

Effect of Background Music on Origami Task Performance Among Pre-school Children

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ABSTRACT

New approaches have always been explored by music education researchers in helping students to perform at their optimum level in their learning processes. The main purpose of this research is to investigate the effect of background music on Origami task performance among pre-school children aged five and six years old. Many types of research were done on the topic of background music on spatial task performance, however, little research was done among the group of pre-school children and using Origami as a measurement tool on spatial task performance. Ninety-one participants from two kindergartens in the Klang Valley, Malaysia were selected for the study. The Origami task chosen in this study is sampan (little boat). The selected background music in this study is Mozart's Sonata, K.448 with the intention of replicating Rauscher and colleagues' research in Mozart effect. In the experiment, the participants completed the folding of Origami sampan under two environments: (1) with music and (2) without music. The participants of Kindergarten A had undergone the environment with background music first, followed by the environment without background music while participants from Kindergarten B had undergone the environment with background music first, followed by the environment without background music. The purpose of switching the environments in the experiment for both kindergartens is to optimize the result of the data collected through the experiment. The Dependent T-tests were used to generate data and results had shown that the participants achieved higher scores in the Origami task in the environment with background music.

Contribution/Originality: The paper's primary contribution is finding that background music is effective in increasing the Origami task performance among pre-school children as young as five years old. This study also provides an alternative way in enhancing the learning ability and performance of the Arts students who major in Art in the academies and schools.

1. Introduction

Research involving the topic of multiple intelligence has been ongoing research for many researchers in the education field throughout the years. This is because education is one of the important ways in developing human multiple intelligence. Education is important for society and nation as it involves creation and innovation in improving the quality of knowledge and living in the next generation. Multiple intelligences include linguistic intelligence, musical intelligence, logical-mathematical intelligence, spatial intelligence, bodily-kinesthetic intelligence, and personal intelligence. However, the spatial intelligence of a child is one of the most essential intelligence that should be nurtured from a young age and it is often being neglected in the process of cultivating by the educators.

In addition, the selected populations in the previous studies of spatial performance often involved college students and adults. Little or no research had focused on children of a young age such as pre-school children. Thus, the effect of background music on spatial task performance among pre-school children remains unknown and it is worth researching. The outcome of the research can contribute to the education field and help our society to build a better future for our next generation.

Based on this, the purpose of this study is to investigate the effect of background music on Origami task performance among pre-school children. Therefore, this study makes an attempt to address the following:

- i. What is the effect of background music on Origami task performance among pre-school children aged five and six years old?
- ii. What are the contrasts in the Origami task performance between the environment with background music and the environment without background music if the null hypothesis is rejected?

2. Literature Review

Many types of research had been done on the topic of background music since the 1990s. The term Mozart effect was first coined by a French Ear, Nose, and Throat (ENT) medical doctor, Dr. Alfred A. Tomatis in 1991 when he used Mozart's music in his research to stimulate listening in treating a variety of hearing disorders (Tomatis, 1991). Soon after, Shaw developed the trion model by showing the appearance of similar neural firing patterns in the brain when listening to music (Leng & Shaw, 1991). In 1993, Rauscher and colleagues used the term Mozart effect when they did their research on the effect of Mozart's music on spatial tests among a group of college students (Rauscher, Shaw & Ky, 1993).

According to Rauscher et al. (1993), the Mozart effect is not a permanent effect and it can only last around 10 to 15 minutes during the period where the participants were involved in a spatial task while listening to Mozart's music. Verrusio, Moscucci, Cacciafesta and Gueli (2015) stated that the effectiveness of the Mozart Effect is still undetermined to this day, where there are differing opinions among the studies that had been done. After Rauscher's first report of Mozart effect was released, her studies were supported by other findings (Rauscher et al., 1993, 1995; Rauscher & Shaw, 1998; Hallam & Price, 1998; Nantais & Schellenberg, 1999; Jenkins, 2001; Kang & Williamson, 2004; Rauscher & Hinton, 2006; Taylor & Rowe, 2012; Khaghaninejad & Fahandejsaadi, 2016).

However, there were also other studies that disclaimed Rauscher (Steele et al., 1999a; Steele et al., 1999b; Steele et al., 1999c).

