

Music Aptitude and School Readiness in Indonesian Children

Diella Gracia Martauli

Abstract—This study investigated the relationship between music aptitude and school readiness in Indonesian children. Music aptitude is described as children's music potential, whereas school readiness is defined as a condition in which a child is deemed ready to enter the formal education system. This study presents a hypothesis that music aptitude is correlated with school readiness. This is a correlational research study of 17 children aged 5-6 years old ($M = 6.10$, $SD = 0.33$) who were enrolled in a kindergarten school in Jakarta, Indonesia. Music aptitude scores were obtained from Primary Measures of Music Audiation, whereas School readiness scores were obtained from Bracken School Readiness Assessment Third Edition. The analysis of the data was performed using Pearson Correlation. The result found no correlation between music aptitude and school readiness ($r = 0.196$, $p = 0.452$). Discussions regarding the results, perspective from the measures and cultures are presented. Further study is recommended to establish links between music aptitude and school readiness.

Keywords—Bracken school readiness assessment, music aptitude, primary measures of music audiation, school readiness

I. INTRODUCTION

THE transition from kindergarten to primary school is one of the vital times in children's lives. A study revealed that children who are not equipped with the skills to adapt to the changes in transition may possibly encounter academic, social skills and educational attainment problems [1]. Therefore, in order for children to be able to get through this transition successfully, they need to have some specific skills.

To prevent these problems, children should be in a 'ready' condition when transitioning from kindergarten to primary school. School readiness is a condition in which a child is deemed ready to enter the formal education system such as primary school [2], as the result of interaction between the children and their environment [3]. School readiness consists of four main categories; physical and mental health, cognitive abilities, socio-emotional abilities, and pre-academic abilities [3]. In the physical and mental health category, the children are expected to have gross and fine motor skills that are appropriate for their developmental milestones. The cognitive abilities are skills needed for basic functioning, such as attention and the ability to focus on one task. The socio-emotional abilities are including the ability to share and also to listen to other people. And the example of pre-academic skills are the emergent literacy skills and the emergent numeracy

skills. School readiness is essential as it predicts later achievement [4]. Therefore, the activity in kindergarten should be designed in such a way to prepare the school readiness of their students. However, not all education systems require children to enter kindergarten. Indonesia is one of the education systems in the world that does not require children to be enrolled in kindergarten prior to formal education in primary school.

Music might be a solution to be an effective tool to prepare the children's readiness for those who enrol or do not enrol in kindergarten. Music was believed to produce benefits in cognitive and education aspects of humans. Some research studies attempted to investigate the effects of music on academic achievement [5]–[7], with the assumption that children who study musical instruments would get better academic achievement compared to other children who do not study musical instruments. Some studies investigated the benefits of music on specific academic skills such as reading skills [8]–[10] and mathematics [9], [11], [12], as well as other cognitive-related ability such as attention [13], [14], and intelligence [15].

The skills mentioned in the studies above are considered to be the basic components of school readiness. Therefore, it can be assumed that there is an indirect relationship between music skills and the components of school readiness. As mentioned before, music correlates with some of the pre-academic skills which are considered as the components of school readiness. However, only a few research assessed the relationship between music and the school readiness. Usually, these studies only measure the small aspects of school readiness (e.g music and early numeracy skills, as the small part of the pre-academic skills) or focus more on the use of music as an experiment condition to enhance school readiness. It is necessary to conduct a holistic investigation investigating the relationship between music and the components of school readiness. Therefore, the present study investigates the relationship between music and pre-academic skills, one of the components of the school readiness.

In summary, this study aimed to examine the relationship between music aptitude and pre-academic skills of school readiness in kindergarten children aged 5 to 6 years old in Jakarta, Indonesia. Music aptitude, described as the children's music potential [16], was chosen with the consideration that at the age of 5 to 6 years old, the children do not have music skills or music achievement that can be assessed objectively. Then, music aptitude is considered as the appropriate construct to be used in this study. The pre-academic skills were chosen to represent the school readiness because pre-academic skills

Martauli, D. G. was with Department of Music, The University of Sheffield, Indonesia (e-mail: diellagracia@gmail.com).

