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The interplay of technology, social factors, and music learning in academic outcomes: A mediating-moderating model

Amjad Islam Amjad[1], Umaira Tabassum[2], Sarfraz Aslam[3*], Abdulaziz Abdullah Alanazi[4], Sharareh Shahidi Hamedani[5]

[1]*School Education Department, Government of Punjab, Kasur, Pakistan.*
[2]*Department of Education, Guangzhou University, Guangzhou, China*
[3]*Faculty of Education and Humanities, UNITAR International University, Petaling Jaya, Malaysia.*
[4]*Riyadh Technical College, Technical and Vocational Training Corporation, Riyadh, Saudi Arabia.*
[5]*Faculty of Business, UNITAR International University, Petaling Jaya, Malaysia.*

Corresponding author: Sarfraz Aslam (*Email: sarfraz.aslam@unitar.my*)

Abstract

The study was designed to explore the mediating role of social engagement (SE) and the potential moderating effects of social media (SM) and social support (SS) on the relationship between music learning (ML) and academic performance (AP) in music education. We adopted a descriptive research design. Data were collected using a questionnaire from a sample of 480 students selected through multi-method and multi-stage sampling techniques. The data were analyzed with the help of SPSS and Jamovi software. The analysis revealed that ML significantly contributes to students' AP scores. It was found that SE significantly mediates the relationship between ML and AP. Moderation analysis revealed that SM and SS did not significantly moderate the relationship between ML and AP. Our research findings strongly advocate for the prioritization of music education within educational institutions by integrating technology. The study has significant social, practical, and research implications.

Keywords: Academic performance, Music learning, Social engagement, Social media, Social support.

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1. Introduction

In China, universities offer various subjects and disciplines to influence students' personalities, soft skills, and overall well-being. Music learning (ML) is one of those few. Due to its widespread effectiveness, ML is gaining attention inside and outside China [1]. In recent years, the number of students enrolled in ML programs has been increasing significantly. It is narrated in the literature that ML helps students improve their socio-emotional stability and balanced personality (Alessandri, et al. [2]). Zhao [3] argued that integrating ML into curricula improves students' critical thinking and problem-solving.

We found that Cheng and Lam [4] worked on students' engagement (SE), and they found that it improved ML students' academic performance (AP). Their study highlighted the positive impact of music education on various aspects of students' lives, particularly in terms of performance and social life [5]. These findings suggest that ML can potentially improve AP among university students. Istvandity [6] mentioned that ML can contribute to SE and motivation. In another study, Latipah, et al. [7] mentioned that if students are engaged in their ML activities, it improves their AP in the classes.

In the present study, students' academic performance (AP) is measured by their performance in both ML and class activities, including presentations, quizzes, written assignments, and essays. ML includes learning about musical instruments and compositions, as well as arranging and managing musical instruments. We found in the literature that AP in music classes depends on several aspects, including effective teaching, SE, and the school environment [8]. According to Nwokenna, et al. [8], ML significantly affects students' performance and psychological well-being by reducing anxiety and fatigue stressors. Dasadia and Patel [9] also observed a positive effect of music by adding musical tunes into their classes to improve students' AP. Spears and Dordzro [10] examined the effect of ML on students' AP. However, after deploying the intervention, they concluded that there is no significant correlation between ML and AP. This shows that the results are inconsistent, and there is a need to investigate the phenomenon further to determine if they are correlated.

Social media (SM) is gaining academia's attention due to its applicability in various fields. Through SM, sharing and distributing information across borders is very easy. It can help students build their identity in music, and they can easily share their voices and creativity [11]. The literature supports that sharing music through SM is economical and helps people create groups for musical bands and other engagements [12]. SM is a platform with larger audience support and is suitable for sharing and posting content related to ML [13]. In a study, Harb, et al. [14] argued that SM develops networks for online learning and that students use it for ML.