The expansion of research on Mozart effect idea has also produced negative results by other researchers. It was due to failure in replicating the Mozart effect study in similar experiments (Steele et al., 1999a; Steele et al., 1999b; Steele et al., 1999c). The negative result may have been caused by five experimental factors which include (1) task validity, (2) expectancy effect, (3) instructions to the participants, (4) item difficulty, and (5) practice effects that may have influenced the negative outcome of the studies in replicating the effect (Rauscher, 2000). Nevertheless, subsequent studies were done based on the theory of Mozart effect and obtained positive results (Jenkins, 2001; Rauscher & Hinton, 2006; Taylor & Rowe, 2012). Again, Rauscher and colleagues claimed that Mozart effect increased the students' spatial intelligence only temporarily during the treatment and it is not a permanent effect.

Spatial intelligence is one of the intelligence included in Gardner's theory of multiple intelligences. Multiple intelligences include linguistic intelligence, musical intelligence, logical-mathematic intelligence, spatial intelligence, bodily-kinesthetic intelligence, and personal intelligence (Gardner, 1993). Gardner's (1993) study found the following: *"Central to spatial intelligence are the capacities to perceive the visual world accurately, to perform transformations and modifications upon one's initial perceptions, and to be able to re-create aspects of one's visual experience, even in the absence of relevant physical stimuli (p. 182)"*.

In simple words, spatial task performance means activities that involve the ability of one's mind to rotate items from diverse positions in space (Gardner, 1993). The study of mathematics involved geometry (Scriba & Schreiber, 2015) and this is used in Origami (Gür & Kobak-demir, 2017). The geometry involved the ability to visualise objects in virtual images while Origami need other elements such as motor skills in folding. Therefore, Geometry has been used as a measurement tool in measuring students' spatial tasks by many researchers (Rauscher et al., 1993; Rauscher & Shaw, 1998; Hallam & Price, 1998; Nantais & Schellenberg, 1999; Jenkins, 2001; Rauscher & Hinton, 2006; Taylor & Rowe, 2012). As Origami also requires the ability to visualise and rotate the object from the diverse positions in a space, it could also be used as a suitable measurement tool in measuring students' spatial task performance.

Origami is the art of paper folding by transforming sheets of paper into decorative objects and this term comes from Japan (Dureisseix, 2012). Many researchers used Origami as a tool in teaching Mathematics (Meyer & Meyer, 1999; Alperin, 2000; Boakes, 2009; Yin, 2009; Hook & Paul, 2013; Wares, 2014; Obi, Agwagah, & Agah, 2014; Krisztián, Bernáth, Gombos & Vereczkei, 2015; Boakes, 2015; Ünán, 2015; Gür & Kobak-demir, 2017) and language (Takano, 1998; Lee, 2017). In 2013, Taylor and Tenbrink stated that Origami involved spatial thinking. This means an individual needs to have the ability to visualise the Origami product through the folding steps and the connection between the folds to finish the end product (Taylor & Tenbrink, 2013). In 2015, Taylor and Tenbrink stated that Origami involved the cognitive processes in spatial intelligence (Tenbrink & Taylor, 2015). Thus, to fold an Origami product, the brain undergoes various processes that involve elevated and automated cognitive processes. This was further supported by Wacholtz's (2004) study in confirming the relationship between spatial intelligence and the skill of understanding textual/graphical instructions.

Since music could enhance spatial intelligence involved in Origami folding, this triggers the interest of the researcher in investigating whether music could enhance the Origami task performance among pre-school children. The main objective is to investigate the effect of background music on Origami task performance and also compare the result of Origami task performance under the environment with music and without music.

3. Methodology

A total of 91 participants aged five and six years old were selected from two kindergartens in Klang Valley, Malaysia as participants in this study. A short interview with both kindergartens' principals was conducted. This is to ensure that the participants were not exposed to any kind of research experiment prior to the study, have no experience in Origami, and have little or no experience in listening to Classical music. This is also to make sure that the learning environment and the education syllabus used by the selected kindergartens are similar.

The music used in this study is the 1st movement of Mozart's Sonata for Two Pianos in D Major, K. 448, which is a similar piece used in the initial study of the Mozart effect ([Rauscher et al., 1993](#)). The purpose of using this piece is because the researchers have the intention of replicating Rauscher and colleagues' study 1993 to investigate the Mozart effect on spatial task performance among a group of young children, which is a different age group population from Rauscher's study ([Rauscher et al., 1993](#)).

A pilot test was conducted in a kindergarten with a similar background in Klang Valley, Selangor to identify whether the Origami sampan task is a suitable task for pre-school children aged five and six years old. 60% of the twenty-five children in the pilot test completed the task in the set time period or less. This showed that the Origami sampan is age-appropriate for pre-school children.

