Instructor-led or Learner-led for Elementary Learners to Learn Computer-based Music Composition?

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Abstract: The purpose of the present study was to examine the effects of instructional strategy (instructor-led vs. learner-led) and grade level (third grade vs. fifth grade) on elementary learners' music composition performance and attitude with the use of a computer-based music composition software. An experimental learning activity was implemented using 5E learning cycle as a pedagogical framework to facilitate learning. A quasi-experimental design was employed with elementary learners participated in the experiment. The results revealed that (a) fifth grader outperformed third graders in creativity, whereas third graders were extrinsically motivated and perceived that the computer-based music composition software was useful in learning music composition more than fifth graders were and did; and (b) learners with instructor-led instructional strategy outperformed learners with learned-led instructional strategy in creativity and craftsmanship and held high extrinsic motivation than learners with learner-led. The implementations and suggestions for future study were discussed in the present study.

Keywords: Information and Communication Technology (ICT), Music Composition, 5E Learning Cycle.

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1. Introduction

In the 21st century, it has been commonly agreed by Eastern and Western countries that all students should possess literacy on information and communication technology (ICT) (Ho, 2004). For instance, all students aged 7 to 16 in England are required to use ICT in their learning with different academic fields (Armstrong, 2008) and a 5-year plan related to the integration of ICT in education is implemented in Hong Kong for facilitating teachers' use of ICT in curricula (Ho, 2004). Moreover, studies about music education revealed that ICT could be used effectively to motivate students and enhanced students' music composition performance since ICT could be applied as a supporting tool to cultivate students' music composing skills and facilitate students to think independently.

Many researchers in Western countries believe that ICT can also be used effectively to facilitate music teaching (Tang, 2006). In England, the role of ICT in music is thought as a means to express one's ideas given that students can have their music knowledge and skills developed, as well as comprehension toward music enhanced (Armstrong, 2008). All fifth graders in Norway must learn how to compose through computer and information technology till the age of 16 (Rudi, 2007). Therefore, the education in music composition should have students' composing skills cultivated by ICT, exploring and experiencing.

There are two purposes of ICT in music education, one is a substitute of traditional instrument and the other is a means for students to have more exploration on music and software (Savage & Challis, 2002). The latter perspective was applied in the study. There are lots different kinds of computer software for music composition, and each of them has its own characteristics, teachers should determine software based on objectives of curriculum.

Music composition is a way to facilitate self-expression for children (Skott, 2006). However, the traditional instruction for music composition is limited by short class hours, insufficient instrument in classroom and instructor-led approach (Seddon, 2006), which negatively affect the development of creativity and music literacy and even lowers music learning motivation among children. On the other hand, grade level is also a factor that affects children's music composition performance and music learning attitudes due to prior knowledge and skills (Younker, 1997). Such problems can be overcome by information and communication technology (ICT) (Tang, 2006). Nevertheless, ICT itself can only be a tool for supporting teaching and learning, the key to facilitate learners' learning attitudes and performance is the instructional strategy (Truman, 2005).

Although ICT was a powerful tool for supporting teaching and learning in music composition, instructional strategies was also crucial for facilitating learners' music learning attitudes and music composition performance. The instructional model of the 5E learning cycle was proved to be an effective instructional strategy in science education (Lawson, Abraham & Renner, 1989; Bybee, 1993). However, there is a lack of studies for applying the 5E learning cycle model in music education, so different instructional strategies with the 5E learning cycle model and the integration of ICT in music composition need to be further examined. Therefore, the present study aimed to examine the effects of instructional strategy, including instructor-led (I-led) and learner-led (L-led), and grade level, including third grade and fifth grade, on music composition performance and attitude with elementary school students by the 5E learning cycle and the implementation of music composition software.

2. The Theoretical Framework

2.1. Instructor-led versus learner-led

Both instructor-led and learner-led instruction recognized the student as a key factor in improving student achievement (Brown, 2003). Instruction-led instruction was related to the transmission of knowledge and focused more on content itself than learner processing (Brown, 2003). Learner-led instruction is a form of active learning where learners were engaged and involved in what they were learning; and through learner-led instruction, learners could be self-sufficient, creative thinkers and people who appreciate and value the subject being taught, which made it was possible for learners to explore ideas and teach themselves (Brown, 2008).

