

STEAM-based Batik Activities as an Effort to Stimulate Cognitive Abilities

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ABSTRACT

The low cognitive abilities of early childhood and the lack of variety of media and methods used in learning mean that this research aims to look at STEAM-based batik activities in improving cognitive abilities in early childhood. This research approach is a mixed method with a focus on group B children aged 5-6 years in one of the kindergartens in Gebangudik District, Cirebon Regency. Data was collected using observation techniques and interviews. Interview data and observations of STEAM-based batik activities using a qualitative approach. Observational data on children's cognitive abilities will be analyzed using a quantitative approach. The results of this research show that STEAM-based batik activities can improve children's cognitive abilities with a percentage gain of 39% in the Starting to Develop category to 70% in the Developing According to Expectations category, especially in the ability to solve problems, think critically, develop reasoning power, and make decisions. Because this batik activity is modified into an activity that can make children explore their environment because this batik activity goes through several steps, namely patterning, wiping and batiking. Steps of activities that are integrated with the STEAM approach can improve the ability to solve problems, think critically, develop reasoning power, and make decisions.

Keywords:

Batik Learning, Cognitive Abilities, STEAM, Early Childhood

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Introduction

Early childhood is a child aged 0-6 years with different and unique characteristics because during that period all aspects of their development develop very rapidly which cannot be achieved in later life (Hidayati & Zaman, 2021). This is in line with (Mulyasa; 2012; Suyadi & Ulfa; 2015) who say that in early childhood, brain development is developing very extraordinary so if brain cells are rarely or even not stimulated then these cells will die so During this period, children need to be given stimulation or encouragement because every stimulation the child gets whichn will grow new cell connections or strengthen connections that the child already had. Added by (Kohler; 2008) during childhood there is an increase in intellectual intelligence. Thus, during childhood, young children need positive stimulation or stimuli to grow and strengthen brain cells so that their intellectual intelligence can increase and be useful in the future.

Intellectual and cognitive are often synonymous because both are related to various concepts that children have and are related to their thinking abilities (Mulyasa, 2012). Therefore, this cognitive development is one aspect that needs to be developed and optimized from an early age because this cognitive is the child's ability to recognize, compare, remember, solve problems (Klingerg, 2013; Valentina Dewi et al., 2023). In line with that, cognitive development is always related to children's intelligence and talents, the ability to solve problems, make decisions, and better ways of thinking (Putri et al., 2023). Apart from that, it is cognitive because it is used by children to gain knowledge (Morrison, 2012). Knowledge is obtained by children through the exploration process which will become a provision for their survival in the future. This exploration process involves changes in children's abilities and thinking patterns, and language skills (Muntomimah & Wijayanti, 2021). Because according to Piaget (Santrock, 2012) through this exploration children will gain practical experience or imagination which can form brain networks. Thus, children's learning experiences through this exploration process depend on the child's stage of cognitive development.

According to Piaget (Kohler, 2008; Santrock, 2012) this stage of cognitive development is not determined by the form of behavior which is learned or gathered from certain knowledge but rather the ability to learn, make decisions, solve underlying problems and the deep structure that determines knowledge, and skills acquired so that there are stages of cognitive development, including (a) sensori-motor stage (0-2 years); (b) pre-operational stage (2-7 years);); and (d) formal operational stage (11-Adult). Looking at this stage, early childhood is in the concrete preoperational stage in which children think mostly concretely and cannot yet develop their abstract thinking so that they gain new knowledge through objects or symbols. children's daily experiences or events (Beaty, 2013; Umroh et al., 2021). Therefore, educational institutions need to organize learning that can optimize and manage children's cognitive abilities.

Initial research shows that class B children in one of the kindergartens in Gebangudik District of Cirebon Regency have low cognitive abilities. This shows that children are not yet able to solve problems and make decisions with their own thoughts or ideas. As a result, the teacher will help the child solve the problem. Furthermore, children have less interest in exploring their environment. Apart from that, children also have difficulty classifying objects based on color and also have difficulty distinguishing colors. However, the Regulation of the Minister of Education and Culture of the Republic Indonesia Number 137 of 2014 stipulates that early childhood children aged 5 to 6 years have the ability to solve problems and think logically. They can also show creative efforts to solve problems, as well as engage in exploratory and exploratory activities (such as figuring out what happens when water is spilled). This happens because it is influenced by several factors, the only teacher-centered learning which emphasizes the transfer of knowledge from teacher to child so that children are relatively passive when learning.