Students interact to help each other in several tasks to provide social support (SS). It encompasses various forms of support, such as emotional support, guidance, and material resources that students receive through their friends and families [15]. SS can manifest in tangible and intangible forms and holds an essential place in an individual's psychological well-being and capacity to manage diverse life obstacles and sources of tension [16]. While SE describes the proactive engagement and interpersonal interaction of students in educational contexts, Nguyen, et al. [17] noted that Faber, et al. [18] described SE as a practical and valuable platform to foster engagement for bringing about behavior modifications through active engagements. Thus, SE can help individuals improve their relationship quality [19].

Studies on ML and AP are often conducted in isolation. However, a research gap exists to examine the interplay of ML, SM, SS, and SE and their contribution to AP. This gap in the literature is the basis for designing the current investigation. We also found theoretical and methodological gaps in finding the causal relationships among the present study variables in a mediation-moderation model. Thus, we designed the current study to examine the contribution of ML to Chinese university students' AP with the mediating role of SE and the moderating roles of SM and SS.

2. Literature Review

2.1. Music Learning and Academic Performance

ML and AP are widely studied topics in music education. In this regard, [20] conducted a study to examine the effect of ML on students' AP by assisting them in handling musical instruments and skills to master playing them. They found that it helped them significantly. Osmanoglu and Yilmaz [21] conducted a study examining the impact of ML on students' psychological well-being and AP. They revealed a significant relationship between ML and AP. Mabborang-Caban [22] also mentioned that integrating music into instruction is crucial for enhancing students' AP. He identified a significant relationship between ML and students' AP. In context to the above literature, we designed the following directional hypothesis.

H_1: Music learning significantly contributes to Chinese university students' academic performance.

2.2. Social Engagement, Music Learning, and Academic Performance

We found studies on ML, AP, and SE in the context of separate studies. We did not find any study on the mediating role of SE in the relationship between ML and AP. We found that students' interactions and performance are crucial to their success in class [23]. It was also found that ML can strengthen social skills, teamwork, and collaboration, potentially positively influencing AP [24]. Furthermore, there has been a lack of investigation into the impact of individual characteristics, such as personality or learning styles, on their moderating roles in the relationship between ML and AP [25]. In addition, research on this aspect exhibits variations in technique and sample demographics, posing challenges to establishing uniform results [26]. In this regard, we designed the following directional hypothesis.

H_2: Social engagement positively mediates the relationship between Chinese university students' music learning and academic performance.

2.3. Social Media, Music Learning, and Academic Performance

We found several research gaps in music education for constructs like SM, ML, and AP. There is a lack of research on the combination of SM and ML, even though both have been shown to positively affect AP when studied separately [5]. However, it has not been investigated whether ML can improve AP in this context [27]. We also found no studies on how SM may mediate or moderate the relationship between ML and AP, although several studies have explored these relationships separately [13, 28]. Students' music literacy, musical perceptions, and learning styles are individual characteristics that need to be investigated [29]. Based on the above arguments, we designed the third directional hypothesis by combining SM and ML to examine their influence on AP.

H_3: Social media usage positively moderates the relationship between Chinese university students' music learning and academic performance.

2.4. Social Support, Music Learning, and Academic Performance

We did not find any study on the moderating role of SS between ML and AP. However, SS has been studied separately concerning students' AP in different subjects and settings [30, 31]. The literature supports that SS can improve students' motivation and well-being and positively affect students' AP [7, 32]. Despite these different directions of inquiry, there is a significant gap regarding the potential moderating role of SS in the relationship between ML and AP. Hence, significant concerns remain unresolved regarding how SS may enhance or optimize the educational benefits of ML since no research has investigated the synergistic effects of SS and ML on AP [33]. It is further argued in the literature that SS, cultural context, or individual variations could impact the magnitude and orientation of these relationships [34]. From the above arguments, we designed the following directional hypothesis.

H_4: Social support positively moderates the relationship between Chinese university students' music learning and academic performance.