2.2. The 5E learning cycle model

The learning cycle model was first developed by Karplus who was a physicist in University of California, and afterward was modified by Biological Science Curriculum Study (BSCS) in USA (Bybee, 1993). The modified model has been called 5E learning cycle. The 5E learning cycle model is based on the principle that knowledge is constructed by experiences, as the claim of cognitive theory by Piaget (Marek, Gerber, & Cavallo, 1998). There are five teaching stages in the model, including engagement, exploration, explanation, elaboration and evaluation (Bybee, 1993), as shown in Table 1. Engagement is a preparing stage that aims to stimulate learners' learning motivation and facilitate learners to be active in the participation of learning activities. The purpose of exploration is to provide learners a session for exploring, which learners will be able to construct knowledge through doing or experiencing. Learners will, then, provide explanation on the phenomenon they observed in their own words during the explanation stage. The intention of elaboration is to see if learners can apply and extend new knowledge they have constructed to other new situations. Finally, evaluation is a stage for learners to evaluate what they have done.

Although the 5E learning cycle model is used to apply in science education, the model may also work in music education since many studies related to music composition and creativity showed that exploration is very crucial during composing process (Sternberg, 1988; Webster, 1996). Moreover, worked-examples by instructor also played an important role in composing process given that there were many researchers pointed out that worked-examples given by instructor could be helpful for learners to construct knowledge during the process of exploration (Bruner, 1986; Wood, Bruner, & Ross, 1976; Vygotsky, 1978), and worked-examples and guidance could be supportive in composing process (Nilssona & Folkestad, 2005). Therefore, the effects of type of instructional strategy (instructor-led vs. learner-led) on elementary learners' music composition performance and attitude using music composition software were examined in the present study.

Table 1. The comparison of the 5E learning cycle model in science education and in the present study

Stages	The 5E learning cycle model in science education	The 5E learning cycle in the present study
Engagement	Object, event or question used to engage students. Connections facilitated between what students know and can do.	Stimulating students' learning motivation on music composition by showing a completed music composition and asking questions.
Exploration	Objects and phenomena are explored. Hands-on activities, with guidance.	Music and software are explored. Learning by doing, with guidance. Create rhythm and melody.
Explanation	Students explain their understanding of concepts and processes. New concepts and skills are introduced as conceptual clarity and cohesion are sought.	Students explain their creation of rhythm and melody.
Elaboration	Activities allow students to apply concepts in contexts, and build on or extend understanding and skill.	Activities on music composition allowing students to apply and extend the rhythm and melody they have done in music composition.
Evaluation	Students assess their knowledge, skills and abilities. Activities permit evaluation of student development and lesson effectiveness.	Students assess their music knowledge, computer skill and composing ability. Activities permit evaluation of student development and lesson effectiveness.

Reference: Bybee (1993)

2.3. Grade levels

Grade levels can also affect one's music composition performance. Dasgupta (1996) stated that knowledge was an important basis for the development of creativity. Wilson and Wales (1995) pointed out that the older the children were, the complex the music composition was; and children who had previous music training would also make a more complex music composition. However, Ward, Saunders and Doods (1999) concluded that a) pre-school children's creativity was enhanced as aging; and b) creativity was most enhanced during pre-adolescence but declined afterwards. Furthermore, some researchers found that visual approaches employed in music composition would be helpful to people with all ages (Bamberger, 1982; Davidson & Scripp, 1988).

In order to better understand the effect of grade levels on music composition performance and attitude among elementary school students, third graders and fifth graders have been chosen in the present study since the educational system in Taiwan does not include computer and music as an independent course during first grade and second grade meaning that third graders are categorized as computer and music novices and fifth graders are categorized as advanced computer and music learners.

3. Research Methods

A quasi-experimental design was conducted to examine the effects of instructional strategy (instructor-led vs. learner-led) and grade level (third grade vs. fifth grade) on elementary learners' music composition performance and attitude toward the learning activity. A computer-based music composing tool, *Hyperscore*, developed by the team in the MIT Media Lab was employed as a means to enhance intuitive and fluent musical composition experiences for the learners in a 5E task-oriented learning activity. The software is suitable for beginners and young children who have not been trained in music, and users can create music compositions by a visual approach of "drawing" with little effort, as shown in Figure 1.

