Mathematical intelligence developed in math learning with classical backsound music of the classical era

Karlimah
Universitas Pendidikan Indonesia Tasikmalaya Campus, Tasikmalaya, Indonesia

Corresponding author’s email : karlimah@upi.edu

Abstract. This study examines the application of classical music backsound in mathematics learning. The method used is quasi experimental design nonequivalent pretest-posttest control group in elementary school students in Tasikmalaya city, Indonesia. The results showed that classical music contributed significantly to the mathematical intelligence of elementary school students. The mathematical intelligence shown is in the cognitive ability ranging from the level of knowledge to evaluation. High level mathematical intelligence is shown by students in reading and writing integers with words and numbers. The low level of mathematical intelligence exists in projecting the story into a mathematical problem. The implication of this research is the use of classical music backsound on learning mathematics should pay attention to the level of difficulty of mathematics material being studied.

1. Introduction
In understanding the concept of elementary school mathematics (ES), elementary students are prepared to be 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 [1].

The objective of mathematics learning, according to the curriculum of 2013, is the achievement of affective, psychomotor and cognitive domains supported by the mastery of both conceptual and procedural mathematics content. The achievements of three domains are: first, attitudes that reflect the faithful, noble, confident, and responsible person in interacting effectively with the social and natural environment 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 [2].

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 [3-5]. Thus, mathematical intelligence can be a skill or prowess in solving mathematical questions or problems, as well as the ability to solve problems in daily life.

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 mathematics. Mathematics learning facility in question is the using of classical music. Playing music works to improve and foster the development of personal social capabilities [6] that is useful not only for entertainment but also media in education, relaxation, spiritual interests, discovering hidden aspects of personality, stimulating creativity and imagination, increasing intelligence, and trigger improvements in learning ability [7].

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 [8].

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 [10, 11] music stimulus could improve students' brain performance when thinking mathematically and linguistically [12] music influenced students' mathematical literacy interest [6] first grade elementary school students who attended music classes had dramatically increased their reading and mathematical 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 mathematics learning [13].

The facts resulted from our research provide information and understanding to us that music can basically improve students' mathematical intelligence. Based on that, we were encouraged to reveal the mathematical intelligence shown by students who got the experience of learning mathematics accompanied by the music of the classical era. This attracted the attention of us because of the mathematical intelligence which showed by the students who joined the learning process accompanied by Classical music was at a high level of mathematical intelligence.

2. Methods
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 level of mathematical intelligence of a series of three-month math learning activities in a sample of elementary schools using the classical backsound 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 backsound music of the classical era. Descriptive statistical results in question are available on section 3.
3. Results 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 classical backsound music. The test results showed that students' intelligence in terms of cognitive abilities presented as percentage for knowledge (C1) was 68.18%, comprehension (C2) was 56.82%, application (C3) was 39.90%, analysis (C4) was 43.94% synthesis (C5) was 45.45%, and evaluation (C6) was 34.09%. Overall, students' cognitive abilities were at the highest level in the knowledge aspect, at the low level in the application aspect, and at the lowest level in the evaluation aspect. However, the analytical and synthesis abilities were fairly good. In other words, the analytical and synthesis abilities of students who learned mathematics accompanied with classical backsound music of the Classical era was sufficient. The recapitulation of mathematics learning result with the classical backsound music of the Classical era can be seen in Table 1.

| TEST PERIOD | COGNITIVE ASPECTS | DIFFICULTY LEVELS |
|-------------|-------------------|------------------|
|             | C1     | C2     | C3     | C4     | C5     | C1   | Easy  | Moderate | Hard  |
| PRETEST     | 53.03  | 34.09  | 25.25  | 30.30  | 29.55  | 27.27| 95.45 | 15.40    | 15.00 |
| POSTEST     | 68.18  | 56.82  | 39.90  | 43.94  | 45.45  | 34.09| 90.91 | 24.60    | 17.50 |

Judging from the overall level of difficulty, it was found that easy, medium, and difficult questions could be solved correctly by 90.91%; 24.60%; and 17.50%. Another finding was about the ability of students in answering the problems based on the various levels of difficulty and cognition. The students' answers were categorized into very low, low, medium, and high level. There were only a few students who showed very low performance, more students showed high performance, and half of them showed moderate performance. The attainments were proven by the ability to correctly answer the questions. The data is shown in Table 2 below.

| No | Correct Response Attainment Levels | Various Levels of Difficulty and Cognition |
|----|-----------------------------------|------------------------------------------|
| 1  | Low                              | 9.09 %                                   |
| 2  | Medium                           | 27.27 %                                  |
| 3  | High                             | 50 %                                     |
| 4  | Very High                        | 13.64 %                                  |

We also found the lowest attainment shown by students in solving the evaluation category about projecting the word problems into form of mathematical problems. The problems were created in the forms of multiple choice questions, and a series of sentences with moderate difficulty. These problems could be solved by 13.64% of students. The problems in question are as follows.
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Figure 1. The problems in question

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, 45.45% in the knowledge category (C1); 68.18% in the comprehension category (C2); 81.81% in the application category (C3); 86.36% in the evaluation category (C6) all of the problems were in moderate difficulty. Furthermore, the errors made by students in answering the problems of difficult category and analysis category (C4) of 77.27%; and 63.63% on synthesis category (C5). Meanwhile, another attainment, which showed most correct answers or good results, existed in the knowledge (C1) and comprehension (C2) abilities that is 90.91%; 72.72% on application ability; 68.18% on analytical ability; 54.54% on synthesis (C5) and evaluation (C6) abilities. Thus, it can be concluded that the higher demand of cognitive abilities, the lower the attainment. However, there were similar attainments in the aspects of knowledge (C1) and comprehension (C2), as well as synthesis (C5) and evaluation (C6).

4. Conclusion
The results showed that classical music contributed significantly to the mathematical intelligence of elementary school students. It is well demonstrated in the ability of knowledge is to read and write integers in words and numbers even less good at the ability of evaluation in terms of projecting the story into the problem of mathematical problems. Another finding is the ability to solve problems, students demonstrate the same skills in aspects of knowledge (C1) and understanding (C2), as well as synthesis (C5) and evaluation (C6).

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