This research study is fully funded by Lembaga Pengelola Dana Pendidikan, the Ministry of Finance of Republic of Indonesia.

are still considered as the main indicator indicating the school readiness of the children in the context of Indonesia.

The present study is a correlational research, where the music aptitude scores are obtained using Primary Measures of Music Aptitude, the school readiness scores are obtained using Bracken School Readiness Assessment 3rd Edition, and the sets of data from music aptitude and school readiness are synthesised to establish the correlation point. This study also assessed the differences in relationship between music aptitude and school readiness based on gender, socio-economic, and additional academic class. Recent studies have shown that music correlates with the components of school readiness. Therefore, the present study assumes that there will be a significant relationship between music aptitude and school readiness in Indonesian children aged 5 to 6 years old.

II. METHOD

A. Participants

Participants were 17 (nine females and 11 males), with the age range was from 5 years 4 months to 6 years 8 months ($M = 6.1$, $SD = 0.33$). Participants were students in kindergarten school located in East Jakarta, Indonesia. Some 52% of the participants came from low to middle socio-economic status. All participants had never taken a private music lesson before. However, two participants had taken and were, during data collection, taking additional lessons to help with their academic study.

B. Measures

1. Primary Measures of Music Audiation

The Primary Measures of Music Audiation (PMMA) measures children's potential to learn music for kindergarten to grade 3 [17]. It uses short musical phrases where participants are asked to identify whether the pattern of the musical phrases sounds the same or different. PMMA consists of two subtests, tonal and rhythm [18]. The tonal subtest assesses the participant's ability to identify tonal patterns, whereas rhythm subtest assesses the participant's ability to identify rhythm patterns. These subtests should be administered on two different days with a one-week interval. Each subtest consists of practice samples and 40 test questions which take 32 minutes to complete. The maximum score for each subtest is 40, whereas the maximum score for the music aptitude composite is 80.

2. Bracken School Readiness Assessment 3rd Edition

The school readiness was measured with Bracken School Readiness Assessment (BSRA) developed in 2002 by Bruce A. Bracken. The latest edition of BSRA is Bracken School Readiness Assessment 3rd Edition (BSRA-3) published in 2007, measuring pre-academic skills including colours, letters, numbers/counting, sizes/comparisons and shapes.

C. Procedure

After obtaining informed consent, the data collection began with a building-rapport session with children in the class followed by the assessments, PMMA and BSRA-3. The

PMMA subtests were administered on two different days within a week interval. For example, the tonal subtest was conducted on Thursday, and the rhythm subtest was held on the next Wednesday. Each subtest lasted for 30 - 40 minutes. Both tests were conducted collectively in a classroom with all participants present at the same time accompanied by their class teachers. BSRA-3 was conducted individually for each participant in a separate room in the kindergarten accompanied by one teacher. The assessment lasted for 15 to 20 minutes.

III. RESULT

The participants' scores of tonal ($M = 25.24$, $SD = 3.49$) and rhythm ($M = 24.06$, $SD = 3.86$) subtests in this research belong in the average group. The result of music aptitude scores was also found to be in the average group ($M = 49.19$, $SD = 6.07$).

This study found that there was no effect of gender ($t(15) = -0.362$, $p = 0.72$) and socio-economic status ($F(2,14) = 1.76$, $p = 0.20$) on music aptitude. These results indicated that there was no significant difference of music aptitude score between gender and socio-economic status.

The average score for school readiness in this study was 73.82, ranging from 65 to 81. This result implied that the participants achieve 86% mastery of the school readiness composite. The percentage of mastery of school readiness subtests from the highest to lowest were; 90% mastery of the colour subtest, 87% mastery of the letters subtest, 94% mastery of the numbers/counting subtest, 82% mastery of the sizes/comparisons subtest, and 70% mastery of the size subtest.

This study found that there was no effect of gender ($t(15) = 3.48$, $p = 0.08$), socio-economic status score ($F(2,14) = 0.735$, $p = 0.497$), and additional academic lesson ($t(15) = 0.94$, $p = 0.34$) on school readiness. These results indicated that there was no significant difference of school readiness score between gender, socio-economic status, and additional academic lesson.