2.5. Theoretical Background

The current study is grounded in Bandura's Social Cognitive Theory (SCT). SCT provides a foundation for understanding the variables in the present study and the causal relationships considering behavioral, personal, and contextual aspects of development and learning [35]. SCT advocates that learning is a social phenomenon influenced by individuals' interactions [36]. In the current paper, AP is viewed using an SCT lens to be influenced by social factors such as SE, SM, and SS. ML involves teachers' contribution and self-directed learning using classroom and out-of-classroom interactions [37]. In the present study, SM and SS are considered environmental variables that act as moderators between ML and AP. SM is an additional self-regulated and observational learning source and can improve students' SE. The literature narrates that SM is a valuable platform to enhance SE in the learning process. Similarly, SS from friends, family, teachers, and supporting staff can also enhance the influential impact of ML by providing sources, support, and psychological support, which will increase SS and AP. Based on the literature review and theoretical background, the study's research model is presented in Figure 1.

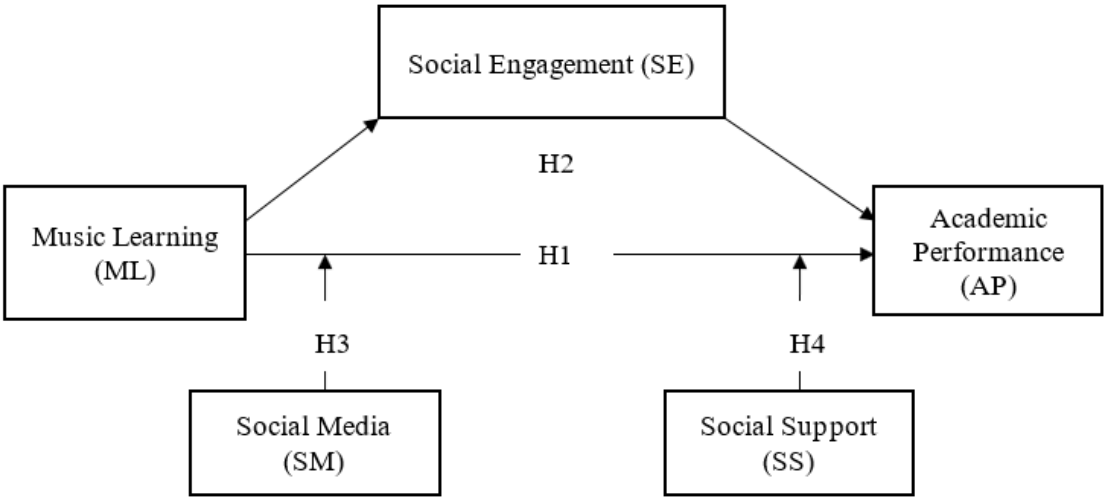

Figure 1.
Conceptual Model.

3. Methods and Materials

3.1. Research Design

We found that several researchers deployed quantitative approaches and questionnaires to conduct studies in music education [34, 38, 39]. Thus, we adopted a quantitative research approach, focusing on students in the School of Music at the University of Beijing, China. The focus is on generalizing the study results by following the cross-sectional research design. This methodology facilitated a methodical examination of the moderating effects of SM and SS on the relationship between ML and AP, with specific emphasis on SE as the mediating factor. The research design of the current study was descriptive, and we used a cross-sectional data collection design.

3.2. Participants

The current study's participants were university students in music programs at the University of Beijing, China. The researchers utilized multi-methods and multi-stage sampling techniques to enlist individuals from the School of Music, ensuring adequate representation across various levels of music education. We had a selection criterion that only students who used social media in their music classes would be selected. The study's sample size was 480 candidates from the University of Beijing, China. Their demographic information is provided in Table 1.

Table 1.
Demographic Information of Participants (N = 480).

