

Digital and Traditional Learning: Learning Styles with Music and Technology for Early Childhood Education [†]

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Abstract: A non-experimental, a quantitative SPSS research design (independent sample *t*-test, two-way ANOVA, multiple regression analysis) was used to examine the statistically significant difference existing among Taiwan college early childhood education students for the students with blended learning, background demographic characteristics, music emotion, learning styles, technology acceptance, and students' satisfaction. The purpose of this quantitative research study is to examine the statistically significant difference existing among Taiwan college early childhood education students for students with blended learning, background demographic characteristics, music emotion, learning styles, technology acceptance, and students' satisfaction.

Keywords: music emotion; learning styles; technology acceptance; AI; student's satisfaction

1. Introduction

Early childhood education is defined as any type of educational program that takes care of children birth to five years of age. Ogunnaike [1] proposed that "Early Childhood Education theories provide a framework for understanding the nature, abilities, and how to create learning environments that enhance children's overall development". In 1939, Taiwan Ministry of Education mandated that the kindergarten curriculum had to include music, general knowledge, children's songs, stories, and games [2]. In early childhood education and care (ECEC), music education provides small children with an interest in creating a relationship with music, including both pre-planned and spontaneous activities [3,4]. Basic music elements experiences include listening to music, singing, moving, rhyming, creating music, playing instruments, and body percussion. Music education has a strong positive effect on young children learning; in particular, music enhances spatial perception and auditory skills [5,6]. Music develops creativity, as well as emotional skills [7,8].

In the 21st century, technology has been playing an essential role in our life. However, researchers are still discussing the positive and negative impact it has on early childhood development. Several researchers believe technology may isolate children in their early childhood and make them anti-social. In another viewpoint, some researchers believe technology can support young children to work collaboratively and to become social people [9]. Kirkwood et al. [10] and Kazakoff and Bers [11] proposed that technology can improve pupils' social interactions and benefit their understanding during their learning process. Nowadays, many family favorite pastimes include digital computers, smartphones, and social media [12,13]. In addition, young children are growing up in a digital home environment. Thus, digital musical parenting is a new way for parents to take care of their children [14,15] for young children's exposure to a variety of music learning environments later in life [16].



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cues of music or culture-specific cues. The BRECVEMA framework of emotion in music presents the social construction of stereotyping. Music affects emotion. Music has been found to evoke emotions that allow individuals to “value music primarily because the emotion evokes” [31,32]. People use music to change, release, and match their emotions and to release stress [33].

2.2. Blended Learning

Blended learning becomes one of the most accepted learning modes in which learners can learn from digital media and the traditional classroom method [34]. Garrison and Vaughan [35] defined blended learning as “the organic integration of thoughtfully selected and complementary face-to-face and online approaches and technologies”. Motteram and Sharma [36] defined blended learning as “the integrated combination of traditional learning with web-based online approaches”. Blended learning is characterized by three features: (1) personal contact face-to-face with an instructor; (2) electronic items delivered learning objects; and (3) a blend of traditional and electronic items to achieve learning goals [37]. Besides the physical learning space, learners also can learn from the virtual space with much flexible time and achievable and progressive resources, including Google Meet, Zoom, and Microsoft Teams. In addition, online and face-to-face interactions in the blended course can achieve higher levels of learning and academic achievement [38,39].

Graham [38] depicted the four critical dimensions of interactions in face-to-face and online learning environments in a blended course (Figure 2). According to the dimension of *space*, blended learning mixes the face-to-face and virtual interactions learning methods together. The second *time* dimension for the traditional face-to-face learning environment is live synchronous learning with a limited and shorter time lag than online learning. Additionally, the third *fidelity* dimension of interactions in face-to-face interaction has higher fidelity than online learning. In the final *humanness* dimension, face-to-face interaction has a higher level of humanness than computer interaction learning.

