Elementary school students' mathematical intelligence based on mathematics learning using classical music of the baroque era as the backsound

Karlimah

Primary Teacher Education, Universitas Pendidikan Indonesia Tasikmalaya Campus
Jl. Dadaha No.18 Tasikmalaya, 46115, West Java, Indonesia

Abstract. Many studies suggest that classical music can inccrease the listeners' intelligence, including mathematical intelligence [3, 12, 2, 11]. In this research, we used the classical music of Baroque era as the backsound during math learning. The research method used was quasi experiment with nonequivalent pretest-posttest control group design to grade V SD students in Tasikmalaya city. The results show that the use of classical music of Baroque era during the learning of mathematics gave a high contribution to the mathematical intelligence of fifth grade elementary school students. The student's mathematical intelligence can be seen in the cognitive abilities which were at the high level in the knowledge up to analysis, and at the low level in the synthesis and evaluation. Low mathematical intelligence was shown by students in calculating amount and difference of time, and projecting word problem into the form of mathematical problems. High mathematical intelligence arose in reading and writing integers in words and numbers. Thus, the mathematical intelligence of fifth grade Elementary School students will be better if classical music of Baroque era is used as the backsound in mathematics learning about solving math problems.

KeyWord: Baroque Classical Music, Backsound, Mathematics Intelligence Elementary Students

1. Introduction

The target of learning mathematics for elementary school students is to enable students to understand the concepts of mathematics, being able to explain the interrelationships between concepts and apply concepts or algorithms flexibly, accurately, efficiently, and appropriately in problem-solving; being able to use reasoning on patterns and traits, perform mathematical manipulations in generalizing, compiling evidence, or explaining mathematical ideas and statements; being able solve problems that include the ability to understand problems, design mathematical models, solve models and interpret the solutions obtained; being able to communicate ideas with symbols, tables, diagrams, or other media to clarify circumstances or problems; has an appreciation of the usefulness of mathematics in life that is the curiosity, attention, and interest in learning mathematics, as well as resilience and confidence in problem solving [6].

In 2013, the objective of learning mathematics was focused on the achievements of three domains that require the mastery of mathematical contents according to the objectives of the 2006 curriculum. The achievements of three domains are: first, attitudes that reflect the faithful, noble, confident, and responsible person in interacting effectively with the social environment and nature around his own home, school, and playground. Second, effective and creative thinking and action in the abstract and concrete realm as assigned to him. Third, factual and conceptual knowledge in science, technology, art, culture, humanities, with national, state, and civilization insights related to phenomena and events in the home, school, and playground [7].

The achievement of domain attitudes, skills and knowledge is a concrete form that can be seen and felt when used in the wider community related to learning outcomes. The results of mathematics learning will be seen from the ability to solve problems or math problems as a result of mathematical thinking activities. The quality of mathematical thinking is closely related to mathematical intelligence. Each student has different mathematical thinking skills, so his mathematical intelligence is different. Mathematical intelligence is an intelligence that involves the skills of processing numbers well and/or using reasoning or logic correctly. This intelligence includes sensitivity to logical relationships, causality, and other logic [13, 1, 8]. Thus, mathematical intelligence is a skill or prowess in solving mathematical questions or problems as a result of the process of learning mathematics.

During the process of learning mathematics, all mathematics learning facilities are considered, provided and used to achieve the learning objective of mathematics that most students need as a provision in their daily life that is mathematical intelligence. However, there is a mathematics learning facility that has not been implemented in elementary schools, when in fact it is theoretically recommended for use when students learn math. Mathematics learning facility in question is the using of classical music. Playing music works to improve and foster the development of personal social capabilities [2]. Besides that, it is also useful for entertainment, media in education, relaxation, spiritual interests, discovering hidden aspects of personality, stimulating creativity and imagination, increasing intelligence, and trigger improvements in learning ability [3].

Therefore, music as a medium in learning mathematics is used in an effort to develop cognitive, affective, psychomotor skills, and improve students' intelligence and learning readiness. Studies of brain function showed that music activates the flow of nerve impulses into the corpus callosum, the network of brain fibers that connect the left brain and right brain. When the left and right brain are active, various mental functions will be aligned. This alignment of left and right brain functions will enhance a person's learning readiness [11].

