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The Effectiveness of Adapting the Six Thinking Hats Model into Music Courses to Improve Critical Thinking Skills

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ABSTRACT

The purpose of this study was to assess the effectiveness of adopting the Six Thinking Hats (STH) model into music appreciation courses to examine the improvement in student critical thinking skills. The research employed a pre-experimental research design with a single group pre-test and post-test design. The study was a quantitative study analyzing the results of a critical thinking pre-test and critical thinking post-test for a sample of 24 college students. The results of the study revealed that adapting the STH model for discussion activities resulted in more positive results compared to other teaching techniques proposed in the curriculum.

Keywords: Six Thinking Hats Model, Critical Thinking Skills, Music Appreciation Course, General Education

1. Introduction

Developing critical thinking skills are pervasive issues that have a significant impact in the higher education field (Geissler, Edison, & Waylad, 2012; Johnson, 2011; Roy & Macchiette, 2005; Smialek & Boburka, 2006; Topoğlu, 2014). One of the important goals in education is developing individuals who can think critically in everyday life (Roy & Macchiette, 2005; Smialek & Boburka, 2006). Improving critical thinking skills is an expected student outcome in many general education courses. Students seek elective courses that can enhance knowledge to improve their critical thinking skills. Educators seek creative teaching strategies, methods, and curricula to challenge students' critical thinking skills. As an experiment, adapting the Six Thinking Hats (STH) model (De Bono, 1985) could be a pedagogical strategy to improve students' critical thinking skills.

As De Bono (1985) stated, thinking categories in the STH model are classified by six different-colored (white, red, black, yellow, green, and blue) hats. The six metaphorical hats are used to guide the thinking process when dealing with complex issues and those are identified as follows: (1) The White Hat provides facts and figures for information that needed: (2) The Red Hat presents the language of feelings and intuition: (3) The Black Hat signifies logics, embedding value and careful cautions: (4) The Yellow Hat focuses on the positive and constructive in attitude: (5) The Green Hat offers new ideas and alternatives to find a better solution on creativity: (6) The Blue Hat controls the overall discussion structure. This model helps individual and team members think and classify ideas in structural divergence. It also helps to avoid confusion in the thinking process.

Several scholars have described the effectiveness of using the STH model in various environments. Dhanapal and Ling (2013) examined how the STH model can be used to enhance learning in environmental studies. Aithal and Kumar (2017) analyzed the lateral thinking process through the STH model that can be applied in business organizations. Gencel and Gencel (2018) also acknowledged the positive aspects of implementing the STH model to solve the problem or to understand the issue of dealing with tax law. Jarrah (2019) investigated the level of practicing the STH model among vocational education teachers in Jordan and identified the relationship between the skill level of teachers and the extent to the skill application.

Since the STH model has been suggested to be one of the creative transitioning teaching tools, several researchers have adapted the STH technique to teach critical thinking skills in their educational courses. Geissler, Edison, and Waylad (2012) utilized the STH model as a teaching tool to promote interactive discussions in their marketing courses. By facilitating in-class game activities, their online survey results showed that using the STH model is an effective technique to teach critical thinking skills, to stimulate creative discussions, and to be more flexible in teamwork operation (Geissler, Edison, & Waylad, 2012, p. 3).

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Kaya (2013) investigated the effectiveness of the STH model on student success in geography classes. The study used a pre-test, post-test control group design. There were two different groups, one in the experiment group taught with the STH model and the other in the control group taught with a normal curriculum. The responses from students were analyzed based on the descriptive and content analysis methods. Also, interview questions (42 multiple choice questions) were provided to measure the student's success. The results show that the averages of the experimental group were higher than the averages of the control group in terms of students' academic success. The teaching strategies based on the STH model were effective and contributed to the development of students' thinking skills.

Azzez (2016) examined the effect of the STH model on innovative competence among randomly selected social workers in Ogun State, Nigeria. The study was conducted with the use of pre-test, post-test quasi-experimental design for the data collection, and analysis of variance for data analysis. The results revealed that the STH technique "significantly affected the innovative competence of participants and the participants in the experimental group had higher scores on the innovative competence scale than their counterparts in the control group" (Azzez, 2016, p. 152).

2. Materials and Methods

As researchers and scholars suggested various ways to adapt the STH model, the goal of this study was to measure the effectiveness of the STH model on students' critical thinking skills by integrating the STH model into music appreciation general education courses. The STH model was used to structure concepts and ideas for discussion activities. The research employed a pre-experimental research design with a single group pre-test and post-test design (Creswell, 2003, Marsden & Torgerson, 2012). Students were given the pre-test at the beginning of the semester. After the completion of the pre-test, students were introduced to the STH model. The authors introduced the STH model to be used along with discussion activities as part of the teaching materials. Students were provided discussion rubrics to further facilitate the thinking process to show each color and apply it to the separate thinking categories that integrate the STH model into musical listening components. Listening examples were selected from the textbook *Listen* (Kerman & Tomlinson, 2015) and music examples are selected from YouTube. The use of the STH model continued for the remainder of the semester.