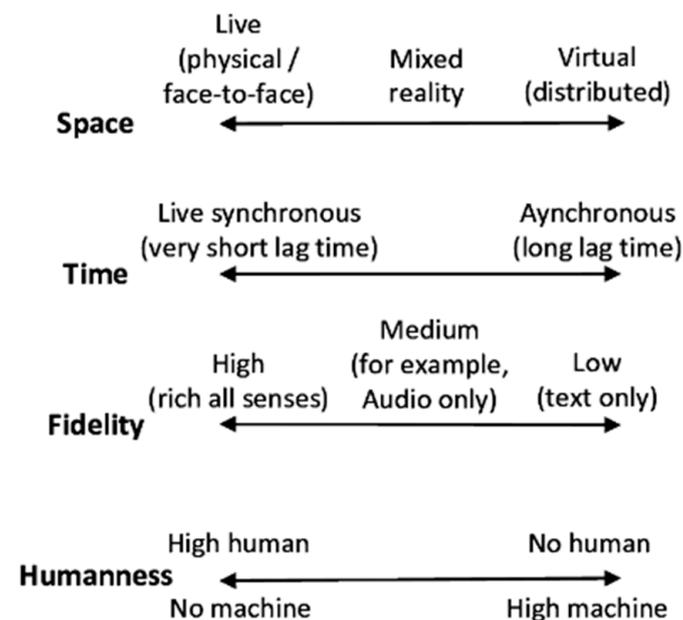


Figure 2. Four dimensions of interaction in face-to face and distributed learning environments.

In the past, people have regarded the two learning methods separately as traditional face-to-face learning and online computer self-paced learning. However, at present, learners have started to mix both methods. In the future, learners are going to apply the major blended learning method (Figure 3).

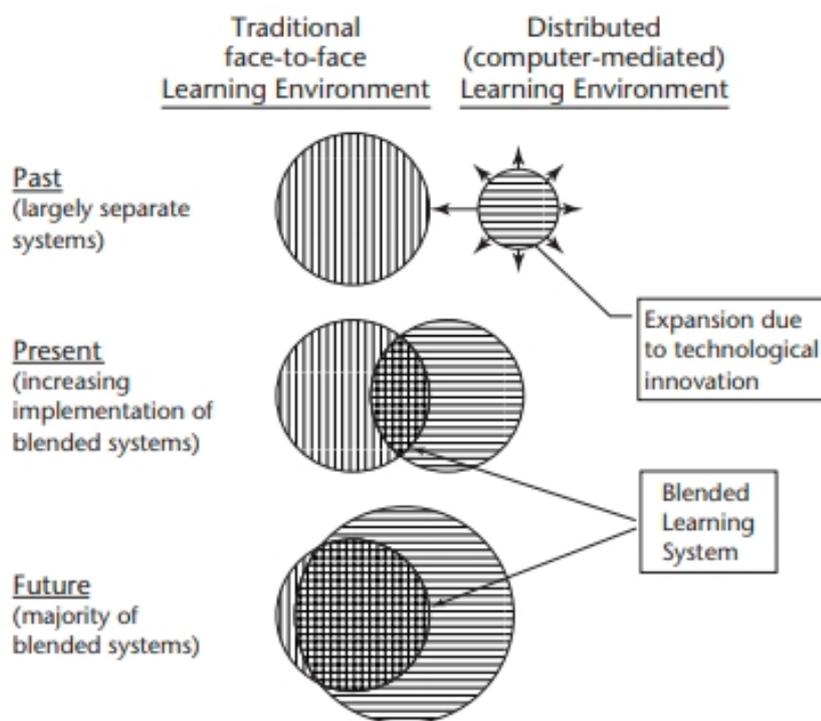


Figure 3. Progressive convergence of traditional F2F and distributed environments allowing development of blended learning systems.

The benefits of blended learning include a personalization/individual learning path, learner-centered approach, self-paced learning, flexibility, enhancement of learners' motivation and engagement improvement in learning outcomes/performance, critical thinking skills, and one-on-one tutoring [40]. In addition, online teaching and learning in Taiwan are both synchronous and asynchronous. In synchronous learning, students can carry out the activities through live video or audio with immediate feedback in real time. Learning can occur individually or in groups or in different places. In asynchronous learning, students can complete their assignments in their own time and speed [41,42]. Online learning occurs in one of two modes, namely asynchronous or synchronous, and is considered to be the safest mode [43]. Students might perceive the transition from virtual learning to remote learning because the lack of in-person learning in the physical classroom may cause a variety of students' emotions.