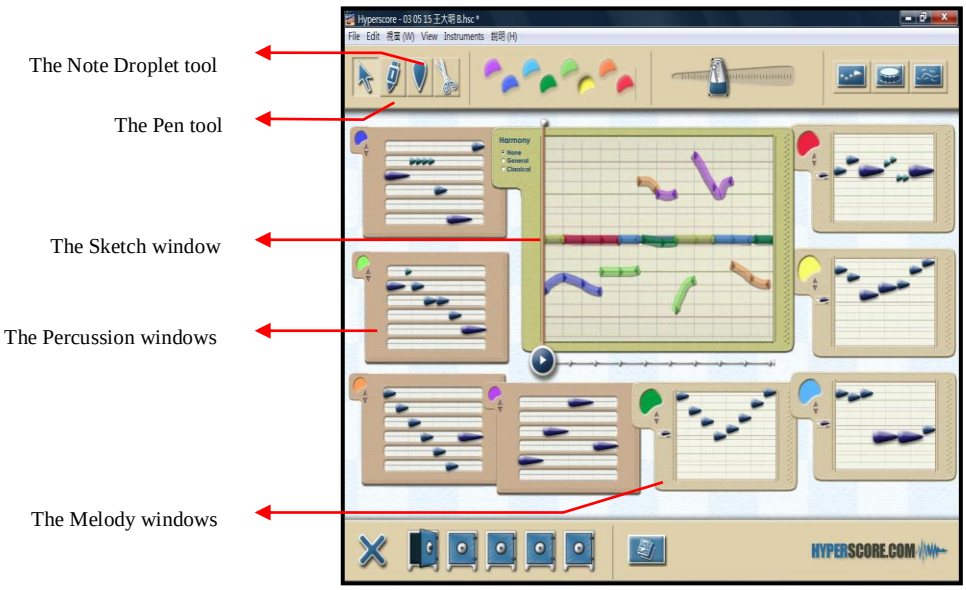

Figure 1. *Hyperscore* uses a visual approach for users to compose music with little effort

Participants were 62 third graders with low prior knowledge and skills on computer and music and 60 fifth graders with relatively high prior knowledge and skills on computer and music, and were assigned to two different groups by class. One of the groups named instructor-led (I-led) and the other named learner-led (L-led), as shown in Table 2.

Table 2. The instructional design for the instructor-led and learner-led groups

Inst. stages	Instructor-led (I-led)	Learner-led (L-led)
Engagement	Stimulating participants' learning motivation by questioning and answering	
Exploration	Creating rhythm and melody: Demonstration was provided by teacher	Creating rhythm and melody: Learner exploration
Explanation	Participants explain their creation of rhythm and melody by completing worksheet	
Elaboration	Music composition: Demonstration was provided by teacher	Music composition: Learner exploration
Evaluation	Participants assess their own music composition	

The 5-stage learning activity lasted 80 minutes and consisted of a) Engagement—learning goals and illustrations of *Hyperscore* music; b) Exploration—practice with the use of *Hyperscore* and create rhythm and melody; c) Explanation—explain the creation of rhythm and melody; d) Elaboration—music composition; e) Evaluation—assess music knowledge, computer skills and composing ability.

After the experimental learning activity, participants' compositions and notes of the theme and thoughts were collected and evaluated by three domain experts based on a rubric for music composition with three aspects including aesthetic appeal, creativity and craftsmanship. Aesthetic appeal with two assessing items measured general impression of music composition to see if the composition would be enjoyed by listeners and keep the listeners interested (Hickey, 1999). Creativity with two assessing items evaluated whether the composition included very original, unusual, or imaginative musical ideas and explored and varied at least tow musical elements (Hickey, 1999). Craftsmanship with six assessing items assessed if the composition presented at least one complete musical idea, had a coherent and organized form with a clear beginning, middle and end, and used musical elements to organize musical ideas or the form (Hickey, 1999). Three domain experts rate participants' music composition on a 5-point Likert-type scale with score options from 1 (low) to 5 (high). The content validity coefficient of participants' music composition was .58, as measured by Kendall's coefficient of concordance.

Then, a questionnaire about attitude toward the learning activity with three aspects including extrinsic motivation, perceived easiness and perceived usefulness was conducted to collect participants' level of extrinsic motivation and perception on easiness and usefulness toward the music composing software. There were six items for extrinsic motivation, seven items for perceived easiness and eight items for perceived usefulness. Participants were asked to rate themselves on a 5-point Likert-type scale with response options from 1 (strongly disagree) to 5 (strongly agree). The reliability coefficient of the measures of attitude was .831, as measured by Cronbach's α.

4. Results

In the present study, the collected data was first examined by descriptive statistics to explore the group means, standard deviations and numbers. Then, two-way multivariate analysis of variance (MANOVA) was conducted to examine the effects of instructional strategy and grade level on music composition performance and attitude toward the experimental learning activity. The analyses are described as follows.

