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The relation between attitudes towards the use of technology in music education and big five inventory personality traits

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The goal with the study reported on here was to determine pre-service music teachers' views regarding the effectiveness, utility, and sufficiency of technology use in music education as well as the associations between their personality traits and their attitudes towards this use. The participants were 224 pre-service teachers studying in music teacher training programmes in Türkiye. The use of technology in music education questionnaire, the big 5 inventory and the attitude towards using technology in music education scale were used as survey instruments to collect the data. The results reveal that attitudes towards using technology in music education showed a positive relation with openness, and a negative relation with neuroticism. A qualified majority of pre-service music teachers think that technology is beneficial and that they can use technology effectively in music education. Nonetheless, the majority of pre-service music teachers still thought that educational technologies were used inadequately during their music education.

Keywords: attitude; big five personality; educational technology; neuroticism; openness; pre-service music teachers

Introduction

Educational technology offers educators extensive opportunities to facilitate, support and enrich learning (Atabek & Burak, 2019; Bester & Brand, 2013). In music education, as in other educational fields, the opportunities offered by educational technology are commonly applied and the use of technology has made significant contributions to music education (Addressi & Pachet, 2005; Byrne & MacDonald, 2002; Cain, 2004; Comber, Hargreaves & Colley, 1993; Crow, 2006; Hanrahan, Hughes, Banerjee, Eldridge & Kiefer, 2019; Ho, 2004; Kim, 2013; Savage, 2007). However, music teachers may have problems in terms of using technology effectively in the teaching process (Atabek & Burak, 2019) and may be concerned about the integration of technology with education (Dorfman, 2016). One of the important factors in integrating technology into education is attitude. There is a strong relation between the degree of using technology and the attitude towards technology (Louho, Kallioja & Oittinen, 2006). Attitude is also one of the personality factors that contribute to learning success (De Raad & Schouwenburg, 1996). Personality is an individual aspect that affects learning, teaching and teacher training (Atabek, 2013). Personality is also associated with technology use (Butt & Phillips, 2008; Schrammel, Köffel & Tscheligi, 2009). Moreover, attitude towards educational technology has been reported to be correlated with cultural aspects such as music in the African context (Hart & Laher, 2015; Jantjies & Joy, 2016; Moodley & Dlamini, 2021). In this context, it can be seen that relations between personality, attitude and learning exist.

Technology needs to be effectively integrated with education at teacher training institutes where pre-service music teachers are currently studying in order to guarantee that they can employ educational technologies in their classrooms when they begin working in the future. The correlation between pre-service music teachers' attitudes towards using technology in music education (AUTME), their personality traits, and their views on whether they can use technology effectively in the classroom, whether or not use of technology in music education is useful, and whether or not educational technologies were used adequately in their education must be revealed for technology integration into music teacher training programmes to be successful. These relations, meanwhile, have not yet been explained well, despite the fact that they might be helpful in advancing the development of the instructional programmes of institutions that train music teachers. Therefore, the purpose of this study was to investigate the correlations between pre-service music teachers' AUTME, their personality traits, as well as their views on whether they can use technology effectively in music education, whether using technology in music education is useful or not, and whether educational technologies were used adequately in their education.

Technology in Music Education

It is possible to make the teaching and learning of music more effective with the instructional support designs that are integrated and enriched with technology (Hernández-Bravo, Cardona-Moltó & Hernández-Bravo, 2016; Portowitz, Pepler & Downton, 2014). Music education technologies offer new approaches that compensate for the deficiencies of traditional teaching approaches (Nijs, 2018). The inclusion of technology in music lessons strengthens such lessons and generates positive results in the development of memory, self-regulation and cognitive flexibility (Portowitz et al., 2014). It has also been reported that music education technologies improve