2.3. Learning Styles (Visual, Auditory, Tactile)

Kolb [44] defined the inherent disposition of a person to the dimensions and continuums of experiential learning, which combined learning preferences. Keefe [45] defined learning styles as affective, psychological characteristics and took a cognitive approach to figure out how learners interacted, saw, and responded to the environment.

Kolb [44] explained the learning style inventory, which includes feeling, watching, thinking, and doing (Figure 4).

Felder and Silverman [46] divided learning styles into four dimensions: perception, input, processing, and understanding. Each dimension has two learning styles. Process (active, reflective) and perception (sensing, intuitive) are from Myers–Briggs, and the Kolb model details input (visual, verbal) and understanding (sequential, global) (Figure 5).

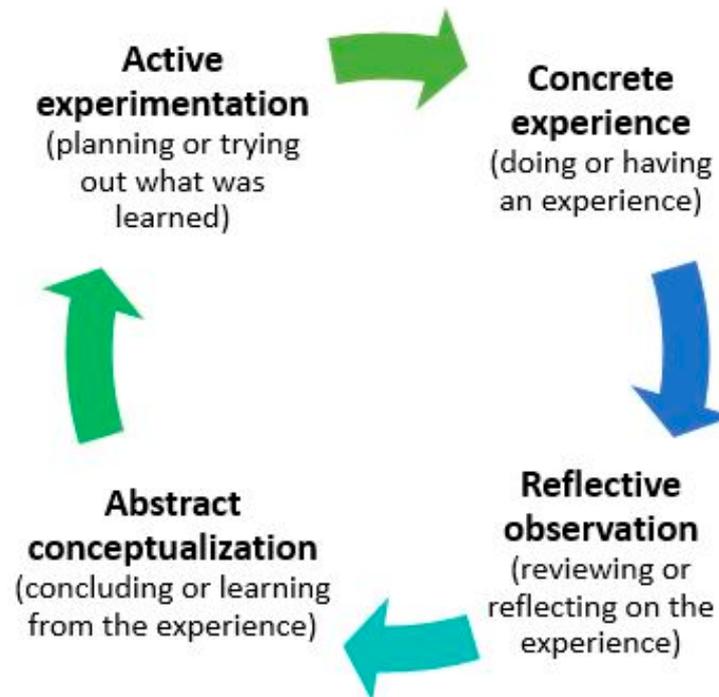


Figure 4. The Experiential Learning Model, Kolb [44].



Figure 5. Dimensions of Felder–Silverman’s Learning Style Model Dimension Learning.

2.4. Technology in Music Classroom

Technology in the music classroom is popular and important for music teachers to guide young children in learning in the 21st century [47]. Sandy and Murdiyasa [48] have mentioned that multimedia-based learning media improve educational quality and support teaching and learning activities. Burnard [49] defined music technology as the development of music educators using technology that allow students to be independent learners of musical instruments and the creativity of music: “Technology provides ideal media for music education”. Students have been influenced by using technology and music in all kinds of settings. Kuzmich [50] stated “With technology and a deliberate plan that you can manage effectively, it is possible to engage students in music making and accomplish your music education goals”. In addition, Kuzmich analyzed four factors for music education with technology: achievable goals, methods for immediate personal feedback, expert instruction, and tools focusing on student practice. Music educators have described success in teaching students with the aid of technology. Kuzmich reported the biggest advantage of the technology was the ability to assign different music levels to the students. Owen [51] described technology as bringing confidence to the students to motivate and engage them in new ways. Wang [52] mentioned that music teaching with technology has supported teachers’ teaching in the classroom in innovating their teaching methods and enriching learning resources. Music technology can improve teaching and learning efficiency and

quality compared to learning music from traditional equipment. Chen [53] and Wang [54] mentioned that music technology teaching improved the shortcoming of traditional music teaching and motivated students' learning enthusiasm, who pay more attention, while also improving the teachers' teaching quality.