4.1. Analysis of the effect on music composition performance

To explore the effects of instructional strategy and grade level on participants' music composition performance, the group means, standard deviations and numbers of music composition performance were firstly analyzed by descriptive statistics, as shown in Table 3. The average mean score equaled to 2.709 out of a total score of 5 in the aspect of aesthetic appeal, 3.482 in creativity and 3.342 in craftsmanship. For grade levels, the mean scores on aesthetic appeal, creativity and craftsmanship for fifth graders were higher than third graders. On the other hand, for instructional strategy, the mean scores on aesthetic appeal, creativity and craftsmanship of learners with instructor-led were higher than learners with learner-led.

Table 3. Group means, standard deviations and numbers of music composition performance

Aspects	Independent variables		Mean	Standard deviation	N
Aesthetic appeal	Grade level	Third grade	2.667	0.646	61
		Fifth grade	2.751	0.651	59
	Inst. strategy	I-led	2.732	0.677	62
		L-led	2.684	0.618	58
Creativity	Grade level	Third grade	3.388	0.609	61
		Fifth grade	3.579	0.479	59
	Inst. strategy	I-led	3.610	0.559	62
		L-led	3.345	0.520	58
Craftsmanship	Grade level	Third grade	3.284	0.661	61
		Fifth grade	3.402	0.533	59
	Inst. strategy	I-led	3.465	0.635	62
		L-led	3.211	0.541	58

Two-way MANOVA was conducted to examine the effects of instructional strategy and grade level on participants' music composition performance. The significance level was set to .05 for the analysis. Box's test of equality of covariance matrices was insignificant (F = 1.323, p = .161). The error variance of the dependent variables was equal across groups. The homogeneity assumption was sustained.

The summary of two-way MANOVA on participants' music composition performance is shown in Table 4. The interactions of grade level and instructional strategy for the aspects of aesthetic appeal, creativity and craftsmanship were insignificant. The main effects of grade level were only significant for creativity ($F_{(1, 115)}$

= 4.500, $p < .05$), meaning that fifth graders were significantly creative than third graders. The main effects of instructional strategy were significant for all the aspects but aesthetic appeal (creativity: $F_{(1, 115)} = 7.977$, $p < .05$; craftsmanship: $F_{(1, 115)} = 5.957$, $p < .05$), implying that learners with instructor-led obtained significantly higher scores on creativity and craftsmanship than learners with learner-led.

Table 4. Two-way MANOVA summary on music composition performance

Source	Aspects	Type III Sum of Square	df	Mean Square	F	Sig.
Perceived-Computer ability	Aesthetic appeal	1.877	1	1.877	4.620	0.034
	Creativity	0.197	1	0.197	0.688	0.409
	Craftsmanship	0.518	1	0.518	1.481	0.226
Grade level	Aesthetic appeal	0.212	1	0.212	0.521	0.472
	Creativity	1.289	1	1.289	4.500*	0.036
	Craftsmanship	0.527	1	0.527	1.507	0.222
Instructional strategy	Aesthetic appeal	0.111	1	0.111	0.273	0.602
	Creativity	2.286	1	2.286	7.977*	0.006
	Craftsmanship	2.083	1	2.083	5.957*	0.016
Grade level * Inst. strategy	Aesthetic appeal	0.712	1	0.712	1.752	0.188
	Creativity	0.121	1	0.121	0.121	0.517
	Craftsmanship	0.006	1	0.006	0.006	0.895
Error	Aesthetic appeal	46.724	115	0.406		
	Creativity	32.949	115	0.287		
	Craftsmanship	40.223	115	0.350		

* $p < .05$

4.2. Analysis of the effect on attitude

To explore the effects of instructional strategy and grade level on participants' music composition attitude, the group means, standard deviations and numbers of attitude toward music composition were firstly analyzed by descriptive statistics, as shown in Table 5. The average mean score equaled to 3.439 out of a total score of 5 in the aspect of extrinsic motivation, 3.582 in perceived easiness and 3.572 in perceived usefulness. For grade level, the mean scores on all the aspects of the third graders were higher than the fifth graders. For instructional strategy, the mean scores on all the aspects of learners with instructor-led were higher than learners with learner-led.

Table 5. Group means, standard deviations and numbers of music composition attitude

Aspects	Independent variables		Mean	Standard deviation	N
Extrinsic motivation	Grade level	Third grade	3.643	0.655	62
		Fifth grade	3.225	0.919	59
	Inst. strategy	I-Led	3.584	0.809	62
		L-Led	3.286	0.807	59
Perceived easy-of-use	Grade level	Third grade	3.732	0.928	62
		Fifth grade	3.424	1.138	59
	Inst. strategy	I-Led	3.611	0.974	62
		L-Led	3.551	1.119	59
Perceived usefulness	Grade level	Third grade	3.747	0.842	62
		Fifth grade	3.388	1.041	59
	Inst. strategy	I-Led	3.713	0.968	62
		L-Led	3.423	0.932	59

Two-way MANOVA was conducted to examine the effects of instructional strategy and grade level on participants' attitude toward music composition. The significance level was set to .05 for the analysis. Box's test of equality of covariance matrices was significant (F = 1.236, p = .221). The error variance of the dependent variables was equal across groups. The homogeneity assumption was sustained.

