according to the expectations. Higher quality outcomes of learning generally lead to greater insight into effective use of technology. Likewise, pedagogical approaches are believed to shape perceptions of quality integration of technology, as an integration that is pedagogically informed and has a clear structure can greatly enhance student engagement and satisfaction. As per TPACK, this framework operationalizes abstract ideas into measurable survey items that can be used for analysis with the SPSS. The research offers a systematic framework which assesses how pedagogical strategies and student outcomes have been impacting the perceived quality of digital technology integration in professional music education contexts.

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

Hypothesis

- ***H1:*** Student Learning Outcomes (SLO) have a significant effect on the Perceived Quality of Digital Technology Integration (DTI) in music education.
- ***H2:*** Ways of Technology Integration (WI) have a significant effect on the Perceived Quality of Digital Technology Integration (DTI) in music education.

Literature Gap

There has been plenty of research on the integration of digital technology into education, but not a lot of research has been done on music education in professional art colleges. Existing literature often looks at general academic subjects while ignoring learning needs in specific domains such as creative composition, collaborative performance, and digital music production. Furthermore, researchers mainly focus on students' learning outcomes or the methods through which technology is integrated. There is hardly any study which looks at the combined role of both. This indicates an important gap; there is a lack of evidence from students in music-focused programs. There is a need for context-specific quantitative research to link teaching approaches to learning outcomes and perceived quality of technology.

III. METHODOLOGY

The current study has been conducted through a positivism research philosophy. The positivism philosophy stresses measurements and quantifies relationships in between variables (Mbanaso, Abrahams &Okafor, 2023). A primary quantitative research design encompasses the systematic collection and analysis of numerical data. This helps the researcher to examine the effects of student learning outcomes (SLO) and ways of technology integration (WI) on perceived quality of digital technology integration (DTI). The research has adopted a deductive approach, wherein the hypotheses are derived from the existing theory and literature which were tested and proved by collecting the data. The total number of students learning popular music in professional art colleges in China has been the population of this particular research since they have direct exposure to digitalization of music tools and their integration. A convenient sampling technique was used to select those who are readily available and willing to participate, resulting in 150 students. The data were collected through a structured survey questionnaire with a Likert scale which has two sections. The first section provides the five demographic questions to get the background of the participants. The second section comprises the research variables' questions that measure perceptions SLO, WI and DTI. The researcher had utilized SPSS software to analyse the data. It helps to conduct descriptive and inferential statistics for testing the hypothesis (Saharan *et al.* 2024). The ethical issues of voluntary participation, informed consent, confidentiality of respondents and proper handling of data has been taken care of. This method was created therefore, the study intended to provide reliable, valid, and generalizable findings on the impact learning outcomes and integration technology have on students' perceived quality of digital technology use in music education.

IV. RESULTS

What is your gender?

	N	%
Male	57	36.3%
Female	100	63.7%

Which age group do you belong to?

	N	%
Below 18	39	24.8%
18–25	72	45.9%
26–35	28	17.8%
36–45	18	11.5%

What is your current role in music education?

	N	%

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

Student	36	22.9%
Music teacher	97	61.8%
Administrator	24	15.3%

How many years of experience do you have in music education?

	N	%
Less than 1 year	36	22.9%
1-3 years	75	47.8%
4-6 years	10	6.4%
7-10 years	36	22.9%

How frequently do you use digital technology in music-related activities?

	N	%
Never	43	27.4%
Rarely	48	30.6%
Sometimes	45	28.7%
Often	15	9.6%
Always	6	3.8%

Table 1: Demographic Analysis

The demographic results, as presented in Table 1, have significant implications for the context of the study. Most of the respondents are female who constitute 63.7%. Most of the respondents are in the age bracket of 18-25 with a percentage of 45.9%. Therefore, it can be stated that most of the insights are from youth who are either students or working professionals. Most of the respondents are music teachers (61.8%). This means that the perspectives are likely drawn from people with hands-on teaching experience, rather than the point of view from some administrative job. Almost half of the respondents (47.8%) have 1–3 years of experience. Conversely, a significant percentage is either fresher or moderately experienced, which may ease their comfort level with digital tools. The use of digital technology is not uniform as only 13.4% use it either often or always which indicates gaps in its consistent use and effectiveness in music education.