According to Fishbein and Ajzen [55], the technology acceptance model (TAM) was developed by Davis in 1985 with the main purpose of providing external variables on the attitude, behavioral intention to use, and actual system use of technology. TAM was used for a multitude of technologies [56,57]. Perceived usefulness (PU) and perceived ease of use (PEOU) are the main two components that influence technology acceptance behavior (Figure 6).

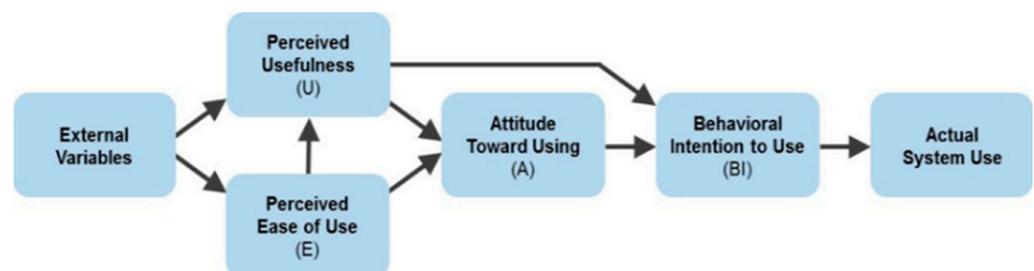


Figure 6. Technology Acceptance Model (TAM) (Davis, 1989).

Artificial intelligence (AI) technology has developed dramatically over the last five years, but AI learning for music still needs to be improved. AI technology can support teachers in preschool music teaching and preschool children in learning in an innovative way, as well as stimulate the students' motivation of learning [58]. AI technology's main purpose is to reflect human beings and technology interaction. Teachers are no longer the only source of knowledge to communicate with the students. AI music technology learning can improve the student's self-learning ability and reduce the time spent directly learning knowledge from the teachers. In addition, it can stimulate students' imagination and appreciation of music [25]. Electronic keyboard instruments are becoming more intelligent recently. According to the student's needs, they can arrange different timbres and melodies at flexible times and locations [59].

3. Hypothesis Development and Methodology

3.1. Research Question and Hypothesis

3.1.1. Research Question

Are there any differences in blended learning, music emotion, learning styles, technology acceptance, and students' satisfaction for being fond of playing instruments or not? (Figure 7).

3.1.2. Hypothesis

H1: *Blended learning and learning styles (visual, auditory, tactile) are statistically significant for students' satisfaction (interaction, structure, support).*

H2: *Music emotion and learning styles (visual, auditory, tactile) are statistically significant for students' satisfaction (interaction, structure, support).*

H3: *Technology acceptance and learning styles (visual, auditory, tactile) are statistically significant for students' satisfaction (interaction, structure, support).*

H4: *Listening to music has significant perceived explanatory variables for blended learning, music emotion, learning styles, technology acceptance, and students' satisfaction.*

H5: *Playing instruments have significant perceived explanatory variables for blended learning, music emotion, learning styles, technology acceptance, and students' satisfaction.*