hearing, vocal, instrumental and expression skills, as well as movement, dance (Hernández-Bravo et al., 2016; Nompula, 2011) and rhythmic skills (Smith, 2009). Using educational technology in music education supports students in terms of better understanding the essence of the subjects (Savage, 2007), improves students' musical performance (Byrne & MacDonald, 2002), perception (Kim, 2013) and creativity (Addressi & Pachet, 2005; Savage, 2005). The benefits of using technology in music education are not limited to musical achievement (Gorgoretti, 2019; Nompula, 2012). Music lessons supported by technology increase students' motivation with regard to music (Ho, 2004; Kim, 2013; Savage, 2007), interest, and participation in lessons (Comber et al., 1993; Crow, 2006; Savage, 2007), and helping to improve their psychological state (Hanrahan et al., 2019). Technology in music education also provides a valuable tool for bridging the music worlds of the student, both in and outside of school (Cain, 2004; Cassidy & Paisley, 2013).

Successful use of technology in music education requires music teachers to acquire new competencies (Atabek & Burak, 2020; Cain, 2004). However, music teachers may encounter obstacles and experience difficulties in integrating technology into music education (Byrne & MacDonald, 2002). Research reveals that music teachers tend to be slow to adopt new uses of music technologies (Savage, 2007), hesitate to include new technologies in their classrooms (Portowitz et al., 2014), and are concerned about the possible lack of technical and pedagogical support associated with integrating technology into education (Dorfman, 2016). Negative attitudes with regard to the use of technology are also an obstacle for teachers in terms of integrating technology with education (Beri & Sharma, 2019).

One of the most important factors for the effective use of educational technology is the positive attitude of the people involved in technology integration (Sedoyeka, 2012). Therefore, it is important for teachers to have such positive attitudes towards technology so that they can carry new technologies into the educational environment and use them (Gerçek, Köseoğlu, Yılmaz & Soran, 2006; Uğurlu & Gürsoy, 2018). Attitude is defined as "an individual's degree of evaluative affect towards the target behavior" (Fishbein & Ajzen, 1975:216). In theoretical models aiming to explain the reasons of behaviour, such as the theory of reasoned action (Ajzen & Fishbein, 1980), attitude plays a vital role in an individual's intention to use technology. Teachers' attitudes are also an important factor in accepting technology (Agyei & Voogt, 2011; Marshall & Cox, 2008). Studies have determined that teachers' technology experience is an important factor that contributes to positive attitudes towards technology

(Tsitouridou & Vryzas, 2003). In the field of music education, research reveals that pre-service music teachers have developed positive attitudes towards using educational technology in music education (Atabek & Burak, 2019) and computer-assisted learning (Lehimler, 2016). Research also shows that pre-service music teachers have their own computers (Çevik Kılıç, 2015) and their frequent use of the computer (Lehimler, 2016) positively affects their attitudes towards technology.

Personality

The big five personality trait model or the five-factor model of personality is a commonly used theoretical model to explain human personality and how it influences behaviour (Goldberg, 1981:159). This model is a factor framework for personality in which personality traits are arranged hierarchically across five key dimensions (Atabek, 2019). The big five was created and thoroughly examined in numerous research projects within the framework of personality trait theory, and it is now likely the most widely-accepted model of personality traits (John & Srivastava, 1999). This theory, which became the foundation of the big five factors, proposes patterns of individual traits to think, feel, act, and react. The five factors are determined as (1) extroversion, (2) emotional stability (neuroticism), (3) agreeableness, (4) conscientiousness, and (5) openness to experience (Karim, Zamzuri & Nor, 2009). These dimensions are defined as follows (Dunn, De Ruyter & Bouwhuis, 2012; Yoo, Kang & Fung, 2018):

- 1) Neuroticism (N): individuals' tendency to feel sadness, fear, shame, guilt, anger, or fear.
- 2) Extraversion (E): an individual's tendency to be social, active, assertive, talkative, and their preferences for exciting and stimulating environments.
- 3) Openness to experience (O): an individual's tendency towards imagination, intellectual curiosity, emotional sensitivity, aesthetics, and originality.
- 4) Agreeableness (A): an individual's tendency to be helpful, altruistic, empathetic, and sympathetic towards other individuals.
- 5) Conscientiousness (C): an individual's disposition towards cleanliness, orderliness, self-determination and self-control.