Sr no	Variable	Category	Frequency	Percentage (%)
1	Gender	Male	235	49
		Female	245	51
2	Age group	20-25 years	210	44
		26-30 years	205	42
		31-35 years	32	7
		More than 35 years	33	7
3	Income	1000-3000 ¥	331	69
		4000-6000 ¥	86	18
		7000-10000 ¥	63	13
4	Qualification	Bachelor's	56	12
		Master's	391	81
		Other	33	7
5	Social media usage	Yes	480	100
		No	0	0
6	Music learning experience	1 year	131	27
		2 years	129	27
		3 years	123	26
		4 years	97	20

3.3. Measure and Data Collection

We reviewed extensive literature to find any relevant tools to measure university students' responses to the current study's context and variables. However, we did not find any suitable tools. Therefore, we developed a questionnaire comprising five sub-scales with demographic variables such as gender, qualification, music learning experience, monthly income, and social media usage. The sub-scale items were developed on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). After developing the questionnaire, as experts, we determined the face and content validity. Subsequently, the revised questionnaire was shared with 55 university music students for pilot testing. After receiving the informed consent form, the LifePoints link was shared through WeChat and email. The survey consisted of established scales and items that evaluated participants' experiences in music learning, their usage habits of social media, their perception of social support, their degrees of self-efficacy, and their academic performance indicators. The reliability analysis and sample items of the questionnaire are provided in Table 2.

Table 2.
Sub-scales' Reliability Statistics.

Sr no	Sub-scales	No of items	α	Sample items
1	Music learning	5	0.72	I actively participate in music classes and practice sessions. Music has helped me develop discipline and time management skills.
2	Social engagement	5	0.80	My involvement in music-related groups enhances my sense of belonging. Music performances and collaborations allow me to connect with others.
3	Academic performance	5	0.75	My academic performance has improved since I started studying music. Music learning has positively influenced my overall GPA.
4	Social media	5	0.88	I frequently use social media platforms for academic purposes. Social media helps me stay informed about music-related events and opportunities.
5	Social support	5	0.84	I feel supported by my peers in pursuing my music education. My friends provide emotional support when I face challenges in my music learning.

We found that Cronbach's alpha value is higher than .70 for all sub-scales (Table 2). We also carried out EFA and CFA to ensure the questionnaire's construct and convergent validity. Although reporting the results of EFA and CFA is not the current paper's subject, measure fit indicators and sample adequacy are reported here. For example, the value of KMO (.82) highlights. The values of Bartlett's test (χ^2 = 5060, *df* = 300, *p* = .000) also reinforced the suitability of the factor analysis. The RMSEA value of .85, with the 90 % CI ranging from .805 to 920, indicated a good measure of fitness. The TLI value was .93, above the criteria of .90, showing good model fit.

3.4. Research Ethics

This study addressed ethical considerations by obtaining ethical clearance and informed consent from all participants. The researchers also ensured the anonymity of participants by not asking for their personal information, which could reveal their identity and compromise the confidentiality of the data throughout the research process. Participants were assured that the data collected from them would only be used for the current study and would not be shared with anyone without a valid reason. Moreover, respondents were given the right to withdraw from the study if they felt any harm during the data collection process. As the respondents were asked to answer the questionnaire with ease, no psychological harm was involved due to this flexibility. Since the respondents filled out the questionnaire in their homes or on university campuses, no physical contact or harm was involved in the data collection process.

4. Results

After collecting data, it was stored in the Excel sheet and protected using a password option. Then, a screening was carried out to identify the missing values. We used SPSS (version 27) and Jamovi (version 2.6.13) for data analysis. Before testing the study's hypotheses, we analyzed the data to ensure the use of parametric statistics. We assessed the data for the normality of all variables present in sub-scales, their residuals, homoscedasticity, and linearity, which fulfilled the assumptions.

4.1. Contribution of Music Learning to Academic Performance

To test the first hypothesis related to ML's contribution to AP, the researchers deployed simple linear regression at the significance level of .001, and the results are presented in Table 3.

Table 3.
Contribution of ML and AP.