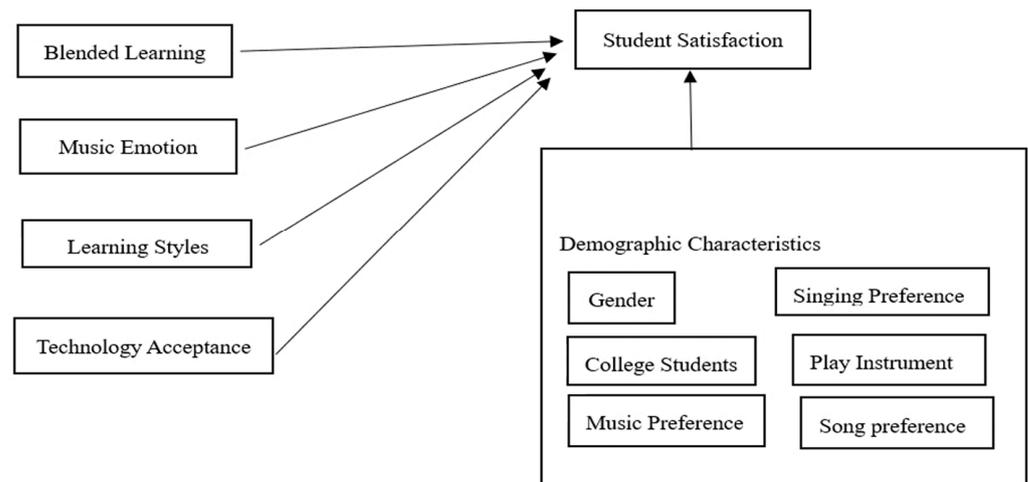


Figure 7. Hypothesized model of background characteristics, blended learning, music emotion, learning styles, technology acceptance, and student satisfaction.

4. Result

4.1. Research Question 1: Independence t-Test

Levene’s test for the equality of variances in Table 1 indicates that the variables of ‘students who like to play the instruments or not’ for blended learning ($p = 0.015$), music emotion ($p = 0.189$), learning styles ($p = 0.000$), technology acceptance ($p = 0.036$), and students’ satisfaction ($p = 0.023$). There are significant differences in learning styles for students in favor of playing instruments or not. Other variables did not differ significantly.

Table 1. Independent sample *t*-test for all variables of students who like playing instruments or not.

	F	Sig.	t	df	Sig. (Two-Tailed)
Blended Learning	2.624	0.106	2.437	292	0.015
			2.377	241.601	0.018
Music Emotion	1.824	0.178	1.316	292	0.189
			1.328	277.742	0.185
Learning Styles	2.793	0.096	3.578	292	0.000
			3.527	253.723	0.000
Technology Acceptance	0.034	0.853	2.109	292	0.036
			2.115	272.276	0.035
Student Satisfaction	1.713	0.192	2.286	292	0.023
			2.243	248.270	0.026

4.2. Hypothesis 1: Two-Way ANOVA Analysis

The value of significance ($p = 0.000$) in Table 2 indicates statistical significance. Therefore, research hypothesis 1 (blended learning and learning styles are statistically significant for students’ satisfaction) was supported.

4.3. Hypothesis 2: Two-Way ANOVA Analysis

The value of significance ($p = 0.000$) in Table 3 indicates statistical significance. Therefore, research hypothesis 2 (music emotion and learning styles are statistically significant for students’ satisfaction) was supported.

Table 2. Two-way ANOVA of Blended Learning, Learning Style, and Students' Satisfaction.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	41.136	126	0.326	2.284	0.000
Intercept	962.793	1	962.793	6735.689	0.000
Blended Learning	6.061	14	0.433	3.029	0.000
Learning Styles	8.248	23	0.359	2.509	0.000
Blended learning Learning styles	10.789	89	0.121	0.848	0.805

Table 3. Two-way ANOVA of Music Emotion, Learning Style, and Students' Satisfaction.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	59.174	235	0.252	2.504	0.000
Intercept	1668.748	1	1668.748	16,595.412	0.000
Music Emotion	17.357	82	0.212	2.105	0.002
Learning Styles	8.478	23	0.369	3.666	0.000
Music Emotion Learning Styles	17.369	130	0.134	1.329	0.112

4.4. Hypothesis 3: Two-Way ANOVA Analysis

The value of significance ($p = 0.000$) in Table 4 indicates statistical significance. Research hypothesis 3 (technology acceptance and learning styles are statistically significant for students' satisfaction) was supported.