Scale: Student Learning Outcomes

Reliability Statistics

Cronbach's Alpha	N of Items
.916	5

Table 2: Student Learning Outcomes

According to the reliability statistics presented in Table 2, the five survey items had a Cronbach's Alpha of 0.916, indicating high reliability. The high reliability suggests that the items in the questionnaire show high internal consistency and that they measure the same thing which refers to the research variables. The consistency lends more credibility to the dataset, ensuring the accuracy of the subsequent tests. In this respect, it means that the responses of those surveyed can be read as a true reflection of their perceptions of digital technology integration in music education. The reliability of the instrument was confirmed with strong consistency, indicating a low measurement error and added credibility of findings to draw recommendations and implications on technology use in professional music education.

Scale: Ways of Technology Integration

Reliability Statistics

Cronbach's Alpha	N of Items
.901	5

Table 3: Ways of Technology Integration

According to the reliability analysis that is displayed in Table 3 the five survey items have a Cronbach's Alpha of 0.901, showing that the scale is reliable. It suggests that all the items reflect the same thing and therefore responses can be interpreted in line with respondents' views of the study variables. According to the study, the

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

questionnaire is reliable to measure student learning outcomes, teaching methods, and perceived quality of digital technology in music education. High reliability decreases the likelihood of measurement errors, thereby enhancing the credibility of the data as well as the interpretation of the results. Thus, results from this instrument can validly ascertain the impact of pedagogy and technology on students' experience and perception in music education contexts.

Scale: Perceived Quality of Digital Technology Integration

Reliability Statistics

Cronbach's Alpha	N of Items
.898	5

Table 4: Perceived Quality of Digital Technology Integration

The reliability analysis in Table 4 presents a Cronbach's Alpha value of 0.898 on the five survey items which is very high. This shows that the items reliably measure the building they are intended to measure, with similar answers from participants on the research variable. As such, it means that the instrument is reliable for obtaining perceptions of student learning outcomes, teaching approaches and the perceived quality of digital technology integration in music education. High reliability reduces error in measurement and improves the trustworthiness of the measurement. Thus, the data can be used for quantitative analysis. Moreover, the findings drawn from these items can accurately represent the participants' experiences and perceptions and provide a strong basis for the investigation of the relationships among the variables.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
I feel confident applying digital tools in music tasks.	157	2	5	4.10	.568
I understand music concepts better using technology.	157	3	5	4.22	.488
Technology helps me improve my musical skills.	157	4	5	4.57	.497
I can complete music assignments more effectively with technology.	157	4	5	4.61	.490
My learning in music has improved due to digital tools.	157	3	5	4.15	.508
Valid N (listwise)	157				

Table 5: Descriptive Statistics 1

The descriptive statistics in Table 5 shows that the participants have a positive opinion about the use of digital tools in music education. According to the mean ranges from 4.10 to 4.61, which indicates strongly agreeable that technology helps them learn and hone skills. In particular, the items pertaining to doing assignments effectively (4.61) and improving musical skills (4.57) show the highest means. This indicates students believe technology can be useful and effective in performance-related tasks. The lower scores for confidence in using digital tools (4.10) as well as the confidence in understanding music ideas (4.22) are still positive. Similarly, this probably shows less familiarity or comfort with these. As a whole, students believe that digital technology is extremely useful for musical learning. There appears to be potential for targeted student support to further enhance confidence and understanding of concepts to ensure that their use of technology will improve their learning in professional music education.