Noteworthy connections exist between personality and the emotional use of music (Vella & Mills, 2017), ensemble talent (Kawase, 2016), music preferences (Dunn et al., 2012; Neuman, Perlovsky, Cohen & Livshits, 2016; Vella & Mills, 2017), world music preferences (Yoo et al., 2018), and genre preference (Bansal, Flannery & Woolhouse, 2021). Using Holland's theory, Teachout (2001) determined that there were significant differences between the personality types of the candidates and revealed that candidates had artistic, social and researcher personalities. In a similar study, Cevik, Perkmen, Alkan and Shelley (2013) revealed that

pre-service music teachers were, first and foremost, artistic. In another study, pre-service music teachers scored high in the openness, conscientiousness, extraversion and agreeableness dimensions, and low in the neuroticism dimension (Cevik, 2011). Personality traits also play an important role in the acceptance of technology (Maican, Cazan, Lixandriou & Dovleac, 2019). It has been reported that the extraversion and openness dimensions contribute significantly to the prediction of computer-assisted learning motivation, and that pre-service music teachers who see themselves as extroverted, sociable, organised, careful and disciplined are more motivated to use computer assisted instruction than those who see themselves as introverted, shy, disorganised, careless and impulsive (Perkmen & Cevik, 2010). It has also been found that individuals with openness to experience also have more positive attitudes towards technology dimensions such as individual response technology (Hunsinger, Poirier & Feldman, 2008) and teleworking (Marhadi & Hendarman, 2020).

Present Study

Music teachers need to be able to use these tools effectively in the classroom, given the contributions that the use of technology makes to music education. This situation places the responsibility on music teacher training institutions to provide their students with sufficient skills and understanding to use educational technologies. In the training of music teachers, it is useful to know the pre-service teachers' tendencies towards using the technology according to their personalities, and to reveal their attitudes towards and competencies of using technology in music education, in terms of shaping the aforementioned programmes correctly, and compensating for their deficiencies. Thus, with this study we aimed to provide answers to the following questions:

- 1) What are pre-service music teachers' views on using technology in music education?
 - a) Do pre-service music teachers think that they can use technology effectively in music education?
 - b) Do pre-service music teachers think that using technology in music education is beneficial?
 - c) Do pre-service music teachers think that educational technologies were used adequately during their music education?
- 2) Do the pre-service music teachers' attitudes towards using technology in music education differ according to their class levels?
- 3) Do pre-service music teachers' attitudes towards using technology in music education correlate with personality traits?

Methodology

In this survey study we used a correlational design. *Ethical Principles of Psychologists and Code of Conduct* was followed throughout the study (American Psychological Association, 2002). The

scientific research and publication ethics committee of the university where the authors were employed granted ethical clearance for us to undertake the study.

Participants

Convenience sampling was used to recruit 224 pre-service teachers (116 [51.8%] females and 108 [48.2%] males) studying in the music education programmes at three universities in Türkiye as participants in this study. The participants' ages ranged between 17 and 38 years ($\bar{x} = 21.47$, $M = 21$). Forty-seven (21%) were in their first, 34 (15.2%) in their second, 89 (39.7%) in their third, and 54 (24.1%) in their fourth year ($\bar{x} = 2.67$, $M = 3$) of university study. Only participants who gave their consent were involved in the study.

Data Collection

A survey that included the use of technology in music education questionnaire (UTMEQ), a demographics questionnaire, and two psychometric scales were used to gather data. Psychometric scales included the big five inventory (BFI) and the attitudes towards using technology in music education scale (AUTME). Information regarding the participants' class, age, and gender was gathered via the demographics questionnaire. UTMEQ consists of three Yes/No questions corresponding to three categorical variables: (1) "Do you think that you can use technology effectively in music education?", (2) "Do you think that the use of technology in music education is beneficial?", and (3) "Do you think that educational technologies were used adequately during your music education?"