Learning is carried out using various contexts that can bring the subject matter closer to everyday life or themes that are close to the child's world, namely the STEAM (Science, Technology, Engineering, Arts and Mathematics) approach (Khodijah & Mulyaningsih, 2023). The STEAM approach in learning can develop children's reasoning power naturally because through this approach children observe, ask

questions, gather information and communicate, thereby stimulating curiosity and encouraging children to think at a higher level which includes problem solving, collaboration, independent learning, project-based learning (Muntomimah & Wijayanti, 2021; Umroh et al., 2021). Added by (Winarti, 2022) STEAM learning similarly teaches children to be skilled in children's thinking processes which allows them to acquire, process, and solve problems. Therefore, the STEAM approach also motivates children to be able to understand learning and solve problems according to 21st century skills so that children are trained to analyze and innovate existing problems (Tiasna et al., 2023).

According to research by (Başaran & Bay, 2023) which states that learning with a STEAM approach in the classroom has a long-lasting positive effect on the problem-solving and critical thinking, cooperation, social and presentation skills of preschool children. Therefore, through the STEAM approach, it is possible for children to play while learning. Children are taught to count with objects through fun learning. They are also invited to tell stories and retell what they have done. Educators create rules for learning and provide freedom to choose various types of learning activities, so that children enjoy education with great joy and enthusiasm (Handayani et al., 2023; Umroh et al., 2021).

Learning that is in accordance with the STEAM approach can be found in batik activities. This batik activity is an activity which uses drawing techniques and chooses patterns or decorative patterns. Apart from that, coloring activities are carried out using white cloth, tissue, paper, or other things (Adhe et al., 2023; Pertiwi et al., 2022). Through batik activities, children aged 5 years have the opportunity to develop their creativity, especially when they try to make motifs. Not only that, batik activities also train problem solving, decision making, and concentration when choosing motifs, and also pouring dye (Pertiwi et al., 2022). Even though we see the benefits of batik activities, especially in developing children's cognitive abilities, research that focuses on cognitive abilities is still low because previous research on batik activities focused more on developing creativity, motor, and social emotional abilities in children. This can be seen from the research described by (Adhe et al., 2023; Puri & Rohmalina, 2023) stated that this batik activity can improve children's creativity, fine motor and

emotional abilities with a percentage of 76% of children experiencing changes from the previous 35%. By exploring the STEAM approach through batik activities, this research aims to help early childhood education by focusing on developing children's cognitive abilities in helping educators and policy makers incorporate STEAM principles into early learning environments.

Method

The approach used in this research is a mixed-methods approach with a concurrent embedded design. This research investigates how STEAM-based batik making activities improve the cognitive abilities of young children. Quantitative data regarding the development of the cognitive abilities of the children involved in the research are combined with qualitative data, especially regarding descriptions of the STEAM learning process (Creswell, 2014; Sugiyono, 2012). Qualitative data is collected through interviews with class teachers and observations during STEAM-based batik activities in one of the PAUDs in Gebangudik District, Cirebon Regency. At this school, this activity is carried out in Class B with 10 students aged 5-6 years. Qualitative data is collected through interviews and observations of STEAM-based batik activities. Quantitative data is collected through observational assessments of the development of children's cognitive abilities. Data observed from teacher and student activities are explained descriptively while answers from interviews are reduced and presented narratively.

The assessment scale refers to an arrangement made by the Ministry of Education and Culture in which each child's cognitive abilities are assessed based on certain criteria: Not Yet Developing (BB), Starting to Develop (MB), Developing as Expected (BSH), and Developing Very Well (BSB). Observation data on the development of children who take part in STEAM-based batik activities are categorized on a scale of 1-4. The data obtained will be analyzed using descriptive statistics by calculating the percentage of children who meet certain criteria using a formula.