Table 4. Two-way ANOVA of Technology acceptance, Learning Style, and Students' Satisfaction.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	46.145	122	0.378	3.429	0.000
Intercept	983.089	1	983.089	8913.021	0.000
Technology Acceptance	7.094	13	0.546	4.948	0.000
Learning Styles	4.759	23	0.207	1.876	0.013
Technology Acceptance Learning Styles	11.461	86	0.133	1.208	0.149

4.5. Hypothesis 4: Multiple Regression Analysis

The value of significance ($p = 0.140$) in Table 5 indicates there is no statistical significance. Therefore, research hypothesis 4 (listening to music has significant perceived explanatory variables for blended learning, music emotion, learning styles, technology acceptance, and students' satisfaction) was not supported.

Table 5. Multiple Regression R-Squared Analyses of Students Who Like to Listen to Music, Blended Learning, Music Emotion, Learning Styles, Technology Acceptance, and Student Satisfaction.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.166	5	0.033	1.678	0.140
Residual	5.711	288	0.020		
Total	5.878	293			

4.6. Hypothesis 5: Multiple Regression Analysis

The value of significance ($p = 0.140$) in Table 6 indicates there is no statistical significance. Therefore, research hypothesis 5 (Playing instruments has significant perceived explanatory variables for blended learning, music emotion, learning styles, technology acceptance and students' satisfaction) was not supported.

Table 6. Multiple Regression R-Squared Analyses of Playing Instruments, Blended Learning, Music Emotion, Learning Styles, Technology Acceptance, and Students' Satisfaction.

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.461	5	0.692	2.909	0.014
	Residual	68.539	288	0.238		
	Total	72.000	293			

4.7. Reliability Analysis

Table 7 indicates that Cronbach's alpha for internal consistency of all variables $\alpha = 0.876$ was an acceptable value of reliability. All of them were more than 0.70; therefore, internal consistency was satisfactory.

Table 7. Reliability Statistics for All Variables.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.876	0.879	57

4.8. Factor Analysis and Construct Validity

Table 8 shows the results of KMO and Bartlett's test of sphericity. The value of KMO for blended learning was 0.785, and there was a statistical significance of 0.000.

Table 8. KMO and Bartlett's Test Results on Blended Learning, Music Emotion, Learning Styles, Technology Acceptance, and Students' Satisfaction.

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.785
Bartlett's Test of Sphericity	Approx. Chi-Squared	550.467
	df	10
	Sig.	0.000

Table 9 shows that factor values were larger than 1 after varimax rotation was extracted, which accounted for approximately 58% of the total variance.

Table 9. Extraction Sums of Squared Loadings on All Variables.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1	2.902	58.037	58.037	2.902	58.037
2	0.883	17.657	75.694			58.037
3	0.549	10.971	86.666			
4	0.398	7.957	94.622			
5	0.269	5.378	100.000			

5. Conclusions

Research question 1: The result shows that the value of significance ($p = 0.000$) for learning styles and other variables did not differ significantly for whether students like to play instruments or not.

'Research Hypothesis 1: Blended learning and learning styles are statistically significant for students' satisfaction' was supported.

'Research Hypothesis 2: Music emotion and learning styles are statistically significant for students' satisfaction' was supported.

'Research Hypothesis 3: Technology acceptance and learning styles are statistically significant for students' satisfaction' was supported.

‘Research Hypothesis 4: Listening to music has significant perceived explanatory variables for blended learning, music emotion, learning styles, technology acceptance, and students’ satisfaction’ was not supported.

‘Research Hypothesis 5: Playing instruments has significant perceived explanatory variables for blended learning, music emotion, learning styles, technology acceptance, and students’ satisfaction’ was not supported.

6. Limitation and Future Study

The participants were only from two colleges. When the researchers were conducting the research and data collection during the pandemic for 2 years, we encountered difficulties in data collection. Colleges would not support completing the questionnaires because many students took remote courses and the return rate was low. Furthermore, the distribution in these groups was irregular. The case was limited to a small portion of educational research. While still valid, the results may be overgeneralized. In addition, we only tested undergraduate students. In future studies, we will compare the difference between public and private students. In addition, we will try to focus on specific musical instruments instead of general musical instruments, such as pianos, tambourines, recorders, ukuleles, and others. We will try to enlarge the number of universities and science and technology universities. Furthermore, we will try to test types of technology. More diverse ways will be tested to conduct the research.

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