Big five inventory

John, Donahue and Kentle (1991) created the inventory in English to use brief words to evaluate the most archetypal characteristics linked to each of the big five dimensions (Benet-Martínez & John, 1998; John, 1990). Sümer, Lajunen and Özkan (2005) adapted BFI for Turkish individuals. The inventory includes 44 items. It is a Likert-type scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). The five personality dimensions are neuroticism, extraversion, openness, agreeableness, and conscientiousness. According to John and Srivastava (1999), the dimensions' Cronbach's alpha scores varied from 0.75 to 0.90, and the results of the 3-month test-retest showed a similar range of 0.80 to 0.90. Cronbach's alpha values for the original English BFI were 0.79 for agreeableness, 0.88 for extraversion, 0.82 for conscientiousness, 0.81 for openness, and 0.84 for neuroticism (Benet-Martínez & John, 1998). For the Turkish version of BFI, Cronbach's alpha scores were 0.64 for agreeableness, 0.77 for openness, 0.66 for extraversion, 0.72 for neuroticism, and 0.75 for conscientiousness (Sümer

et al., 2005).

Attitude towards Using Technology in Music Education Scale

The scale was created by Atabek and Burak (2020) to assess individuals' attitudes towards using technology in music education (AUTME), which consists of eight items and is a Likert-type scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). The score range is 8 to 40 and higher scores indicate a stronger AUTME. The scale includes items such as "I believe that the use of technology makes music instruction more effective" and "I need technology while teaching music." Cronbach's alpha value of the scale was reported as 0.931 (Atabek & Burak, 2020).

Data Analysis

Data in this study were analysed using IBM SPSS Statistics Version 25 (Statistical Package for the

Social Sciences). Firstly, descriptive statistical methods were applied. Later, kurtosis and skewness metrics were used to determine whether the scale factors, scale total scores, and demographic data were normally distributed. Lastly, one-way analysis of variance (ANOVA) and Pearson's product-moment correlation coefficient were used to analyse the associations between psychometric and demographic data.

Results

Initially, descriptive statistical methods were used to analyse each variable. Table 1 demonstrates the results of the descriptive analyses. Then, data were analysed in order according to the research questions.

Table 1 Results of the descriptive analyses

Variable	Min	Max	<i>M</i>	<i>Mdn</i>	<i>SD</i>	Skewness	Kurtosis
UTMEQ							
Can use technology effectively	0	1	0.76	1	0.42	-1.24	-0.44
Technology is beneficial	0	1	0.96	1	0.18	-5.03	23.58
Technology was used adequately	0	1	0.38	0	0.48	0.52	-1.74
AUTME							
Attitude*	1	5	3.95	4	0.93	-1.30	1.72
BFI							
Extraversion	1.5	5	3.51	3.5	0.78	-0.17	-0.63
Agreeableness	1.78	5	3.81	3.88	0.54	-0.52	0.39
Conscientiousness	1	5	3.65	3.66	0.67	-0.44	0.28
Neuroticism	1	4.38	2.84	2.87	0.78	-0.14	-0.48
Openness	2.30	5	4.05	4.2	0.54	-0.60	-0.11

Note. *Attitude refers to attitude towards using technology in music education. Min, Max, *Mdn*, and *SD* refers to minimum, maximum, median and standard deviation, respectively.

Research Question 1: What are Pre-service Music Teachers' Views on Using Technology in Music Education?

Pre-service music teachers' views on using technology in music education were measured using three closed questions (Yes/No). The questions were about (1) whether or not they can

use technology effectively, (2) whether or not technology is beneficial in music education, and (3) whether or not educational technologies were used adequately during their music education at university. The participants' responses as well as other categorical variables are depicted in Table 2.