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
I frequently use music apps during lessons.	157	3	5	4.29	.520
I incorporate digital instruments in my practice.	157	3	5	4.32	.532
I use online tutorials to learn music techniques.	157	3	5	4.57	.558
I integrate technology in collaborative music projects.	157	3	5	4.44	.624
I explore new music tools independently for learning.	157	4	5	4.64	.481
Valid N (listwise)	157				

Table 6: Descriptive Statistics 2

In Table 6, the results of descriptive statistics found that the participant uses a variety of ways for integrating technology in music education activity as shown by the mean scores between 4.29 and 4.64. The most considerable mean is 4.64 in the case of exploring new music tools on their own. This reflects the tendency of students and teachers to try their own way to learn technology. The high scores of 4.57 for using online tutorials and 4.44 for using technology in group projects indicates that learners are using technology for personal as well as collaborative learning activities. Participants use digital instruments (4.32) and music apps in lessons (4.29) indicating that technology is being used for practical skill learning and in-class activities. The findings suggest that professional music students and educators are employing different meaningful integration strategies, suggesting the increasing use of technology for creative, collaborative and skill-based learning in music education.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
I find technology integration in music education effective.	157	1	5	4.22	1.029
Digital tools improve the overall quality of music learning.	157	3	5	4.22	.558
I am satisfied with how technology is used in lessons.	157	4	5	4.69	.465
Technology enhances my engagement in music classes.	157	3	5	4.44	.613
I believe digital integration supports better music learning outcomes.	157	3	5	4.12	.624
Valid N (listwise)	157				

Table 7: Descriptive Statistics 3

Descriptive statistics in Table 7 shows that participants rate integration of digital technology effective in improving music education with mean ranging from 4.12 to 4.69. Highest of all scores was 4.69 regarding satisfaction with the use of technology in lessons. This score indicates that both the students and the teacher have knowledge of the advantages of technology and its application. The

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

high ratings for engagement (4.44) and perceived quality of learning (4.22) indicate that the technology aids in understanding musical concepts and motivates engagement. Although the average score of 4.12 is somewhat lower, it indicates that pedagogical application can be better for learning through Integration. Therefore, it can be said the technology positively impacts the students' perception of the quality of learning, engagement and satisfaction which shows its strategic value in learning professional music.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Student Learning Outcomes	157	4	5	4.61	.490
Ways of Technology Integration	157	4	5	4.68	.470
Perceived Quality of Digital Technology Integration	157	3	5	4.51	.562
Valid N (listwise)	157				

Table 8: Overall Descriptive Statistics

The descriptive statistics in Table 8 shows that the participants have high perception of student learning outcomes (SLO) with a mean score of 4.61, ways of technology integration (WI) with a mean score of 4.68, and quality of digital technology integration (DTI) with a mean score of 4.51. WI with a mean score of 4.68 depicts that the respondents believe the strategies and ways of infusing technology in music education are highly effective. Similarly, SLO's high mean (4.61) indicates that students feel that using technology helps to improve their skills, understanding and learning experience. The DTI mean is slightly lower than those of previous studies indicating that most participants think the quality of digital integration is high, as meant by the 4.51 score. However, some aspects of DTI can still be improved at which minor enhancement is acceptable. Based on the results, efficient teaching methods, learning outcomes and perceived quality are in harmony in professional music education contexts.

Correlations

		Student Learning Outcomes	Ways of Technology Integration	Perceived Quality of Digital Technology Integration
Student Learning Outcomes	Pearson Correlation	--		
	N	157		
Ways of Technology Integration	Pearson Correlation	.102**	--	
	Sig. (2-tailed)	.000		
	N	157	157	
Perceived Quality of Digital Technology Integration	Pearson Correlation	.972**	.961**	--
	Sig. (2-tailed)	.000	.000	
	N	157	157	157

**. Correlation is significant at the 0.01 level (2-tailed).

Table 9: Correlation Analysis

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

The correlation results in Table 9 indicate that all studied variables are positively related. According to the findings, the correlation between student learning outcomes (SLO) and ways of technology integration (WI) is moderate but significant ($r = 0.102$, $p < 0.01$). This means that while the two are related, the relationship is not a strong one. Perceived quality of DTI shows strong positive correlation with SLO ($r = 0.972$, $p < 0.01$) and WI ($r = 0.961$, $p < 0.01$). The results indicate that the enhancement of student learning outcomes and the performance of successful technological integration strategies are closely related to the students' perception of the quality of digital integration. All in all, this shows that both pedagogical strategies and student achievement impact perceptions of the effectiveness of digital technology in music education, demonstrating the necessity of pedagogical alignment during instruction design.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.879[a]	.736	.727	.031

a. Predictors: (Constant), Ways of Technology Integration , Student Learning Outcomes

