Developing Kindergarten Teachers' Computational Thinking Skills Through Song Creation

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Abstract: *This research aimed to assist teachers in developing computational thinking skills through children's song creation. The study focused on the process of creating songs while integrating computational thinking elements such as decomposition, pattern recognition, abstraction, and algorithm. The study was conducted in 2024. Sixteen kindergarten teachers from Lab-school Jakarta participated in the research and were divided into four groups for the song-creation process. A development research method using the Borg & Gall procedural model was employed. Due to time constraints and the nature of the product, the research adapted the ten-stage development research procedure by condensing it into five steps: information gathering, initial draft planning and development, product testing, revision of test results, and dissemination and implementation. Data was collected through focus group discussions, observations, and documentation of the song creation process. Data Analysis used descriptive analysis using field notes, critical memos, coding, data reduction, and data display based on factual data and information, along with music analysis techniques . The results indicated that teachers could develop computational thinking skills through song creation. During the process, teachers could identify how decomposition, pattern recognition, abstraction, and algorithms were applied. The four songs produced by the teacher groups demonstrated the development of teachers' computational thinking skills. This research implies that teachers can enrich early childhood learning approaches by adding a computational thinking dimension through music activities. Additionally, it provides recommendations for education in designing effective learning programs to develop computational thinking in young children.*
***Key Words**:* Computational Thinking; Song Creation; Early Childhood Education

Introduction

In today's digital era, computing, and programming are increasingly important skills to master in various fields. Advances in science and technology require the younger generation to be able to think critically and systematically to overcome the problems they face. The world of education also continues to improve to pursue the skills that must be possessed by the next generation.

One of the skills that the younger generation must have is computational thinking skills or computational thinking skills (Fauji et al., n.d.). The definition of computational thinking is an approach to solving problems that involves logical and systematic thinking that is usually done by computers. Computation thinking involves an understanding of decomposition, pattern recognition, abstraction, and algorithm (Budiyanto et al., 2021).

The issue of computational thinking has become an increasingly popular idea in early childhood education to university. According to computational thinking experts, computational thinking can help us solve complex problems and organize our actions in an efficient way (Kumala et al., 2023).

Computational thinking has become an increasingly popular idea in K-12 and college education. Even at the earliest levels of education such as kindergarten, teachers need to introduce basic computational concepts to students (Griselda, 2021). One effective way to build computational thinking in children is through musical arts activities, one of which is songwriting (Shafer & Skripchuk, 2020).

In learning activities in kindergarten, musical learning are an inseparable part because of the character of children who like to sing and move (Sub et al., 2019). Through musical learning, children can express their feelings create something based on their imagination, and appreciate or appreciate musical works creatively (Barrett et al., 2019a). One of the activities that are always present in kindergarten classrooms is singing because singing is a natural activity for children, where by singing children can improve their musical, physical motoric, cognitive, language, and social-emotional abilities (Alimi Selmani, 2024)

In addition, it is stated in the 2022 Minister of Education and Culture that the development of the educational unit curriculum refers to the Independent Curriculum for early childhood education (PAUD), Elementary Education, and Secondary Education (Pendidikan et al., 2022). Early Childhood Education is very important because it lays the foundation for further growth and development. In the independent curriculum structure of PAUD, there are intra-curricular learning activities so that children can achieve the predetermined learning outcomes (Barrett et al., 2019a). The essence of intra-curricular learning activities is emphasized by the realization of "Freedom to Learn, Freedom to Play". Activities in PAUD must be designed through play so that children can have a direct experience in a pleasant atmosphere (Jensen et al., 2022)

As previously mentioned, early childhood education in kindergarten is very important. PAUD is the foundation for achieving early childhood development which includes the need to educate them so that they have 21st-century competencies and are ready to become global citizens. Learning activities that can develop imagination, creativity, critical thinking, and aesthetic sense must be provided optimally(Pérez-Moreno, 2018)

One of the learning activities that can meet these needs is through music arts activities (Barrett et al., 2019b). The development of kindergarten children's art is directed at the acquisition of learning outcome competencies that are aspects of knowledge, basic art skills, and attitudes related to the ability to be sensitive to the sense of beauty and the development of creativity (Suminah, 2015)

Moreover, Recent research has shown that the use of song creation as a learning approach can increase children's interest and involvement in learning computational thinking concepts (Chong, 2019). Through songwriting, children can combine musical elements and computational concepts to create unique songs. This involves an understanding of musical structure, programming, algorithms, and logic (Shafer & Skripchuk, 2020)

It can be stated that song creation involves creative thinking, problem-solving, and concept modeling. Additionaly, it is important to understand that the basic element in creating song involves knowledge of melody, rhythm, harmony, form/structure, and expression (Nasution, 2016).

When kindergarten teachers use this approach, they can teach basic concepts such as sequence, pattern development, grouping, and abstraction through fun and interesting activities. In addition, through song creation, children can also learn about narrative structure, music vocabulary, and self-expression (Yazar, 2024)

However, research on the use of music in early childhood education, especially those focused on song creation to build computational thinking in kindergarten teachers is still limited. Therefore, based on the discussion above, the author is determined to research how to build teachers' computational thinking skills through song creation.