For the first two activities, the authors facilitated the discussion activities to ensure that students think and share their opinions in a structured environment so that they can stay on track. Then, students in the classroom were divided into several groups (5-6 students for each) and managed their activities to share the ideas and answers back and forth with the questions. At the end of each discussion activity, the representative facilitator in each group evaluated their discussion performances based on the rubrics provided by the author. Those discussion activities took place eight (8) times (40 minutes each) during the semester, along with regular course lectures, writing assignments, quizzes, and exams. After the semester, students took the post-test. Grades on the pre-test and post-test were collected and compared for analysis.

Testing conditions were the same for the pre-test and post-test. Students completed each test outside of class via the class learning management system. Students were given one opportunity to complete each test. Each test had a sixty-minute time limit. Students were prevented from seeing their scores on either test. Students were prevented from reviewing the pre-test during the semester and before taking the post-test.

There are several standardized tests used to measure critical thinking skills. For example, Education Testing Service (ETS) has a product, HEIghten Outcomes Assessment Suite, measuring critical thinking skills, and the Council for Aid to Education (CAE) produces the Collegiate Learning Assessment (CLA) which partly measures critical thinking skills. Each of these products can be purchased for use on a per-test basis. Given the fact that our research budget for this study was zero, we decided to use a free critical thinking test produced by Assessment Day (https://www.assessmentday.co.uk/). We obtained permission from Assessment Day to use and reproduce the test on our LMS for our research project.

The Assessment Day test is made up of five sections. The five sections are 1. inferences (14), 2. assumptions (14), 3. deductions (21), 4. interpreting information (12), and 5. arguments (25). The number of questions in each section varies. The number of questions in each section is provided in parentheses. Scores were not calculated as a percentage score. Scores were recorded as the number of questions correct on the overall test as well as the number of questions correct within each section. As stated in the test booklet "…critical thinking test assesses your ability to make inferences and logical assumptions and to reason with supported arguments." It should be noted that Assessment Day has not done any research on validity and reliability.

Along with pre-test and post-test scores, data were collected on each student. Institutional Review Board approval was obtained for this research. All personal identity information was removed from the dataset once data collection was completed. Data included career GPA (before the semester in which the experiment was conducted), career credit hours earned (before the semester in which the experiment was conducted), semester GPA (after the semester in which the experiment was conducted), student major, and student sex. Summary statistics are presented in Table 1. There were 36 students enrolled in two sections of the course at the beginning of the semester. Of these, 30 students completed the pre-test. One student withdrew from the course shortly after the semester began. This student did not complete the pre-test. Thirty-one students completed the post-test. Observations dropped if the student did not complete one of the tests. This left us with 24 observations who completed both the pre-test and post-test.

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Table 1: Summary Statistics of Variables

	Obs.	Mean	Std. Dev.	Min	Max
GPA	22	3.13	.61	1.75	4
Credits Hours Earned	24	57.3	40.84	0	161
Semester GPA	24	3.47	.47	2.17	4
Pre-Test Score	24	49	15.25	33	85
Post-Test Score	24	56.8	19.76	35	85
Difference (Post-Test – Pre-Test)	24	7.8	13.97		

Two students in the sample had no career GPA before the semester in which the experiment took place. Nine students in the sample were female and 15 students were male. The course in which the experiment was conducted is a general education course. The selected major of the students varied. There were 17 different majors among the 24 observations. The highest number of majors was in early childhood education. Three students were early childhood education majors. The relationship between major and pre-test score was weak. The correlation coefficient was -0.17. There was a weak relationship between total credit hours earned and scores on the pre-test. The correlation coefficient was 0.33. More surprising was the relationship between career GPA and pre-test scores. The correlation coefficient was 0.12. Although student characteristics varied, the above measures provide anecdotal evidence to support the claim that the students at this university are a homogeneous group.

3. Results and Discussion

The main purpose of this research is to test the difference between student scores on critical thinking pre-test and post-test. The null and alternative hypotheses are as follows:

$$H_0: \mu_{pre} \geq \mu_{post}$$

$$H_a: \mu_{pre} < \mu_{post}$$

A paired-sample *t* test was calculated to compare the mean post-test score to the mean pre-test score. The mean on the pre-test was 49 (*sd* = 15.25) and the mean on the post-test was 56.8 (*sd* = 19.76). A statistically significant increase was found ($t(23) = 2.75$, $p = 0.005$). The results indicate that the intervention, introducing and utilizing the STH model, had a statistically significant impact on student critical thinking skills as measured by the Assessment Day test.