Predictor	**B**	**SE**	***t***	***p***
Intercept	2.583	0.12	21.1	< 0.001
Music learning (ML)	0.437	0.03	15.2	<0.001
R = .571, R^2 = .33, F(1, 478) = 231, p < .001				
Dependent Variable: Students' AP				

Table 1 provides the analysis for the first hypothesis. The results indicate that the model demonstrates a good fit to the data (R = .571, R^2 = .326), explaining 32.6% of the variance in students' AP. The overall model test was significant (F [1, 478] = 231, p < .001), highlighting that ML contributes significantly to students' AP. The coefficients further support the model's validity, with the intercept (B = 2.583, SE = 2.583, t = 21.1, p < .001) indicating the baseline level of students' AP when ML is constant. ML had a significant positive effect (B = .437, SE = .03, t = 15.2, p < .001), suggesting that students' AP increases significantly as ML increases.

4.2. Social Engagement as Mediator

The second hypothesis was designed to examine SE's mediating role in Chinese university students' ML and AP. We deployed the mediation analysis at the 95 % confidence interval (CI) and a bootstrap sample of 1000. The results are presented in Table 4.

Table 4.
Mediation Estimates.

			95 % Confidence Interval (CI)				
Effect	***B***	***SE***	**Lower**	**Upper**	***Z***	***p***	**Mediation (%)**
Indirect	0.176	.04	0.104	0.262	4.45	< 0.001	35
Direct	0.334	.06	0.222	0.441	6.00	<0.001	65
Total	0.510	.04	0.445	0.583	14.26	< 0.001	100

Table 4 provides the results for the second hypothesis. The mediation analysis supporting H2 reveals a significant indirect effect of the predictor on the Chinese university students' AP, with an estimate (*B* = .176, *SE* = .04, *Z* = 4.45, *p* < .001), accounting for 35 % of the total effect. The 95 % confidence interval (.104, .262) confirms the precision and reliability of the indirect effect estimate. The direct effect remains significant, with an estimate (*B* = .334, *SE* = .06, *Z* = 6.00, *p* < .001), explaining 65 % of the total effect and a 95% confidence interval ranging from .222 to .441. These findings demonstrate that the mediation process is robust and meaningful, with the indirect pathway significantly and positively explaining the relationship. The graphical representation of the mediation analysis is presented in Figure 2.

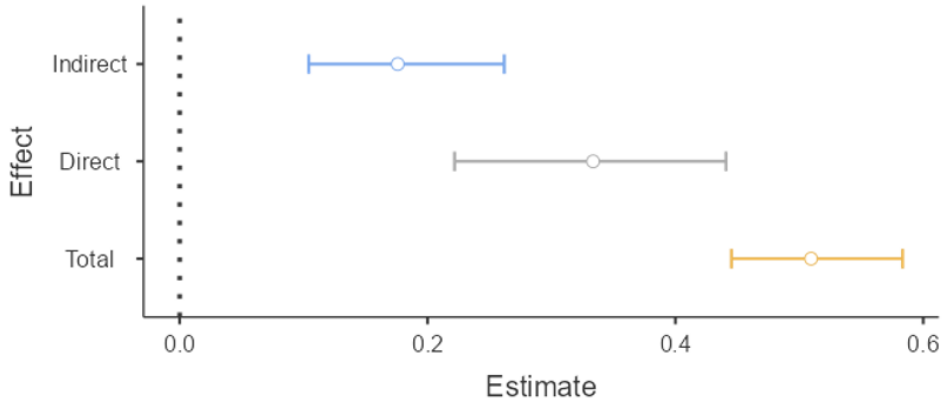

Figure 2.
Estimate Plot.

4.3. Social Media as Moderator

The third hypothesis of the study was designed to measure the moderating effect of SM on the relationship between ML and AP. The researcher deployed moderation analysis at a 95 % confidence interval with bootstrap samples of 1000. The results are presented in Table 5.

Table 5.
Moderating Effect of SM between ML and AP.