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.524	2	8.262	38.896	.000[b]
	Residual	32.712	154	.212		
	Total	49.236	156			

a. Dependent Variable: Perceived Quality of Digital Technology Integration

b. Predictors: (Constant), Ways of Technology Integration , Student Learning Outcomes

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.248	.391		3.194	.002
	Student Learning Outcomes	.556	.004	.486	5.339	.000
	Ways of Technology Integration	.450	.009	.425	3.378	.000

a. Dependent Variable: Perceived Quality of Digital Technology Integration

Table 10: Regression Analysis

The regression analysis reveals the predictive power of the independent variables - Student Learning Outcomes (SLO) and Ways of Technology Integration (WI) - on the dependent variable, Perceived Quality of Digital Technology Integration (DTI). The model summary shows a

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

strong overall correlation (R = 0.879) and R^2 of 0.736 means SLO and WI together explain around 73.6% of the perceived quality variance. The output of ANOVA ($F = 38.896$, $p < 0.001$) signified the acceptance of the model, confirming that these predictors are collectively responsible for students' perceptions of digital technology integration. The coefficients additionally confirm that both SLO ($\beta = 0.486$, $p < 0.001$) and WI ($\beta = 0.425$, $p < 0.001$) are significantly positive predictors of DTI. In other words, their use of methods relating to digital technologies and the improvement in students' learning outcomes enhances the perceived quality of music education technologies. Based on these findings, well-thought-out instructional design and using technology can be applied to achieve great learning outcomes for all students. It will help them to integrate as a quality one that enhances engagement and educational effectiveness in professional music outcomes.

V. DISCUSSION

The results of this research provide substantial evidence on the effects of Student Learning Outcomes (SLO) and Ways of Technology Integration (WI) on Perceived Quality of Digital Technology Integration (DTI) in professional music education. The finding from the descriptive statistics shows that generally the perception of the participant towards the digital technology is highly favourable. The overall mean scores for the items associated with the efficient completion of tasks, improvement of music skills, and exploring different music tools independently signifies students' recognition of practical and cognitive benefits of technology. The above results prove that it is not just an added additional tool for education rather it also permits taking place in music education. Data on WI showed the frequent use of digital instruments, music apps, online tutorials and collaborative platforms by participants in their learning. It implies that professional music students and educators are using different strategies to use technology meaningfully (Lingyu, 2024). Exploring tools independently and collaborating technology integration significantly emphasises the role of autonomy and peer-to-peer learning in the perception of integration positively. The finding is in line with contemporary approaches to music education that emphasize the student and provide real experiences (Şakalar&Gürel, 2024).

SLO, WI and DTI have a strong positive correlation, analysis reveals. The very high correlation coefficient of DTI with SLO (0.972) and WI (0.961) indicates that students' perception on the quality of digital technology closely matched with their learning outcomes and ways of integrating technology. Evidence suggests that merely having the internet in schools at home in the classroom does not guarantee effective use of technology. You must have a plan and software for the use of technology. Results were confirmed, using regression analysis, indicating that SLO ($\beta = 0.486$) and WI ($\beta = 0.425$) are both positive predictors of DTI. The perceived quality variance explained was 73.6% by the model. The high level of significance shows that probably the learning outcomes and the integration approaches were key in the evaluation of the digital tool by the students. The results of the study suggest that the quality of digital experiences in music education depends on technology-enhanced learning outcomes.