Table 2: t-Test: Paired Sample for Means, Overall Test Score

	Post-test	Pre-test
Mean	56.8	49
Standard Deviation	19.76	15.25
Observations	24	24
Pearson Correlation	0.71	
Hypothesized Mean Difference	0	
df	23	
t Stat	2.75	
P(T<=t) one-tail	0.005	
t Critical one-tail	1.71	

The same hypotheses and procedure was used to compare the mean scores on each section of the exam. Section 1 of the test measures inferences. As indicated in the test instructions, "…questions in this section of the test will begin with a statement of facts that must be regarded as true. After each statement you will be presented with possible inferences which might be drawn from facts in the statement" (Assessment Day, p. 2). A paired-sample *t* test was calculated to compare the mean Section 1 post-test score to the mean Section 1 pre-test score. The mean on the Section 1 pre-test was 5.13 (*sd* = 4.13) and the mean on the

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Section 1 post-test was 7.04 (*sd* = 4.21). A statistically significant increase was found ($t(23) = 2.85$, $p = 0.005$). The results indicate that the intervention increased students' skills on the inferences section of the test.

Table 3: t-Test: Paired Sample for Means, Section 1 Test Scores

	Post-test	Pre-test
Mean	7.04	5.13
Standard Deviation	4.21	4.13
Observations	24	24
Pearson Correlation	0.69	
Hypothesized Mean Difference	0	
df	23	
t Stat	2.85	
P(T<=t) one-tail	0.005	
t Critical one-tail	1.71	

Section 2 of the test measures assumptions. The instructions state: "Each statement will be followed by a series of proposed assumptions. You must decide which assumptions are logically justified based on the evidence in the statement" (Assessment Day, p. 12). A paired-sample *t-test* was calculated to compare the mean Section 2 post-test score to the mean Section 2 pre-test score. The mean on the Section 2 pre-test was 8.21 (*sd* = 3.04) and the mean on the Section 2 post-test was 9.71 (*sd* = 3.30). A statistically significant increase was found ($t(23) = 2.50$, $p = 0.009$). The results indicate that the intervention increased students' skills in the assumptions section of the test.

Table 4: t-Test: Paired Sample for Means, Section 2 Test Scores

	Post-test	Pre-test
Mean	9.71	8.21
Standard Deviation	3.30	3.04
Observations	24	24
Pearson Correlation	0.71	
Hypothesized Mean Difference	0	
df	23	
t Stat	2.50	
P(T<=t) one-tail	0.009	
t Critical one-tail	1.71	

Section 5 of the test measures analyzing arguments. The instructions state: "A strong argument is both important and directly related to the question. A weak argument is not directly related to the question or is of minor importance. A weak argument may also be related to a trivial aspect of the question or confuses correlation with causation" (Assessment Day, p. 37). A paired-sample *t-test* was calculated to compare the mean Section 5 post-test score to the mean Section 5 pre-test score. The mean on the Section 5 pre-test was 14.96 (*sd* = 4.52) and the mean on the Section 5 post-test was 16.92 (*sd* = 6.12). A statistically significant increase was found ($t(23) = 1.98$, $p = 0.03$). The results indicate that the intervention increased students' skills in the analyzing arguments section of the test.

Table 5: t-Test: Paired Sample for Means, Section 5 Test Scores

	Post-test	Pre-test
Mean	16.92	14.96
Standard Deviation	6.12	4.52
Observations	24	24
Pearson Correlation	0.62	
Hypothesized Mean Difference	0	
df	23	
t Stat	1.98	
P(T<=t) one-tail	0.03	
t Critical one-tail	1.71	

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Results analyzing Sections 3 and 4 were not statistically significant. Section 3 of the test measured deductions. For this section "…a statement will be provided followed by a series of suggested conclusions. Here, you must take the statement to be true. After reading each conclusion underneath the statement, you must decide whether you think it follows from the statement provided" (Assessment Day, p. 19). Section 4 of the test measures interpreting information. "The following questions will consist of a passage of information, followed by a series of conclusions. You are instructed to assume all information in the passage is true. The task is to judge whether or not each of the proposed conclusions logically flows beyond a reasonable doubt from the information given in the paragraph" (Assessment Day, p. 29).