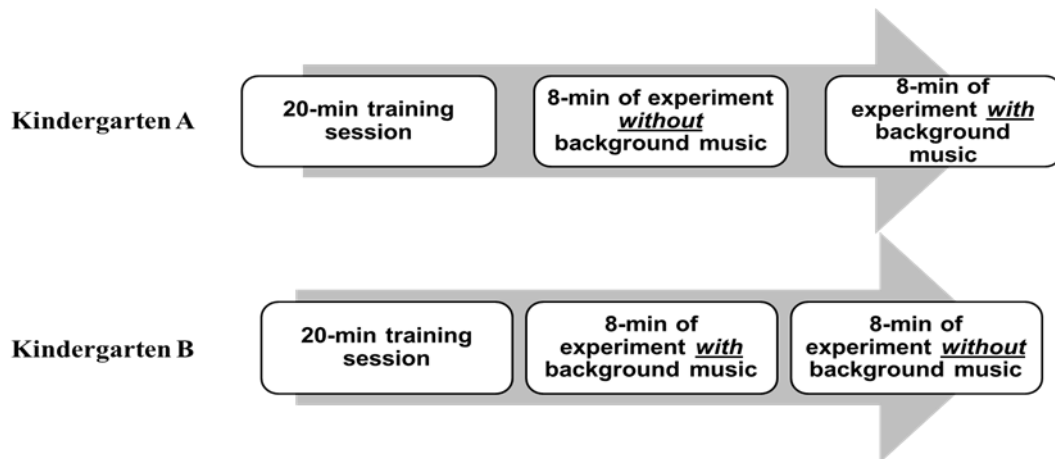
The experiments were conducted separately in two kindergartens. The kindergartens were labeled as Kindergarten A and Kindergarten B. Participants from both kindergartens had undergone two different environments while completing the Origami task given. The two different environments were the environment without background music and the environment with background music. Participants from Kindergarten A were given instructions to complete the given Origami task under the environment without background music first, followed by the environment with background music and vice versa for Kindergarten B. The aim of switching the environments in Kindergarten A and Kindergarten B is to minimize the effect of the repeated tests.

In Kindergarten A, a 20-minutes training session was given by the researcher before the experiment starts. A square paper of 15cm X 15cm was given to all participants before the training session starts. After the 20-minutes training session, the participants were needed to hand in their products to the researcher as evidence of the training session. The participants were given a new piece of 15cm X 15cm square paper to start the experiment (1st evaluation) with the environment without background music, which means the participants were required to complete the task given in a natural setting. The participants were given 8-minutes to complete the task and no explanation or guidance regarding the folding of sampan was given in the process. After 8-minutes, the products of the experiment were collected and a new piece of 15cm X 15cm square paper was again given to each participant for the next experiment (2nd evaluation), which is to complete the given Origami task under the environment with background

music, 1st Movement of Mozart's Sonata for Two Pianos in D Major, K.448. The participants were given 8-minutes to complete the task and no explanation or guidance regarding the folding of sampan was given in the process. After the experiment under the environment with background music (2nd evaluation), the products were again collected by the researcher, and a token of appreciation to the participants was given to each participant in their classroom.

The similarity and differences of the experimental procedure can be seen in [Figure 1](#).

Figure 1: Experimental procedure in Kindergarten A and Kindergarten B.



The products of the experiment – Origami sampan were evaluated based on the scale of 0 to 8. This is because Origami sampan making required 8 steps to complete the product. Thus, each child was scored on a scale of 0 to 8 according to the steps completed.

4. Result

4.1. Analysis of Kindergarten A

Kindergarten A (N = 47) went through two environments, which include an environment without background music and an environment with background music while completing the Origami task. The results obtained from the environment without background music (Variable 1) were compared to the results obtained from the environment with background music (Variable 2).

From [Table 1](#), the p-value obtained from the calculation is 0.04, which is smaller than 0.05, $p = 0.04 < 0.05$. There is a significant difference in the mean score between the environment without music and the environment with music. The task performance in Kindergarten A is significantly better in the environment with music.

Table 1: T-test analysis of Kindergarten A (Kin. A)

	Variables	Mean	SD	t	df	p-value
Kin. A	1=Without Music	2.38	2.19	2.07	46	0.04
	2=With Music	3.02	2.43			

4.2. Analysis of Kindergarten B

Kindergarten B (N = 44) went through two environments, which include an environment with background music and an environment without background music while completing the Origami task – sampan given. However, Kindergarten B had gone through the environment with background music first, followed by the environment without music. The results obtained from the environment with background music (Variable 1) were compared to the results obtained from the environment without background music (Variable 2).