This is supported by several research results which reveal that: 1) music gave a significant positive effect on mathematics learning achievement [9] music enhanced mathematics intelligence of sixth, seventh, and eighth grade students in Saudi Arabia [5] music stimulus could improve students' brain performance when thinking mathematically and linguistically [10] music influenced students' mathematical literacy interest [14] in Rhode Island [2] first grade elementary school students who attended music classes had dramatically increased their reading and math skills. In addition, students who learned about music appreciation earned a score of 46 points higher, and 39 points higher for students who had musical experience. The last result of our research on fifth grade elementary school students in Tasikmalaya City - West Java - Indonesia showed the improvement of students' mathematical intelligence up to high level, through the use of Classical, Romantic and Baroque music during math learning [4].

The facts resulting from our research provide information and understanding to researchers that music can basically improve students' mathematical intelligence. Based on

that, researchers are encouraged to reveal the mathematical intelligence shown by students who get the experience of learning mathematics accompanied by Baroque classical music**.** This caught the attention of the authors because the mathematical intelligence shown by the students who joined the learning process accompanied by Baroque music was at a high level of mathematical intelligence.

2. Experimental Method

This research was conducted by using Quasi Experiments of Nonequivalent Pretest-Posttest Control Group Design to students in four elementary schools (SD) in Tasikmalaya City - West Java - Indonesia. Data were collected using the test instruments of integer operation, time unit, rounding, estimating, and problem-solving questions related to time, distance and speed that have been tested and proven valid and reliable. By using ANOVA's inferential statistical test and SPSS 19, we found the high and the highest level of mathematical intelligence of a series of three-month math learning activities in a sample of elementary schools using the Romantic classical background music. Furthermore, we used descriptive statistics to analyze the data of students work as it was so that we could obtain a complete information about the mathematical intelligence of students who experienced the Baroque classical background music. Descriptive statistical results in question are as follows:

3. Result and Discussion

Based on the empirical treatment, we obtained test results which showed that the mathematical intelligence of students who had experience in learning mathematics with the backsound classical music of Baroque era. The test results showed that students' intelligence in terms of cognitive abilities presented as percentage for knowledge (C1) was 75,64%, comprehension (C2) was 58,65%, application (C3) was 52,78%, analysis (C4) was 53,85%, synthesis (C5) was 38,46%, and evaluation (C6) was 21,15%. Overall, the cognitive abilities of students from highest to lowest sequences ranging from knowledge to evaluation. However, analytical skill palced the third position. In other words, the analysis ability of students who learned mathematical with the backsound classical music of Baroque era was better than their application ability. Judging from the overall level of difficulty, it was found that easy, medium, and difficult questions could be solved correctly by 100,00%; 53,47%; and 32,05% respectively**.**Recapitulation of math learning result with backsound classical music of Baroque era can be seen in Table 1.

Table 1. Recapitulation of Fifth Grade Elementary School Students' Test Results

TEST PERIOD	COGNITIVE ASPECTS						DIFFICULTY LEVELS		
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	EASY	MODERATE	HARD
PRETEST	56.41	34.62	32.91	44.23	38.46	19.23	92.31	35.61	28.21
POSTEST	75.64	58.65	52.78	53.85	38.46	21.15	100.00	53.47	32.05

Then, the number of students who can answer the problem with the variation of difficulty levels and variation of cognition was also revealed. The student's answers were categorized into low, medium, high, and very high attainment. The ability to correctly answer the questions shown in Table 2 below.

Table 2. Recapitulation of Correct Response Attainment Levels and Various Levels of Difficulty and Cognition

No	Correct Response Attainment Levels	Various Levels of Difficulty and Cognition
1	Low	19.23%
2	Medium	42.31%
3	High	34.62%
4	Very High	3.85%

There was the lowest attainment shown by the students in solving the problem in the evaluation category about projecting word problem into the form of mathematical problems, and the application category about calculating the amount and the difference of time appropriately. The problems were made in the form of multiple choice, and a series of sentences with moderate difficulty. This problem could be solved by 11.54% of students. The questions are as follows.