Method

A development research method using the Borg & Gall procedural model was employed. Due to time constraints and the nature of the product, the research adapted the 10-stage development research procedure by condensing it into five steps: (1) gathering information; (2) planning and developing the initial draft; (3) testing the product; (4) revising the result; and (5) disseminating & implementing.

In addition, the method used to obtain initial data in measuring the computational thinking skills of kindergarten teachers is by conducting:

a. Observation : to see and analyze how to integrate the concept of computational thinking in creating song
b. Focus Group Discussion: conducting a joint discussion to obtain information about teachers' understanding toward computational thinking skills, the challenges and solutions to integrating the concept of computation thinking in creating song.
c. Interview: to measure understanding of computation thinking and its use in the process of creating song.

Meanwhile, to analyze a song, music analysis using the Leon Stein approach of musical elements:

a. Rhythm (how teachers determine the simple rhythm)
b. Melodi (how teachers determine the melody within one octave)
c. Form & Structure (how teachers determine the form)
d. Harmony (how teachers determine the basic harmony)
e. Expression (how teachers determine the tempo and dynamic)
f. Lyrics (how teachers determine meaningful song lyrics and use words that are easly for children to understand)

Data Coding (example of data analysis)

Decomposition (D)	**Pattern Recognition (PR)**	**Abstraction (A)**	**Algorithm (AL)**
Identify song's element such as melody & rhtym	Define interval pattern & melody repetition	Focus on main melody and structure	Define the steps : rhytm, basic note, main melody, theme, & structure, play the song, revise, sing together

Result and Discussion

When teachers practice creating songs based on the concept of computational thinking, keep in mind that songs for children should be short, simple, and repetitive, using lyrics that are easy to digest, and melodies that are easy to sing. It is important for teachers to consider the developmental stage and abilities of children. Early childhood generally has a limited vocal range and may have difficulty with complex rhythms and melodies. It is hoped that after decomposition, pattern recognition, abstraction and algorithms, teachers can create songs with a variety of variations according to children's needs, and can be more productive in their work. The detailed explanation as below:

1. Basic Components of Computational Thinking

• DECOMPOSITION
Breaking down a large problem into smaller, more manageable parts. This allows individuals to focus on one problem at a time.
• PATTERN RECOGNITION
Identifying similar patterns or characteristics in different data or situations to help find the right solution.
• ABSTRACTION
Eliminate irrelevant details to focus on the important aspects of a problem. This helps in simplifying complex problems.
• ALGORITHM
Designing clear steps or procedures to solve a problem. An algorithm can be a written instruction or a step-by-step process to follow.

2. The Relationship between Music and Computational Thinking

In relation to music activities, many studies suggest that music can affect children's cognitive development, including memory, attention, and problem solving. Music activities can also explain the relationship between music activities and spatial abilities, such as understanding patterns, sequences, and their relationships (Chong, 2019).

In creating songs, the ability to understand musical elements such as melody, rhythm, harmony, form/structure, and expression is required. Computational thinking can be used to help the process of creating songs, which involve repetitive and harmonious musical structures. The following are components of computational thinking that can be applied in the creation of songs.

Decomposition:
• Songs are created by breaking them down into smaller and simpler parts
• Identifying the components of songs: main melody, rhythm, number of voice repetitions, time intervals between each voice entry

• Helping to understand the structure of the song in more detail and reducing complexity, making it easier to remember and rearrange

Pattern Recognition:

• Identify the repetition pattern of the main melody in the songs. Each voice will repeat the same melody

• Interval pattern: determining the time interval pattern between each voice entry. Intervals can be the same for all voices

• Use of melody: repetition, stepping or jumping

Abstraction:

• Focus on the main melody

• Focus on cycle (timing)

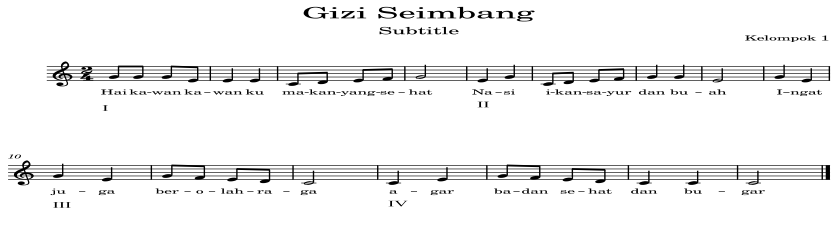
• Focus on structure: two-part or three-part

Algorithm:

• Determine the steps to create a song

1. Determine the rhythm of the song
2. Determine the basic tone
3. Determine the main melody
4. Determine the structure of the song
5. Determine the timing
6. Determine the theme
7. Practice the melody of the song
8. Find lyrics according to the theme
9. Revise the song
10. Practice the song (melody and lyrics) in one voice

Figure 1. Example of song created by teachers



Conclusion

The creation of a song involving the concept of computational thinking helps teachers understand the importance of teaching children computational thinking skills. This process not only helps teachers in learning music, but also develops their critical and creative thinking skills. Teachers can solve the problem of how to create a simple song that can be used in the teaching and learning process.

Finally, the process of creating a song using simple melodies and lyrics can be done by applying the principles of computational thinking such as decomposition, pattern recognition, abstraction, and algorithms. By applying these principles, teachers can create a song that has a clear structure, is easy to remember, is educational, and presents fun music activities for children.

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