These findings have practical and theoretical implications. This research highlights the importance of carefully and contextually integrating technologies into professional music education programs. It will result in improved student learning outcomes and the relationship between perceived quality of the technology and the extent of change in learning outcomes. Educators are required to create learning activities that incorporate the digital tool and which are also useful in teaching (Chen &Safian, 2024). Institutions must provide the necessary infrastructure, training and resources to improve teaching practices and student learning, it underlines. For music education, successful digital integration is dependent on the effectiveness of teaching and learning benefits that shapes students' perceptions of technology quality.

VI. CONCLUSION AND RECOMMENDATIONS

Conclusion

The results revealed that Student Learning Outcomes (SLO) and Ways of Technology Integration (WI) directly influenced information quality (IQ) of digital technology integration (DTI) in music education profession. Students who engage more efficiently in the learning environment involve technologies when they are effective, contextualized and purposeful. According to the students, the use of educational technology is more useful in improving engagement, skills and satisfaction. The results of the correlation and regression analysis show how interdependent teaching methods, learning achievement and perception toward technology. As stated in the research report, the use of these tools is necessary from a pedagogical point of view to achieve quality education and to ensure meaningful learning in music education.

Recommendations

The results of this research provided several recommendations so that digital technology can be integrated in music education. Teachers should adopt educationally informed strategies to ensure that the integration of technology serves a specific learning objective, students developing skills, exploring creativity and practising collaborative skills. Music school programs must ensure ongoing training and support for students and teachers in the effective use of digital instruments, software, and online resources to bring about learning outcomes (Shumska*et al.* 2024). Educational institutions must encourage students' autonomous exploration of technology, allowing for the discovery of new technological tools for personal and collaborative projects in an engaging manner. Designers of the curriculum must embed assessment techniques that reflect both technical competence and creative achievements so that technology integration is infused with value (Bhimavarapu, 2025). Education programs in music should upkeep the infrastructure and continue access to powerful digital resources, including digital audio workstations, collaborative platforms, and virtual instruments, ensuring continued availability for the tasks of learning (Banut&Albulescu, 2024). Conducting regular surveys and feedback mechanisms to evaluate the effectiveness of the technology will help to continuously improve and enable the educators to adapt the method of teaching and integration to maintain the perceived quality of efficient digital learning by the students.

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APPENDICES

APPENDIX- I: SURVEY QUESTIONNAIRE

Section A: Demographic Questions

1. **Which age group do you belong to?**
 a) Below 18
 b) 18–25
 c) 26–35
 d) 36–45
 e) Above 45
2. **What is your gender?**
 a) Male
 b) Female
3. **What is your current role in music education?**
 a) Student
 b) Music teacher
 c) Administrator
 d) ICT support staff
4. **How many years of experience do you have in music education?**
 a) Less than 1 year
 b) 1–3 years
 c) 4–6 years
 d) 7–10 years
 e) More than 10 years
5. **How frequently do you use digital technology in music-related activities?**
 a) Never
 b) Rarely
 c) Sometimes
 d) Often
 e) Always

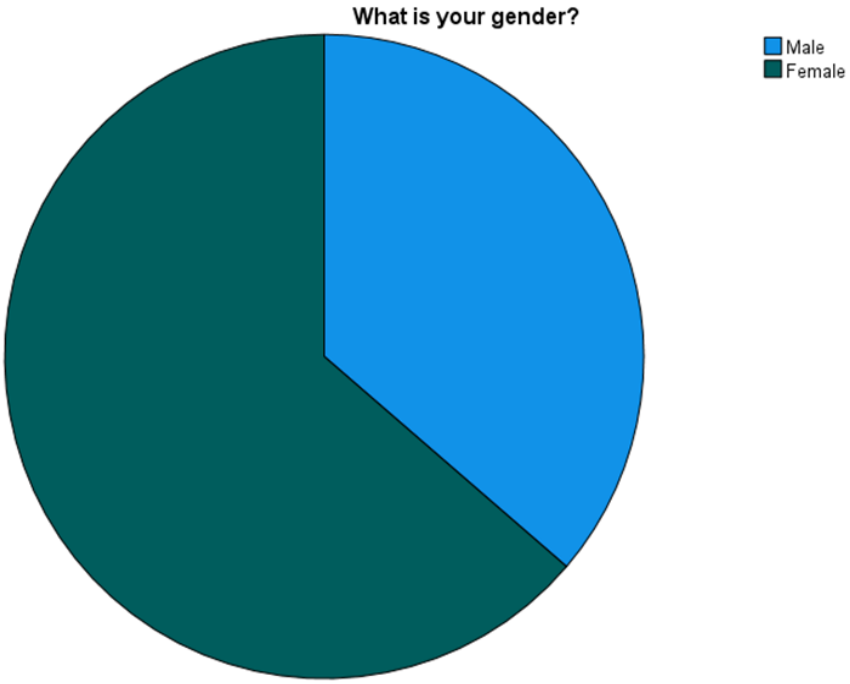
International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