Table 2 Frequency distributions of categorical variables

Variable	Category	Frequency	%
Can use technology effectively	No	53	23.7
	Yes	171	76.3
Technology is beneficial	No	8	3.6
	Yes	216	96.4
Technology was used adequately	No	140	62.5
	Yes	84	37.5

As seen in Table 2, a qualified majority of the pre-service music teachers (171 or 76.3%), thought that they could use technology in music education effectively. Remarkably, almost all of the pre-service music teachers (216 or 96.4%) thought that using technology in music education was beneficial. Only eight participants (3.6%) held a

different view. Nonetheless, only 84 (37.5%) of the pre-service music teachers thought that the educational technologies were used adequately during their music education. The majority of the pre-service music teachers (140 or 62.5%), thought that educational technologies were used inadequately during their music education.

Research Question 2: Do Pre-service Music Teachers' attitudes Towards Using Technology in Music Education Differ According to Their Class Levels?

A one-way ANOVA was employed to determine whether or not the pre-service music teachers' AUTME scores showed significant differences according to their class levels. The results reveal that the pre-service music teachers' AUTME scores did not vary significantly according to class levels ($F(3,223) = 1.492, p = 0.218$).

Research Question 3: Do Pre-service Music Teachers' Attitudes towards using Technology in Music Education Correlate with Personality Traits?

In order to determine whether or not AUTME scores and the BFI dimensions were associated, Pearson's correlation coefficients (r) were lastly calculated. Table 3 displays the findings from the correlational analysis.

Table 3 Correlations between BFI dimensions and AUTME scores

BFI dimensions	Attitude		
	r	N	p
Extraversion	0.129	223	0.055
Agreeableness	0.045	223	0.502
Conscientiousness	0.125	223	0.063
Neuroticism	-0.138	223	0.040*
Openness	0.172	223	0.010**

Note. * $p < 0.05$, ** $p < 0.01$. Attitude refers to attitude towards using technology in music education.

Analyses with Pearson's correlation coefficients revealed that the pre-service music teachers' AUTME scores were not significantly correlated with extraversion, conscientiousness, or agreeableness ($p > 0.05$). However, pre-service music teachers' AUTME scores were correlated weakly but significantly with neuroticism ($r = -0.138, N = 223, p = 0.040$) and openness ($r = 0.172, N = 223, p = 0.01$).

Discussion

The findings from our research reveal that some participants' AUTME values were quite strong ($M = 3.95$) and in agreement with the results of related research on attitude towards educational technology (Atabek & Burak, 2019), computer-assisted learning (Lehimler, 2016), and digital technology (Gudek, 2019). Louho et al. (2006) report that the intention to use technology, attitude towards technology, and the degree to which technology is used were positively correlated. Therefore, the results indicate that the participants intended to use technology in their professional lives in the future. Another interesting finding of the study was that the participants' AUTME scores did not differ significantly according to class levels. In their study with pre-service primary and pre-school teachers, Atabek and Burak (2020) found that pre-service music teachers' AUTME values

increased significantly as their age and class levels increased. Moreover, Gudek (2019) revealed that the attitudes of music teacher candidates towards technology decreased significantly as their age and class levels increased during their undergraduate education. The fact that the attitude scores of the pre-service music teachers did not change during their undergraduate education suggests the need for an examination of the adequacy of the courses that students take in the music education programmes in order to increase their technology proficiency. Technology-related courses in the music teaching programme in Türkiye are limited to information technologies for 3 hours per week in the first semester, and instructional technology courses for 2 hours a week in the third semester. These two technology-related courses in the programme constitute 1.92% of the total credits of the undergraduate music education programme. In addition, it is striking that the programme does not include courses that specifically integrate music education and technology. Similarly, a low percentage of pre-service music teachers (36%) found the education they had received in technology during their undergraduate period to be adequate. In this context, Bauer and Dammers (2016) state that they found various barriers to integrating technology into the music teacher education curriculum in the music teacher education programmes they had researched. They also indicate that teacher educators should constantly try to keep the music teacher education curriculum up-to-date and allow pre-service music teachers to take advantage of the pedagogical opportunities made possible by technology.