Pearson bivariate correlation showed that there was no correlation between music aptitude and school readiness ($r = 0.196$, $p = 0.452$), which indicated that the increase in school readiness scores was not related to the music aptitude score. Further analysis assessing the relationship between subtests of music aptitude and subtests of school readiness found that there was no correlation between the subtests of PMMA with the subtests of BSRA-3. This indicated that the increase in the subtests of PMMA was not related to the increase in the subtests of BSRA-3. Therefore, this result did not support the hypothesis of this study.

The correlation between tonal subtest of PMMA and numbers/counting subtest of BSRA-3 was found to be significant ($r = 0.51$, $p = 0.03$). It is the strongest correlation compared to the other subtests. The second strongest correlations were rhythm subtest of PMMA and shapes subtest of BSRA-3. However, no significant correlation between both subtests indicates that the relationship might occur by a mere chance.

IV. DISCUSSIONS

This study found no statistical correlation between music aptitude and school readiness, therefore the null hypothesis is accepted. Children with a high score of music aptitude do not necessarily have a high score of school readiness and vice versa. The result is in line with the study by Gordon's study in 1986 [19], which found that PMMA was not related to school readiness, gender and children's achievement. The present study proposed two assumptions underlying this result.

The first assumption is music aptitude only plays a role as a music vessel. The music vessel is filled with music potentials that could be developed and transformed into music skills if it is exposed to different music activities. Therefore, this specific potential might not have any correlation at all with other non-musical skills, in this case, pre-academic skills, unless the potentials are trained. There is, however, another explanation, that music predicts music participation [20]. This explanation speculates that children with high music aptitude are more attracted to various music activities which indirectly enhance their music skills; however, further work is required to examine this correlation.

The first assumption, music vessel, suggested that music aptitude is a potential that can only be optimised if it is appropriately exposed at the right time. This assumption leads us to the next suggestion that perhaps the process of learning music is more related to school readiness and other non-musical skills rather than just only the music aptitude. This suggestion may be explained with the role of transfer effects

in the relationship between music and non-musical skills. Transfer effect is the process where skills used in a specific context can be applied to other cognitive abilities skills. Previous research suggested that music training impacted an improvement in the non-musical domains, for example mathematics [12], [21]. Children who study music will develop and improve their music skills. At the same time, the transfer effect occurs, so the result of the music practice does not only improve the music skills but also increases other non-musical skills. Therefore, it can be concluded that music aptitude is not directly related to non-musical skills. However, it is the process of music practice that is directly related to non-musical skills.

It should be noted, that research on the transfer effect still shows inconsistent results. It is not clear whether the transfer effect is possible or not. Further investigation to compare the relationships between music aptitude along with non-musical skills, and music learning along with non-musical skills is recommended. Moreover, Schellenberg explained that music practice also provides children with different qualities in experiences compared to the other children who do not practice music [22]. These experiences include having to be disciplined enough to practice regularly, having to focus during practice, training themselves to decode visual symbols and being able to transform the kinaesthetic instructions to play music. The skills gained from these experiences become automatic and may unconsciously be carried over on other tasks.