The mean on the Section 3 pre-test was 13.17 (sd = 4.42) and the mean on the Section 3 post-test was 14.71 (sd = 5.09). No significant difference was found between two Section 3 scores ($t(23) = 1.47$, $p > 0.05$). The mean on the Section 4 pre-test was 7.54 (sd = 2.55) and the mean on the Section 4 post-test was 8.46 (sd = 2.99). No significant difference was found between the Section 4 scores ($t(23) = 1.65$, $p > 0.05$).

Table 6: t-Test: Paired Sample for Means, Section 3 Test Scores

	Post-test	Pre-test
Mean	14.71	13.17
Standard Deviation	5.09	4.42
Observations	24	24
Pearson Correlation	0.42	
Hypothesized Mean Difference	0	
df	23	
t Stat	1.47	
P(T<=t) one-tail	0.07	
t Critical one-tail	1.71	

Table 7: t-Test: Paired Sample for Means, Section 4 Test Scores

	Post-test	Pre-test
Mean	8.46	7.54
Standard Deviation	2.99	2.55
Observations	24	24
Pearson Correlation	0.53	
Hypothesized Mean Difference	0	
df	23	
t Stat	1.65	
P(T<=t) one-tail	0.06	
t Critical one-tail	1.71	

As noted in Marsden and Torgerson (2012), pre-experimental research designs have some potential flaws. Pre-experimental designs cannot control factors leading to higher scores that are beyond the control of the researchers. Learning occurs outside of the experiment which could lead to higher post-test scores. Another possibility is that students in the experiment simply mature during the long period between the pre-test and post-test. The possibility exists that "…participants remembering questions or the questions raising awareness and triggering learning after the pre-test, independent of the subsequent intervention" (Marsden & Torgerson, 2012, p. 585). We attempted to limit this possibility by hiding the pre-test and pre-test scores in our LMS during the semester. Students were only able to see their pre-test scores after completing the post-test.

Galton (1886) (as cited in Marsden & Torgerson, 2012. p. 585), found RTM or regression to mediocrity while doing his research. Evidence of the RTM effect would show up in comparing pre-test and post-test scores of the lowest and highest pre-test performers (Marsden & Torgerson, 2012). Those scoring lower on the pre-test would have larger gains on the post-test compared to those scoring higher on the pre-test. We calculated the correlation between pre-test scores and the post-test minus pre-test difference. We find a weak, near-zero, correlation (-.09, p = 0.69) between the pre-test and the post-test minus pre-test score difference.

4. Implementations to facilitate the Six Thinking Hats Method

Based on our project, we learned that collaborating and/or integrating music pedagogy with different disciplines can improve students' critical thinking skills in general education music courses. The STH method can be used as one of the creative

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tools for music educators to use to improve students' critical thinking skills. What are the benefits of adopting the STH method to improve students' critical thinking skills in music? How will students adapt to the integration of this teaching method?

When we teach music, there are many important elements to cover with a wide selection of musical literature and cultural sources to expand knowledge of music. As an experiment, adapting the STH method could be a pedagogical strategy to establish the basic structure of discussion activities in music courses. These range from the basic musical terminology to various performance practices. The STH method can be used to provide guidelines and structure that can improve the musical thinking process and lead to better performances. It can also be used to identify fundamental components when listening to musical compositions. The rehearsal methodology for instrumental ensemble and/or choir can be developed based on the STH method by establishing six thinking hats categories. Any type of music lesson plan for teaching can be designed based on the STH method by presenting a comparison and contrast of specific compositions.

For the STH method to be successful, music teachers must encourage students to categorize their ideas based on the six different hats and apply it to their thinking process across disciplines. Teachers will have to monitor students to stay on track. Music educators, therefore, will need to work with teachers from other subject areas to ensure that students are allowed to practice applying critical thinking skills to different contexts. Increasing the complexity of problems over time will result in subtle but measurable improvements in students' critical thinking skills. With the STH method, students will be able to think more clearly. Students will be able to better organize their thoughts and ideas when dealing with complex problems. Moreover, by integrating the STH method across disciplines, students will become more familiar with and more receptive to a new different way of thinking. By simplifying the thinking process, the STH method can make problem-solving fun.

5. Conclusion

This research investigated using the Six Thinking Hats model to improve student critical thinking skills in general education music appreciation courses. A pre-experimental research design was employed with a single group pre-test and post-test. Results showed a statistically significant improvement in scores between the pre-test and post-test. Although the results are encouraging, we recognize shortcomings of the research design. This research can best be viewed as a pilot study set the stage for additional research. Additional research should include a larger sample of students and should include the use of a control group to better measure the impact of the Six Thinking Hats model.

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Declarations of Interest:

None.

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