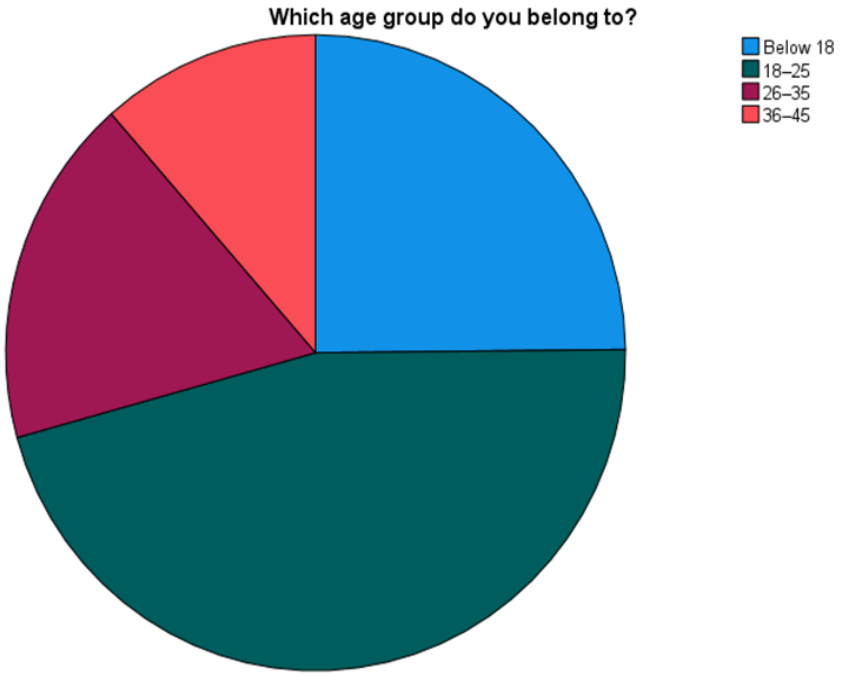
Section B: Research Variable related Questions

Variable	Items	Responses (1-5)
Student Learning Outcomes (SLO) (IV1)	I feel confident applying digital tools in music tasks.	
	I understand music concepts better using technology.	
	Technology helps me improve my musical skills.	
	I can complete music assignments more effectively with technology.	
	My learning in music has improved due to digital tools.	
Ways of Technology Integration (WI) (IV2)	I frequently use music apps during lessons.	
	I incorporate digital instruments in my practice.	
	I use online tutorials to learn music techniques.	
	I integrate technology in collaborative music projects.	
	I explore new music tools independently for learning.	
Perceived Quality of Digital Technology Integration (DTI) (DV)	I find technology integration in music education effective.	
	Digital tools improve the overall quality of music learning.	
	I am satisfied with how technology is used in lessons.	
	Technology enhances my engagement in music classes.	
	I believe digital integration supports better music learning outcomes.	