			95 % Confidence Interval (CI)			
Variables	***B***	***SE***	**Lower**	**Upper**	***Z***	***p***
Music learning (ML)	0.373	0.04	0.2988	.4519	9.422	< 0.001
Social media (SM)	0.1239	0.05	0.0417	.2139	2.770	0.006
ML*SM	-0.0672	0.07	-0.1855	-.0737	-0.688	0.491

Table 5 presents the analysis for the third hypothesis. The moderation analysis indicates that the main effect of ML on university students' AP is significant, with an estimate (B = .3730, SE = .04, Z = 9.422, p < .001) and a 95% confidence interval ranging from .2988 to .4519, demonstrating a strong positive relationship. Similarly, the main effect of SM on the university students' AP is also significant, with an estimate of (B = .1239, SE = .05, Z = 2.770, p = .006) and a 95% confidence interval of .0417 to .2139, indicating a positive but weaker association. However, the interaction term (ML*SM) rejecting H3 is not significant, with an estimate (B = −.0463, SE = .07, Z = −0.688, p = .491) and a 95% confidence interval that includes zero (−0.1855 to 0.0737). This suggests that SM does not significantly moderate the relationship between ML and university students' AP. Overall, while both ML and SM independently influence Chinese university students' AP, their interaction does not appear to have a significant effect. The graphical representation of the moderation analysis for H3 is presented in Figure 3.

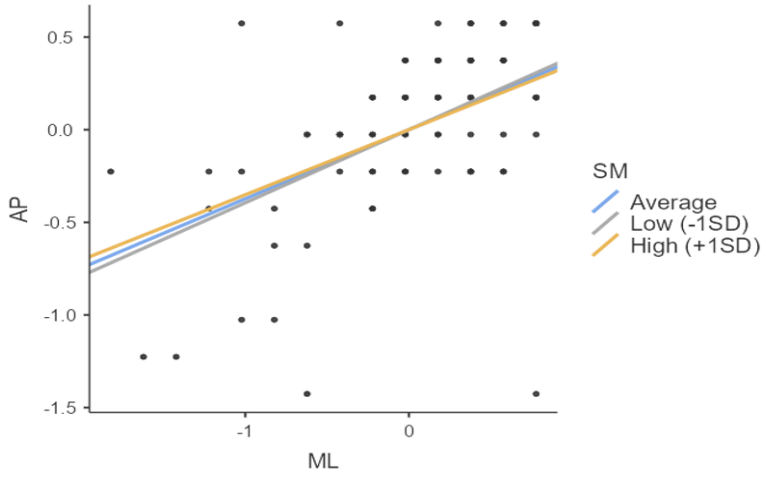

Figure 3.
Simple Slope Plot for H3.

4.4. Social Support as Moderator

The fourth hypothesis of the study was designed to measure the moderating effect of SS on the relationship between ML and Chinese university students' AP in music. We deployed moderation analysis to test H4 with 1000 bootstrap samples at a 95% confidence interval. The results are presented in Table 6.

Table 6.
Moderating Effect of SS between ML and AP.

			95 % Confidence Interval (CI)			
Variables	***B***	***SE***	**Lower**	**Upper**	***Z***	***p***
Music learning (ML)	0.201	0.02	0.155	0.2400	9.19	< .001
Social support (SS)	0.2012	0.02	0.155	0.2400	9.19	< .001
ML*SS	-0.0623	0.05	-0.162	-0.0289	-1.32	.186

Table 6 provides the analysis for the fourth hypothesis. The moderation analysis indicates that the main effects of ML and SS on Chinese university students' AP in music education are significant. Both ML and SS have identical estimates (B = .2012, SE = .0219, Z = 9.19, p < .001), with 95% confidence intervals ranging from .155 to .2400, suggesting that each independently contributes positively to Chinese university students' AP. However, the interaction term (ML*SS) rejecting H4 is not statistically significant (B = −.0623, SE = .05, Z = −1.32, p = 0.186), with a confidence interval of −0.162 to 0.0289, indicating that ML does not significantly moderate the relationship between SS and Chinese university students' AP. This implies that while ML and SS have independent effects, their interaction does not significantly alter the strength or direction of the relationship between SS and Chinese university students' AP in music education. The graphical representation of the moderation analysis for H4 is presented in Figure 4.