2 hours + 15 minutes + 1800 seconds = ... minutes
A. 1827 B. 1835 C. 1817 D. 165

Your sister had 5 boxes of marbles. Each box contained 20 marbles. Then your brother bought 10 more marbles. When playing, 2 marbles disappeared. The rest of the marbles would be distributed equally to his two younger siblings and two neighboring children. Which of the following is a mathematical sentence based on the above story?
A. (5x20) + 10 - (8: 4) = 112
B. [(5x20) + 10 - 4]: 4 = 27
C. (5x10) + 10 - (8: 4) = 62
D. [(5x20) + 10 - 2]: 4 = 27

The highest attainment was shown by students in the material of reading and writing integers in words and numbers. Multiple-choice questions, with typical mathematical questions, the cognitive level of knowledge (C1) and easy difficulty. This problem could be solved by 97.5% of students. The problem is as follows.

(-56,487) is read...
A. Fifty six thousand four hundred and eighty seven
B. Negative Fifty six thousand four hundred and eighty seven
C. Negative Fifty six thousand four thousand eight hundred and seven
D. Fifty six hundred four thousand eighty seven

Among the questions with variations of cognitive and difficulty levels, it was found that most students answered incorrectly on each category of the problems, namely, (53.85%) on the knowledge category (C1); 57.69% on the comprehension category (C2); 88.46% on the application category (C3); 69.23% on the analysis category (C4); 88.46% on the evaluation category (C6) all of the problems were all in moderate difficulty; and also 73.08% on the synthesis category (C5) with hard difficulty. Menawhile, another attainment, which showed the most correct answers or good results, existed in the knowledge ability that is 100.00%; 84,62% on understanding ability; 96.15% on application ability; 84.62% on analysis ability; 50.00% on synthesis ability; and also 30.77% om evaluation ability. Therefore, most correct answers at every cognitive level indicated that the higher the cognitive ability, the lower the attainment.

4. Conclusion

The mathematical intelligence of the fifth grade elementary school students who joined the learning by backsound accompaniment of Baroque classical music was proven by the outstanding ability at the level of knowledge about reading and writing integers in words and numbers, and the lowest one was in application and evaluation abilities. This was indicated in answering questions about calculating the exact amount and difference of time and projecting the word problem into a mathematical problem. The students' ability to solve problems based on variations in cognitive and difficulty levels did not provide distinguishing information. The cognitive level of C1 to C6 and the difficulty level from easy to hard did not show the significant difference in students' ability to find the correct answers.

References

1. Campbell, Linda, dkk, *Metode Praktis Pembelajaran Berbasis Multiple Intelligences* (Intuisi Press, Depok, 2006).
2. Djohan, *Psikologi Musik* (Penerbit Buku Baik, Yogyakarta, 2003).
3. S. Gunara, *Manfaat Pendidikan Musik bagi Anak*. *Ritme,* **6** (1)*,* 19-26. (2008).
4. Karlimah, R. Respati, *Efektivitas Backsound Musik Klasik dalam Meningkatkan Kecerdasan Matematika Siswa Sekolah Dasar* (Laporan Penelitian UPI, tidak diterbitkan, 2016).
5. Khalil, A. *Science of Creativity*. [Online] Tersedia: http://www.adabfalasteeni.org/artical.php. (18 Januari 2015). (2005).
6. ---------- Kurikulum 2006, Standar Isi, Standar Kompetensi, Kompetensi Dasar, (BSNP, Jakarta, 2006).
7. ----------.. Kurikulum, (Kementerian Pendidikan dan Kebudayaan, Jakarta, 2013)
8. Lwin, May, et al., *How to Multiply Your Child's Intelligence* (Penerbit Indeks, Yogyakarta, 2008).
9. H.B. Lamar, *An Examination Of Congruency Of Musical Aptitude Scores And Mathematics And Reading Achievement Scores Of Elementary Children* (Tesis pada University of Southern Mississippi, Tidak diterbitkan, 1989).
10. C.S. Luiz, *International Symposium on Performance Science* (2007).
11. S. Merrit, *Simfoni Otak: 39 Aktivitas Musik yang Merangsang IQ, EQ, SQ untuk Membangkitkan Kreativitas & Imajinasi* (Penerbit Kaifa, Bandung, 2003).
12. M. Muttaqin, Kustap, *Musik Klasik: Pengantar Musikologi untuk SMK* (Depdiknas, Jakarta, 2003).
13. Saifullah, *Mencerdaskan Anak (Mengoptimalkan Kecerdasan Intelektual, Emosi dan Spiritual Anak* (Lintas Media, Jombang, 2004).
14. Omari, M., dkk, Journal of Science Education and Human **21** (1) (2010).