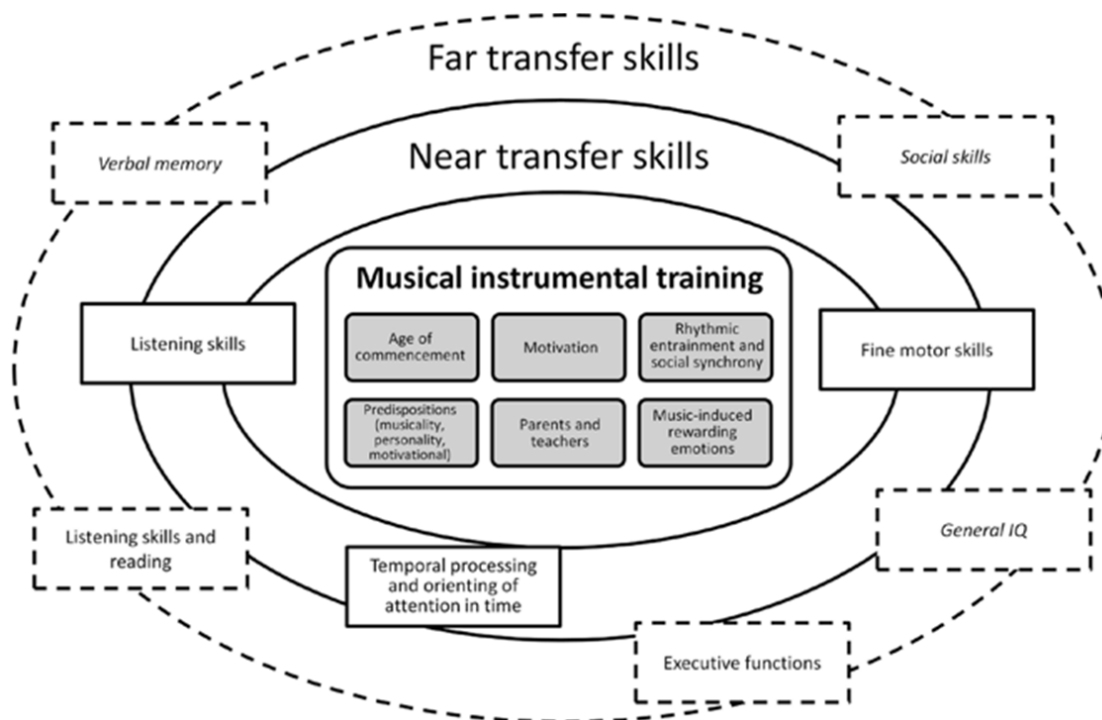


Fig. 1 Transfer Effect Scheme between Music and Non-Musical Skills by [25]

The transfer process depends on the similarity of the cognitive process involved in two different tasks [23], [24].

This process depends on how spontaneous and how automatic the skills can be applied to other domains. If this process can be done automatically and tends to be spontaneous, it is called near transfer skills. However, if it requires continuous processing, reflection and consciously adopting similar skills to be applied to another task, then it is called far transfer skills. Summary of near and far transfer skills in musical training by Miendlarzewska and Trost [25] are presented in Fig. 1. These skills are essential for the school readiness of the children.

Based on the previously mentioned discussion, it is assumed that there might be an indirect relationship between music aptitude and school readiness (Fig. 2). The connection begins with music aptitude which predicts music participation, where children with high music aptitude will naturally be

drawn into more musical activities. The exposure of music activity will develop and enhance their music skills. During this process, the transfer effects occur, where the children may carry over the skills learned in music into other domains, such as the academic skills. On the other hand, children with low music aptitude may not be as drawn into musical activities as their counterparts. Less exposure of music activity will potentially hinder the development of their music skills. Therefore, the possibility for transfer effect to occur is low. This assumption shows that music exposure may play an important bridging role in the relationship between music aptitude and school readiness. Considering that there might be an indirect relationship between music aptitude to school readiness, further investigation is recommended.



Fig. 2 Hypothetical Relationship between Music Aptitude and School Readiness

This study found that there was a positive relationship between the tonal subtest and number/counting subtest with a moderate strength. This is quite an interesting finding since rhythm skills are usually found to be related to mathematical concept [12], [21]. Future study is recommended to explore the further relationship between tonal and number/counting concept in children age 5-6 years old.

A. Perspectives Related to Measures

From the measures' point of view, there are four important points related to PMMA and BSRA-3. The first is that PMMA does not only assess specific skills but also requires combination of skills to complete the tasks. The tasks in PMMA require children to identify the auditory pattern in the forms of melody or rhythm. However, children also need skills to decode the auditory information into visual symbols by circling the answer in the answer sheet. When a child identifies a different pattern but writes the wrong answer in the answer sheet, his or her points will be deducted and will receive a lower score which means that the scores may not reflect his or her true music aptitude. This is one of the problems that music aptitude measures have, where the subtests do not only measure a specific task, but also require different combination of skills to complete the test [26].