The summary of two-way MANOVA on participants' attitude regarding music achievement is shown in Table 6. The interactions of grade level and instructional strategy for all the aspects were insignificant. The main effects of grade level were significant on all the aspects but perceived easiness (extrinsic motivation: $F_{(1, 116)} = 8.879$, $p < .05$; perceived usefulness: $F_{(1, 116)} = 4.844$, $p < .05$), indicating that third graders had significantly higher extrinsic motivation than fifth graders, and both graders had positive attitude toward the usefulness of music composition software, but third graders were more positive than fifth graders . The main effects of instructional strategy were significant on extrinsic motivation ($F_{(1, 116)} = 4.504$, $p < .05$), implying that participants with I-led instructional strategy were motivated extrinsically more than participants with L-led instructional strategy.

Table 6. Two-way MANOVA summary on music composition attitude

Source	Aspects	Type III Sum of Squares	df	Mean Square	F	Sig.
Perceived computer ability	Extrinsic motivation	6.295	1	6.295	11.079	0.001
	Perceived easy-of-use	27.987	1	27.987	32.642	0.000
	Perceived usefulness	16.999	1	16.999	22.698	0.000
Grade level	Extrinsic motivation	5.045	1	5.045	8.879*	0.004
	Perceived easy-of-use	2.792	1	2.792	3.256	0.074
	Perceived usefulness	3.628	1	3.628	4.844*	0.030
Instructional strategy	Extrinsic motivation	2.559	1	2.559	4.504*	0.036
	Perceived easy-of-use	0.103	1	0.103	0.120	0.730
	Perceived usefulness	2.467	1	2.467	3.294	0.072
Grade level * Inst. strategy	Extrinsic motivation	0.283	1	0.283	0.498	0.482
	Perceived easy-of-use	0.656	1	0.656	0.765	0.383
	Perceived usefulness	0.185	1	0.185	0.247	0.620
Error	Extrinsic motivation	65.915	116	0.568		
	Perceived easy-of-use	99.458	116	0.857		
	Perceived usefulness	86.874	116	0.749		

* $p < .05$

5. Discussions

According to the study result, although both graders were creative on music composition and held a positive attitude toward music composition, fifth graders were more creative than third graders, third graders had higher extrinsic motivation than fifth graders and third graders thought that *Hyperscore* was usefulness for music composition than fifth graders did. It was not surprising that fifth graders received higher score on creativity than third graders since fifth graders had already taken computer and music classes for two years meaning that fifth graders had more experiences than third graders. It was interesting that third graders had higher extrinsic motivation than fifth graders after the experimental learning activity. This could be explained by the fact that the music composition software, provided an opportunity for learners to present their compositions to the class, which made learners possibly to receive praise from teacher and peers, and since third graders were novices in music composition, a desire for receive praise from teacher and peers could be stronger than fifth graders. Moreover, third graders possessed more positive attitude toward the usefulness of the music composition software, than fifth graders indicating that *Hyperscore* was helpful for novices in learning music composition.

In addition, regardless of the instructional strategy, learners performed well on aesthetic appeal, creativity and craftsmanship indicating that both experimental learning activities were efficient to music composition. However, the result revealed that learners received instructor-led instructional strategy outperformed significantly than learners received learner-led instructional strategy on creativity and craftsmanship indicating that worked-examples from teachers would be helpful to learners than without worked-examples, which contradicted earlier assumption that learner-led instruction would lead

students to perform better. This could be explained by the fact that learners received learner-led instructional strategy may need more time to explore music and software in order to enhance learners' music composition performance. Thus, it was suggested to implement experimental learning activities with a longer composing session in the future study. Furthermore, it was not surprising that learners received instructor-led instructional strategy possessed higher extrinsic motivation than learners received learner-led instructional strategy for the reason that learners in learner-led learning activity was required to hold higher intrinsic motivation or to be active in order to learn well, as suggested by American Psychology Association (1997) that learner-led instruction means fostering intrinsic motivation by emphasizing conceptual understanding and its application over rote learning. Hence, it was suggested to examine learners' intrinsic motivation, not only extrinsic motivation, in the further study.

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