International Journal of Engineering, Management and Humanities (IJEMH)
Volume 6, Issue 6, Nov.-Dec., 2025 pp: 79-97 ISSN: 2584-2145 www.ijemh.com

APPENDIX- II: DEMOGRAPHIC RESULTS





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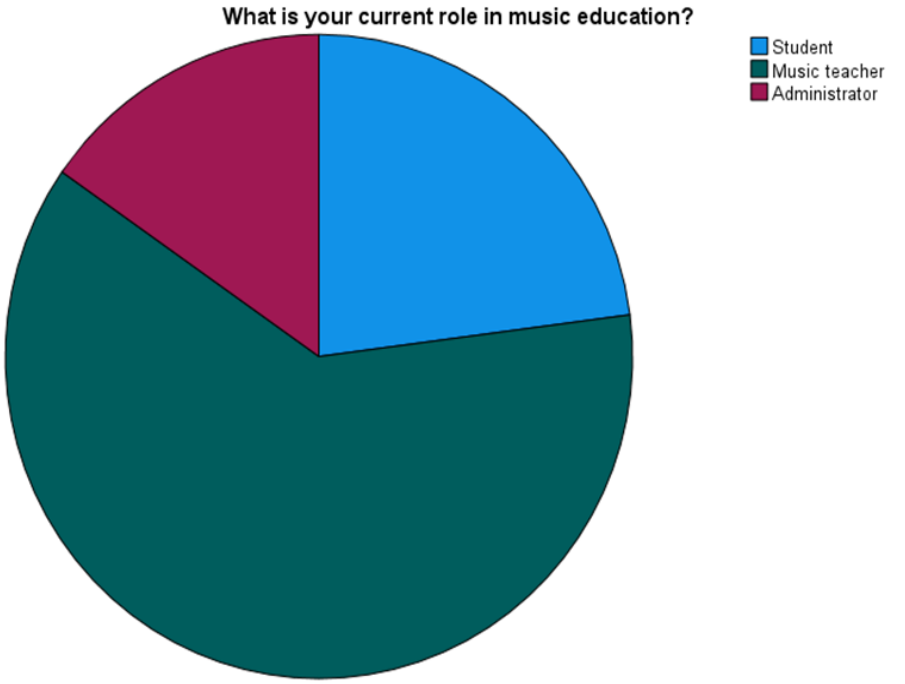

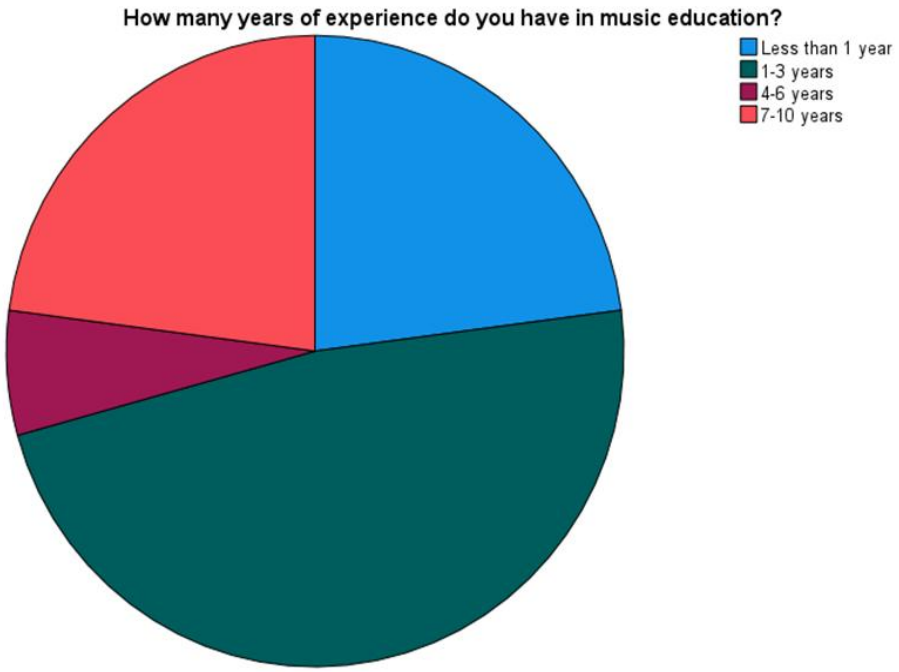

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