Result and Discussion

Based on the results of research that has been conducted, researchers find data on the implementation of STEAM-based batik activities to improve children's cognitive abilities obtained through quantitative and qualitative methods. To see the implementation of STEAM-based batik activities, researchers utilize a qualitative approach. Meanwhile, a quantitative approach is used to obtain children's cognitive abilities.

Implementation of STEAM-based Batik Activities

The implementation of batik activities in this research is different because this batik activity is STEAM based so that the implementation stages use STEAM stages, namely observing, classifying/grouping, communicating, interpreting, predicting, and concluding. This batik activity uses natural ingredients, such as turmeric powder, matcha powder, coffee powder, butterfly pea flower powder, and cocoa powder as a substitute for dye, and liquid detergent as a substitute for wax to make batik patterns.



Figure 1. Batik activity materials

Figure 1. shows the tools and materials used in the research process through batik activities. This batik activity involves several steps, namely patterning, wiping, and batikting. In the first stage, children will be directed to make patterns according to their imagination and creativity. At this stage, children will observe the surrounding environment by naming objects that can be used as patterns, such as circles, rectangles, squares, triangles, and make decisions regarding the pattern that the child will draw. After the child makes a pattern, they enter the second stage, namely wiping. This wiping is an activity which uses color as a basic medium and uses small muscles such as the fingers to press the color strokes so that the object becomes blurred. At the wiping stage, the teacher who acts as a facilitator in this batik activity will ask several questions which can stimulate the

child's cognitive abilities, such as asking about the types of dye used and their colors because the child will choose the color that will be utilized as the wiping color.

Apart from that, children can not only use the colors provided by the teacher but children can mix the colors they want so that at this stage children need to be able to group colors and differentiate colors. At this stage, children have a high curiosity, especially in mixing colors because the dyes used are not existing dyes but natural dyes so when mixing children will take the coloring powder they want and then give them water. At this stage, children will learn that coloring can come from natural ingredients (vegetables and fruit) and they will discover that when mixed turmeric powder and matcha will produce a new color, namely dark green.



Figure 2. Wiping Stage

Figure 2. is a batik activity at the wiping stage. After the child chooses a color, the child will start rubbing the dye onto the cloth using cotton. Children predict the shapes or patterns that will appear when the dye is transferred onto the paper..

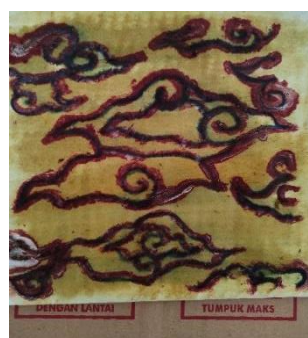


Figure 3. Batik Stage

Figure 3. shows the activities at the batik stage. The batik stage is carried out if the wiping stage is even. This batik process is the process of giving back color following a pattern using cotton buds and detergent soap. At this stage, the child will see and find

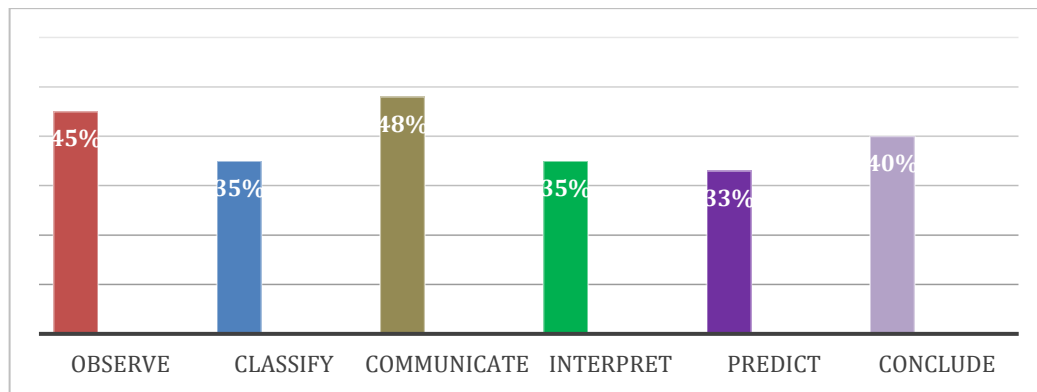
visible color changes when detergent is applied to the pattern. For example, yellow turmeric turns red when soaked in detergent. At the end of the activity, the teacher will give the children the opportunity to tell about the batik they have made and then they will similarly discuss the steps they have taken to achieve these results.