Although the view is that the technology-oriented courses available during the undergraduate period were inadequate, a considerable proportion of pre-service music teachers (76%), thought that they could effectively use technology in music education. This result was in line with the results of research which revealed that pre-service music teachers had high levels of computer self-efficacy (Bauer, 2003; Gudek, 2019). The fact that pre-service music teachers did not regard technology education that they had received during their undergraduate education adequate, but that they felt competent in this regard, suggests that they have improved themselves outside of school. On this subject, Kass (2014) reports that students' self-efficacy with regard to technology increases as they learn technology on their own, or use it by following others. Although pre-service music teachers did not find the technology education they had received as adequate, they felt competent in this regard, maybe as a result of their lack of knowledge about integrating technology with music education. Haning (2016) states that 63% of pre-service music teachers took a compulsory technology course during their undergraduate

programmes, including music notation software, sound mixing, and editing applications, but that 43% of them did not feel ready to use technology effectively in their future teaching positions. Bauer and Dammers (2016), on the other hand, state that pre-service music teachers were adequately prepared to integrate current and future music technology, but they were less ready to teach purely technology-based music lessons. Given that Türkiye's undergraduate music teacher education programme lacks classes that combine technology and music education, pre-service music teachers' familiarity with technology is severely lacking (even though they may feel competent about technology), it is not an indication that they are fully competent in this subject. However, according to the research findings, 96% of the participants agreed that technology was beneficial for music education. Certainly, using technology contributes greatly to music education (Addressi & Pachet, 2005; Byrne & MacDonald, 2002; Hernández-Bravo et al., 2016; Kim, 2013; Savage, 2007; Smith, 2009). The findings reveal pre-service music teachers' awareness about this issue. Another finding is that local and/or cultural characteristics have an influence on the development of attitude towards educational technology, as was shown in the African context (Hart & Laher, 2015; Jantjies & Joy, 2016; Moodley & Dlamini, 2021; Nompula, 2011).

In our study we found a positive relationship between pre-service music teachers' AUTME values and the openness dimension of personality. Accordingly, pre-service music teachers who have intellectual curiosity, a developed imagination, high aesthetics and originality, sensitivity, and emotional sensitivity (Dunn et al., 2012; Yoo et al., 2018) tend to have positive attitudes towards using technology in music education. This result is consistent with the results of other research that determined that individuals with higher scores on openness to experiences had more positive attitudes towards using technology (Hunsinger et al., 2008; Marhadi & Hendarman, 2020) and that their motivation towards technology was relatively high (Perkmen & Cevik, 2010). Openness to experience has positive effects in many areas related to technology along with its contribution to the development of more positive attitudes towards using educational technology in music education. Openness was reported to have positive effects on perceived ease of using technology (Khan, Iahad & Mikson, 2014; Svendsen, Johnsen, Almås-Sørensen & Vittersø, 2013), the perceived usefulness of technology (Khan et al., 2014), information technologies (Al-Qirim, Rouibah, Tarhini, Serhani, Yammahi & Yammahi, 2018; Lakhali & Khechine, 2017) and internet use (McElroy, Hendrickson, Townsend & DeMarie, 2007). Since technology is a constantly-changing and developing field,

individuals need to be open to innovation in order to keep up with the changes and developments in this field (Perkmen & Cevik, 2010). In this context, the openness dimension also has strong effects on technology acceptance (Khan et al., 2014).