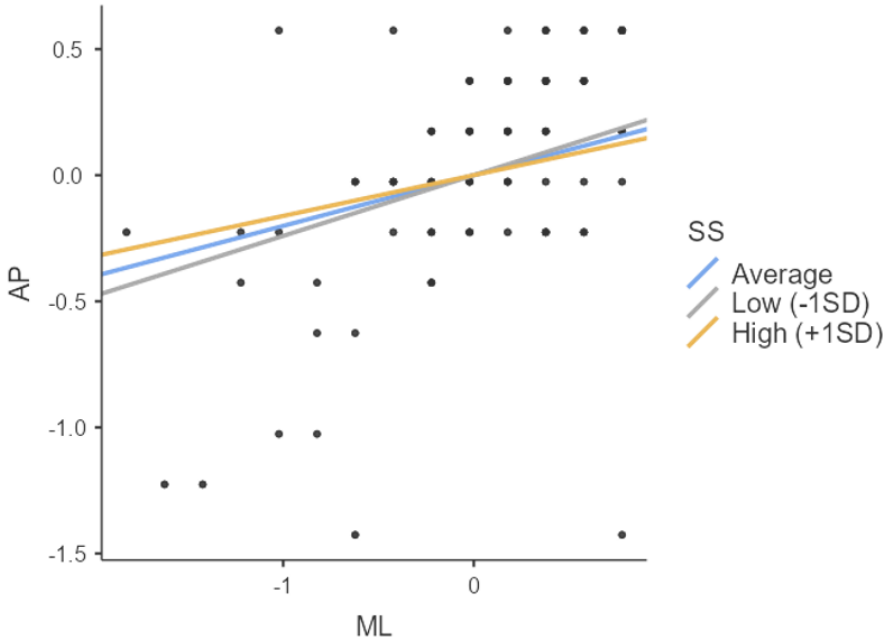

Figure 4.
Simple Slope Plot for H4.

5. Discussion

The findings of the current investigation unveil a significant and positive correlation between the ML and the AP of music students. These results indicate a robust and meaningful relationship and contribution of ML to Chinese university students' AP in music education. This finding contrasts the results of Antony, et al. [20] and Guillén-Gámez, et al. [40] where no significant effect of ML on AP was observed. However, our findings are consistent with the findings drawn by [41]; Osmanoglu and Yilmaz [21] and Mabborang-Caban [22] who have all reported a significant correlation between ML and the AP of students. This contradiction in the findings might result from differences in sample size, context, and study settings. However, we found a strong and positive correlation between ML and AP. This is a significant finding contributing to the literature that students showcasing good skills in ML can be predicted to perform well in their classes to get higher grades.

We designed the second hypothesis to examine the role of SE as a mediator in the relationship between ML and Chinese university students' AP. We found that SE is a significant mediator, which adds novelty to the literature. However, to some extent, it supports the findings of Xie, et al. [23] who found the contribution of SE to the AP. In some other way, our findings support the argument of Concina [42] and Rose, et al. [43] who mentioned that music students can perform well when supported through different social and cognitive interventions. The direct and indirect contribution of SE as a mediator shows that students should be kept involved in ML by providing an environment suitable for social interactions and learning.

This third hypothesis was designed to examine the moderating impact of social media (SM) on the relationship between (ML) and Chinese university students' academic performance (AP). It was found that SM contributes to students' AP independently but does not reinforce the relationship when added to ML. This finding also contributes to the literature, as no study has been carried out using the present study's framework. Furthermore, future studies can be designed to examine the causes of why SM does not moderate the existing relationship. In this digitally infused era, ML should be studied by deploying various information and communication technology (ICT) tools like SM.

Our last hypothesis (H4) was designed to examine the moderating effect of SS on the relationship between ML and AP. The analysis revealed that SS does not significantly moderate this relationship. However, it was found that it contributes solely to AP. Although SS is not a significant moderator, its independent contribution to AP supports the findings of Eveland [30] who argued that SS can contribute to students' AP. Future studies can be designed to examine the possible causes of the poor role of SS as a moderator.