After going through several stages, children's cognitive abilities begin to appear when children enter the patterning stage because at this stage children will observe objects that can form patterns, such as triangles, rectangles, squares and circles, and then make decisions about which patterns to use in which they will draw. This is in line with (Muntomimah & Wijayanti, 2021; Santrock, 2012) Knowledge is obtained by children through an exploration process because it involves changes in abilities and thinking patterns so that they will gain practical experience or imagination.

Besides, at this wiping stage, children can recognize, compare, remember and solve the dyes that will be used in wiping so that at this stage children's cognitive abilities can increase because this cognitive ability is not determined by the form of behavior learned or gathered from certain knowledge but rather the ability to learning, making decisions, and solving problems are the underlying and deep structures that determine the knowledge and skills acquired (Kohler, 2008; Santrock, 2012). This is in line with (Pertiwi et al., 2022) that batik activities also train problem solving, decision making, and concentration when choosing motifs, and also pouring dye.

Improving Children's Cognitive Abilities through STEAM-based Batik Activities

Based on research results obtained through observation using a checklist to determine the conditions before and after implementing STEAM-based batik activities by directly observing children, The data obtained will be analyzed using descriptive statistics. The observation data on children's cognitive abilities before the STEAM-based batik activity can be seen in the following graph.

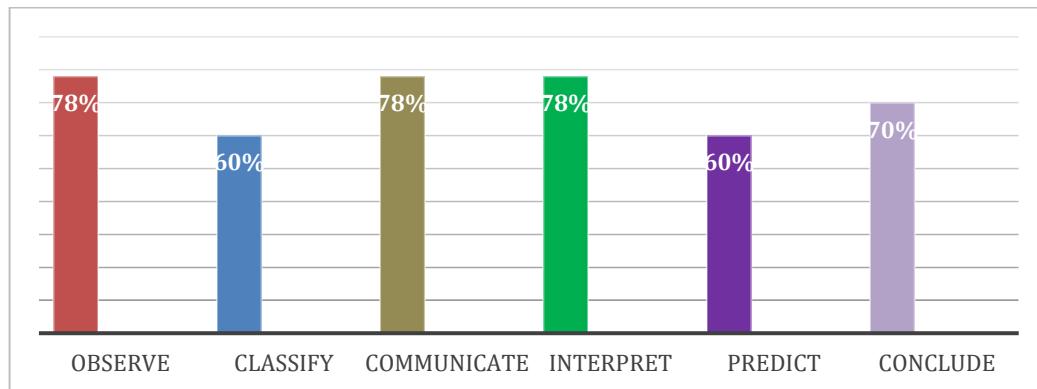


Graph 1. Children's Cognitive Abilities Before STEAM-based Batik Activities

Graph 1. shows the results of children's cognitive abilities before the STEAM-based batik activity entered the Starting to Develop category with a percentage of 45% for the observing indicator, with 6 children in the Starting to Develop category, 1 child in the Developing According to Expectations category, and 3 children in the Starting to Develop category. Furthermore, the child classification indicator is in the Starting to Develop category with a percentage of 35%, with 7 children in the Not Yet Developing category, 2 children in the Starting to Develop category, and 1 child in the Developing According to Expectations category. The Child Communication Indicator shows a percentage of 48% of children in the Starting to Develop category, with four children in the Not Yet Developing category, three children in the Starting to Develop category, and three children in the Developing According to Expectations category.