For future studies, it should be confirmed that PMMA only assesses music-related skills. Additional steps are recommended to ensure that the measure accurately records the music potential of the participants. The additional steps will make sure that the participants are actively engaged and show their understanding, by imitating the sounds through gestures (e.g. clapping) instead of passively listening to the stimuli.

Secondly, this study administrated PMMA collectively, as this test can be administered individually or as a group [17]. However, in practice, the administration of PMMA did not

happen as smoothly as expected. It is crucial to have a complete silence during the administration. But, in the field, some children threw remarks here and there that reduced the complete silence condition of the administration and potentially distracted other participants. This condition disturbed the other participants and may impact their performance on PMMA. Learning from this experience, it is suggested that the PMMA for kindergarten children is carried out individually, to help the participants maintain their focus and create a conducive environment for the assessment.

The third is the lack of music skills measurements for children aged 5-6 years old. At the beginning of the study, music aptitude is the construct that was chosen with the assumption that the participants do not acquire music skills that can be measured objectively. However, the result indicates that there is no relationship between music aptitude and school readiness, which leads us to another suggestion that maybe the music skills that are related to school readiness. To the best of the author's knowledge, standardised music skills measures for 5-6-year-old children are still unavailable.

It is a challenge to distinguish how to measure the concept of music aptitude or music skills in kindergarten students. The boundaries of both concepts are still vague, to what extent evidence is categorised as music aptitude and to what extent it is considered as music skills. Further studies on these two constructs in kindergarten children are needed to provide a true foundation for constructing music aptitude and music skills measurements in the future.

Regarding the BSRA-3, it was found that the participants were not familiar with some of the items. The researcher needed to explain some items to the participants, which led to a nonstandard administration. Moreover, there were two items from subtest shapes which could not be answered by ninety percent of the participants. This indicates two conditions. The first is that there might be some items that might not be

understood by the participants because the word choice was not appropriate for their age, and the second is there were items that generally are not usually used in Indonesian culture. This problem impacted the score of school readiness and indicated that the result did not represent the real condition of the participant. The problem could have been anticipated if the adaptation process of BSRA-3 was followed thoroughly, which includes; back-translation, making sure the new translated version is as similar as possible to the source, further analysis on items that need culture-specific adaptation, involving experts, piloting to the sample that have similar characteristic as the participant, and reliability-validity testing [27]. However, this study only conducted some steps of the cultural adaptation such as translation and consultation processes. This minimal adaptation was not adequate to mitigate the translations issues. It is recommended that future studies conduct the comprehensive adaptation of BSRA-3 to Indonesian culture.

B. Perspectives Related to Culture

The present study also reflects the cultural differences between the western population and Indonesian population. Musical behaviour is considered to be universal, but the interpretation and structure will be different depending on the cultures [28]. These differences are reflected in the variety of music definition and structure, music activities, music functions, and many others. The present study acknowledges that there may be intangible cultural differences that have impacts on the study results.

Studies about music aptitude and school readiness are still western-oriented generating results that are seemingly 'Western culture-oriented'. Most studies recruited Western participants who were brought up in a culture that is different from Indonesian culture. The differences in background of participants may have impacts on the study results. For example, a comparison, which the author will use to analyse the aspect of music structure in both cultures. In Bali, Indonesia, the structure of music consists of irregular rhythm and 'stretched' tones that give the impressions of out-of-tune, which is commonly perceived as unpleasant and avoided in Western music [28]. In terms of the music function, music in Indonesia has been used as part of a ritual to achieve *Sakti* or divine power, whereas in Western culture music is more of a part of maintaining the social connection. Is there a significant difference raised from this condition? The present study cannot yet answer this question. However, the differences in musical forms and functionality between Indonesian culture and other cultures require deeper understanding through further studies. Moreover, the differences in socio-economic status between Indonesia and western cultures may have impacts on the results of the present study. Socio-economic status is related to and becomes a basis for many factors such as the educational background of parents as well as access and exposure to music. A review concluded that the educational background of parents has a significant impact on children's music engagement [29]. Children who engaged in a music activity are more likely to have more educated parents and