The previous studies recognize a significant gap in the existing body of knowledge, emphasizing the lack of studies that have delved into the moderating influence of SS on the intricate relationship between ML and AP [33]. This study contributes to the expanding literature on the subject matter while emphasizing the necessity for further extensive investigations to elucidate the precise conditions in which SS can augment or optimize the educational advantages derived from music education. The present study reveals intriguing divergences in its findings, bringing insight into the relationship between SS and ML. Indubitably, both factors have been independently acknowledged for their positive impact. However, it is interesting to highlight that combining these two variables does not invariably result in a consistent improvement in Chinese university students' AP.

6. Conclusion

In conclusion, our study has revealed significant insights into the causal relationship between ML, moderating and mediating variables, and Chinese university students' AP. After analysis, we identified a strong and positive correlation between ML and AP. It shows that students interested in ML achieve higher grades and performance in their subjects. We also found that SE is a partial mediator with significant contributions compared to its direct and indirect role. This implies that SE can effectively enhance students' learning in their music classes. Students can engage in peer learning or peer tutoring to share their ideas and knowledge to improve AP. During the analysis, it was revealed that SM and SS contributed independently to students' AP. Thus, using SM and SS networks should be encouraged to perform well in the classroom. Although they were not significant moderators of the correlation between ML and AP, they can be appropriately incorporated into the classes, and teachers should promote the use of SM, and they must develop the SS networks. SS networks can be expanded to include students' peers, teachers, family, friends, and the university's support staff. They can share positive interactions with them, enhancing students' experiences and outcomes.

7. Limitations

The current quantitative investigation on the interplay of ML with several other variables has several limitations. Initially, we followed a cross-sectional survey design for data collection, which might only present the phenomenon's picture at a specific time. To gain a long-term understanding of the phenomenon, we suggest longitudinal studies. Secondly, participants responded to a self-reported questionnaire. This may lead to biased responses. Thus, we recommend conducting future studies with qualitative data collection, such as interviews and observations.

8. Social Implications

The present study on ML and its causal relationships with other variables had pertinent social implications. We found that ML and AP are strongly correlated. This implies that curricula infused with ML can contribute to participants' AP and class-related outcomes. The current study is also valuable for enhancing students' musical skills and cognitive development with the help of institutional and teachers' support for ML. We also found that SE is a significant mediator for ML and AP in music education. Thus, being a social phenomenon, SE might enhance peer learning and peer guidance in developing musical skills and improving performance. The authors also found that SM influences the relationship between ML and AP. SM, being a social influencer, has various implications, such as connecting people and interacting with individuals with diverse cognitive abilities. SM is a platform that can contribute significantly to students' ML and AP by fostering positive interactions and SS.

9. Practical Implications

In addition to its social implications, the present paper has several practical implications. Based on the present study's findings, we support the idea that curricula should be integrated with ML concepts. The present study's findings can be the foundation for educational institutions and teachers to effectively allocate resources and time towards implementing music programs. By doing so, educational institutions can promote the holistic development of students and enhance their AP. Furthermore, the significance of SE in music education highlights the necessity for fostering collaborative learning opportunities. Music teachers are suggested to effectively implement this knowledge by developing ML that facilitates group activities, collaborative projects, and peer interaction to optimize the benefits of music education. Moreover, the constrained moderating influences of SM and SS on the relationship between ML and AP necessitate an in-depth examination of the incorporation of technology in music education. It is vital to ascertain that the utilization of SM and SS follows explicit educational objectives and learning outcomes.

10. Research Implications

The present study also had future research implications; focusing on several areas that deserve consideration is vital. Our study revealed that SM and SS individually contribute to university students' AP in music education. However, when combined with ML, they do not significantly moderate the relationship. Future studies can be planned to examine the causes of the insignificant moderation analysis.

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