In this research, a negative correlation was determined between pre-service teachers' AUTME values and the BFI's neuroticism dimension. Neurotic individuals tend to have unstable emotional states (Ülke & Bilgiç, 2011). Neuroticism is also characterised by low self-esteem, irrational beliefs, and pessimistic attitudes (McCrae & Costa, 2008). Neurotic people experience various emotions such as anxiety, anger, hostility, guilt, and depression (Digman, 1990). In addition, people who exhibit neuroticism are less likely to try new experiences, and are more likely to want to avoid new situations altogether when faced with new challenges, such as learning a new form of technology (Rosen & Kluemper, 2008). However, neurotic students strongly resist technological change (Venkatesh, Sykes & Venkatraman, 2014). Given that it is necessary to be open to innovation in order to accept ever-changing technology, neurotic pre-service music teachers' low AUTME values are similar to the results of research stating that neurotic students do not accept technological innovations and show resistance to new technologies (Rosen & Kluemper, 2008; Venkatesh et al., 2014). In addition, the negative effects of neuroticism on the use of technology are also found in other research results (Devaraj, Easley & Crant, 2008; Korukonda, 2007; Terzis, Moridis & Economides, 2012; Zhou & Lu, 2011). According to these studies, neuroticism has a negative effect on the perceived usefulness of technology (Devaraj et al., 2008; Terzis et al., 2012; Zhou & Lu, 2011) and has a positive relationship with computer anxiety (Korukonda, 2007) and even technophobia (Korukonda, 2005).

Conclusion

The findings in our study show that pre-service music teachers' attitudes towards using technology in music education were highly positive. In addition, the attitudes of pre-service teachers who were especially open to experiences were significantly higher than those of others, while those of neurotic pre-service teachers were significantly lower. Pre-service music teachers thought that using technology in music education was beneficial, and regarded themselves as adequately prepared in this regard, but they did not find the technology courses they took in their undergraduate studies were adequate. Pre-service music teachers' positive attitudes towards using educational technology in music education show that they intend to integrate technology into music education. In this context, music teacher educators

should consider the positive attitudes held by pre-service music teachers towards using educational technology. Furthermore, studies should be conducted to increase the competence of the pre-service music teachers in this regard. We found that pre-service music teachers' undergraduate technology education was not sufficient in terms of course content, and accordingly, it did not contribute to any changes in their attitudes towards technology. In this sense, music teacher training programmes need to be developed and revised, should consider pre-service music teachers' personality traits, and should consider how such programmes can integrate technology effectively into music education. This is necessary because pre-service teachers' positive attitudes towards technology, their feelings of self-sufficiency, and their intention to integrate technology with music education does not mean that they can successfully use technology in a music education context.

Based on the findings in our research, the following recommendations are made to enhance the instructional programmes of institutions that offer teaching programmes for music teachers.

- Aiming to stimulate pre-service music teachers' intellectual curiosity, foster their imagination, and reward their quest for originality, these institutions' courses, academic practices, and social programmes should be redesigned and enhanced to capitalise on the positive correlation that exists between openness to experiences and attitudes towards using technology in music education.
- The design of the aforementioned practices, programmes, and courses should also focus on enhancing the aesthetic judgment skills and emotional sensitivity of aspiring teachers in order to further profit on the same association.
- Teacher training institutions should offer accessible medical support to pre-service music teachers who require it in order to help settle down unstable emotional states like depression, anxiety, anger, hostility, and guilt. Additionally, the institutions should offer additional psychological services to help these pre-service teachers acquire effective coping skills that they need to deal with such negative emotional states. This will help lessen the negative effects of neuroticism.
- Pre-service music teachers need to build resilience in order to guard against the harmful impacts of neuroticism that were previously stated. Teacher training institutions should provide their students with financial and social assistance in order to help them avoid irrational beliefs, pessimistic attitudes, and low self-esteem.
- Developing pre-service music teachers' general technology skills within the framework of 21st century skills would help to prevent the candidates from avoiding situations where they come across new and evolving forms of technology. Richer courses and seminars on information technologies can aid in the development of technological skills.
- Lastly, there is a need for far more robust training in educational technology for aspiring music teachers. Teachers may be assisted in gaining the skills

necessary to integrate technology into education by longer-term educational technology training that is not limited to a single one-term course.

Authors' Contributions

OA designed the research, conducted all the statistical analyses, co-wrote the article and provided revisions. SB collected the data and co-wrote the article. Both authors reviewed the final manuscript.

Notes

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