vice versa. Furthermore, it was also mentioned that socio-economic background also influences the music exposure of children. Children with better socio-economic backgrounds may have better music exposure because their parents can afford it. From the perspective of access and exposure to music through the internet, the Indonesian population has less access to music compared to the population in Western countries. This is because internet access in Indonesia is only available to less than approximately 50% of the population [30] and most of the internet users are people living in urban areas of Indonesia. Therefore, if Indonesian and Western cultures are compared based on the socio-economic status, then there is a significant difference since Indonesia is considered as a developing country and most of the western countries are known as developed countries. Furthermore, the standardised measures are mostly from Western culture, including the measures in the present study which are PMMA and BSRA-3. Although efforts have been made, such as cultural adaptation, to ensure that these measures were appropriate to be used in the Indonesian population, the present study encountered challenges that were culture-based.

Music has been claimed as the 'universal language'. However, the same as language skills, a research shows that people have a preference of a particular music scale, based on the conditions and environment where they grew up [31]. Someone who was born into a family with Indonesian culture and exposed to traditional or local music will be familiar with, enjoy and possibly prefer songs with Indonesia-specific music structure. If he or she happens to be exposed to songs with a different structure, he or she will probably consider the songs to be unpleasant and will need time to learn or adapt to the songs before he or she is able to enjoy it. This is because he or she is not familiar with the structure and/or he or she prefers songs from Indonesian culture. A study also found that native language influence people's perception of music, and most importantly the perception of rhythm [32].

It is also the case in this study, where PMMA was constructed from the Western culture which raises an assumption in which this measure might not be appropriate to be used with Indonesian participants who are more familiar with '*Javanese Pelog*' melody (adapting the term used in the study of [31]). This might indicate a cultural barrier, where children who have high music aptitude but could not perform well because they are not familiar with the structure of the melody or rhythm. Future investigation should be done to create an adequate music aptitude measure that considers the Indonesian culture to be used in the future study. Another example was the items in BSRA-3 shapes subtest which contained items that were not familiar to the participants. These differences in culture will eventually impact the results of the study.

V. FUTURE DIRECTIONS

The fact that there is no relationship found between music aptitude and school readiness in the present study indicates that music has functions bridged by the transfer effect as discussed above. However, the role of transfer effect in the

function of music has not been assessed further in this present study. Therefore, it is important to conduct more studies to investigate the effectiveness of music in increasing school readiness in children. Moreover, it is important that future studies assess all components of school readiness, which are cognitive abilities, socio-emotional abilities, and pre-academic abilities to obtain an in-depth understanding of the variable in relation to music.

The results of the present study also indicate that the music aptitude of a child does not predict his or her school readiness. The results show that children with any level of music ability can be trained or educated to have adequate school readiness skills. Referring to several experimental studies [13], [15], [33], music is considered an appropriate 'method' for teaching components of school readiness skills, such as cognitive abilities, pre-academic skills and socio-emotional skills to children aged 5-6 years old. Music is also considered to be a 'universal' tool accessible for anyone who plans to develop school readiness skills in children with various music potentials.

Considering that music aptitude is a predictor of music participation which indirectly trains music skills and by extension influences other non-musical domains through transfer effects, it is recommended that future studies conduct further investigation about the relationships between music aptitude, music participation, music skills and transfer effects. Furthermore, there needs to be comparison studies that seek to examine the relationships between music aptitude and school readiness, and music skills and school readiness.

In regards to measurement, there needs to be an adaptation of PMMA that considers the type of melody and rhythm that are familiar to the Indonesian population. Furthermore, there need to be studies that specifically focus on developing music measurements using norms from Asian cultures. A comprehensive BSRA-3 adaptation is also recommended to modify items that are not culturally appropriate to be used on Indonesian children.

A greater focus on the cultural differences may produce interesting findings on the role of culture in music aptitude in children. This may include but not be limited to, 1) discussions about music components that are considered universal, 2) factors that are influenced by one's culture and surroundings, and 3) roles of these indicators in influencing children's music aptitude, forming music experience, and affirming music identity when they become adults. In addition, it is recommended that all future research studies use adequate sample size based on power analysis to obtain valid, reliable and generalizable results.

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