From Table 2, the p-value obtained from the calculation is 0.02, which is smaller than 0.05, $p = 0.02 < 0.05$. There is a significant difference in the mean score between the environment without music and the environment with music. The task performance in Kindergarten B is significantly better in the environment with music.

Table 2: T-test analysis of Kindergarten B (Kin. B)

Variables		Mean	SD	t	df	p-value
Kin. B	1=With Music	2.86	2.38	2.39	43	0.02
	2=Without Music	2.25	2.00			

4.3. Analysis of Kindergarten A and Kindergarten B

The raw scores obtained from the environment without background music from Kindergarten A and Kindergarten B were compared to the raw scores obtained from the environment with background music from Kindergarten A and Kindergarten B. Comparison between the mean scores of both environments were shown in Table 3. The results obtained from the environment without background music (Variable 1) were compared to the results obtained from the environment with background music (Variable 2).

Table 3: T-test analysis of both kindergartens (Kin. A & B)

Variables		Mean	SD	t	df	p-value
Kin. A & B	1=Without Music	2.32	2.09	3.12	90	0.00
	2=With Music	2.95	2.39			

From Table 3, the p-value obtained from the calculation is 0.00, which is smaller than 0.05, $p = 0.00 < 0.05$. There is a significant difference in the mean score between the environment without music and the environment with music in the two kindergartens. The task performance in two kindergartens are significantly better in the environment with music.

5. Discussion

The results collected from the environment without background music were compared to the results obtained from the environment with background music in Kindergarten A and Kindergarten B. The Dependent T-test analysis consists of 3 pairs of grouping. This includes Pair 1 which consists of results obtained from the environment without background music and the environment with background music in Kindergarten A, Pair 2 consists of results obtained from the environment without background music and the environment with background music in Kindergarten B while Pair 3 consists of the analysis of the environment without background music and the environment with background music based on mean scores of both kindergartens.

The result of Pair 1 obtained from the analysis shows positive results towards the environment with background music. The p-value from the analysis suggested that the null hypothesis is rejected. The result of the mean score obtained from the environment with background music in Kindergarten A had increased by 26.9% as compared to the environment without background music. This proves the effect of background music on Origami task performance in Kindergarten A is significant.

The result of Pair 2 obtained from the analysis shows positive results towards the environment with background music. The p-value from the analysis suggested that the null hypothesis is rejected. The result of the mean score obtained from the environment with background music in Kindergarten B had increased by 27.1% as compared to the environment without background music. This proves the effect of background music on Origami task performance in Kindergarten B is significant.

The result from the analysis of Kindergarten A and Kindergarten B ([Table 3](#)) showed that the children completed more steps in the Origami task in the environment with music. This proves that the presence of background music is effective in helping the students to boost spatial intelligence which placed a major role in Origami task performance.

Furthermore, the researcher also made some observations during the experiment such as students showing calmer emotion while completing the Origami task given in the environment with background music. They showed more focus and attention in doing the Origami task while the music is played in the background. This finding is also supported by the teachers from both kindergartens who found that their students were calmer during the study when Mozart's music was played in the background. In this study, young children as young as five years old responded positively to background music while completing the task.

6. Implications

The aim of this research is to fulfil the knowledge gap of background music by focusing on the population of pre-school children, the effect of background music and measuring the spatial performance using the Origami task. The finding of this research is essential to the proprietor of kindergartens for they could use this method (playing Mozart's Sonata K. 448 in the background during lesson time) to boost the children's performance in learning. Furthermore, in this research, background music is proven to give a positive impact on learning to produce Origami products. Mozart's Sonata K. 448 is proven to enhance the learning process in folding an Origami product. This finding could

contribute to enhancing the learning ability and performance of the Arts students who major in Art in the academies and schools.

7. Conclusion

The result of the experiment showed that the Mozart effect increased the scores of Origami task performance among pre-school children when the Mozart's music is played in the background. This study is based on the theory of Mozart effect which supports Rauscher's study and other researchers (Rauscher et al., 1993, 1995; Rauscher & Shaw, 1998; Hallam & Price, 1998; Nantais & Schellenberg, 1999; Jenkins, 2001; Kang & Williamson, 2004; Rauscher & Hinton, 2006; Taylor & Rowe, 2012; Khaghaninejad & Fahandejsaadi, 2016) who agreed that music could enhance spatial intelligence. This tests can be expanded to other types of intelligence test and different types of music can be used such as music from other genres or different composers.

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Conflict of Interests

The authors declare no conflict of interest in this study.

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