The indicator interprets that one child is included in the Starting to Develop category with a percentage of 35%, with seven children included in the Not Yet Developing category, two children are included in the Starting to Develop category, and one child is included in the Developing According to Expectations category. The indicator predicts it is also in the Starting to Develop category with a percentage 33%, with seven children in the Not Yet Developing category and three children in the Beginning to Develop category. This is different from interpreting indicators. Then, the indicators conclude that five children are in the Not Yet Developing category, four children are in the Starting to Develop category, and one child is in the Developing According to Expectations category with a percentage of 40%. Thus, children who take part in STEAM-based batik activities are in the Starting to Develop category based on their cognitive abilities.

Seeing this, teachers use STEAM-based batik activities to see children's cognitive abilities because batik activities can train problem solving, making decisions, and concentration when choosing motifs, and also pouring dye (Pertwi et al., 2022). The observation data on children's cognitive abilities through STEAM-based batik activities can be seen in the following graph.



Graph 2. Children's Cognitive Abilities Through STEAM-based Batik Activities

Graph 2. shows children's cognitive abilities in STEAM-based batik activities, as shown by the percentage they obtained for each indicator, including in the Developing According to Expectations category, as shown in Graph 2. Children's cognitive abilities are in the Very Well Developing category with a percentage of 78%. Two children are starting to develop, six children are developing according to expectations, and three children are developing very well, according to the indicators observed. On the other hand, the indicator that categorizes children as being in the Developing According to Expectations category with a percentage of 60% shows that seven children are starting to develop, two children are developing according to expectations, and one child is developing very well. In terms of children's communication indicators, a percentage of 78% is in the Very Well Developing category; two children are in the Starting to Develop category, five children are in the Developing According to Expectations category, and three children are in the Very Well Developing category.

The interpretive indicators also produce a percentage of 78% with nine children in the Developing According to Expectations category and one child in the Very Well Developing category. With six children starting to develop and four children

developing according to expectations, the children are in the category developing according to expectations with a gain of 60% of the predicted indicators. Furthermore, the indicators found that children are in the Developing According to Expectations category with a percentage of 70%, with three children Starting to Develop, six children Developing as Expected, and one child Developing Very Well.

The results of the analysis of the cognitive abilities of children who received conventional learning are much lower compared to when children are given batik activities. Most children who take part in STEAM-based batik activities have a much higher level of cognitive ability. It can be seen from the results that the percentage of children's cognitive abilities has increased significantly to 70% compared to the previous 39%. This increase proves the success of STEAM batik activities in growing cognitive abilities in children. This is in line with (Azizah et al., 2022). Project-based activities and experiential learning can effectively improve the cognitive skills of young children. Because the STEAM approach allows children to play while learning. Karena melalui pendekatan STEAM memungkinkan anak memungkinkan anak-anak bermain sambil belajar (Handayani et al., 2023).

In this STEAM-based batik activity, the teacher gives children the freedom to create patterns based on observations of the surrounding environment. In line with (Umroh et al., 2021) which explains that children who are given freedom in having different types of activities can make children enjoy learning happily and enthusiastically. Apart from that, it similarly trains children in solving problems, making decisions, and concentrating when choosing the motif they will sketch (Pertiwi et al., 2022). Not only that, this batik activity using STEAM will interpret and predict colors from natural materials and their mixing. The process of interpreting and predicting can develop cognitive abilities because children can develop children's reasoning powers naturally, thus fostering children's curiosity and encouraging them to think at a higher level (Muntomimah & Wijayanti, 2021; Umroh et al., 2021). Apart from that, children will be invited to tell stories about the batik they have made and retell what they have done. In this process, children can develop their abilities and thinking patterns, and their language skills (Muntomimah & Wijayanti, 2021). Apart from that, Piaget

(Santrock, 2012) stated that practical experience or imagination can form brain networks.

Conclusion

STEAM-based batik activities can improve children's cognitive abilities with the percentage level increasing from 39 percent in the Starting to Develop category to 70 percent in the Developing According to Expectations category. Apart from that, this batik activity is modified into an activity that can produce children exploring their environment because this batik activity involves several steps, namely patterning, wiping and batikting. The batik activity steps are integrated with the STEAM approach in which children are given the freedom to create the desired batik motif or pattern according to their observations, then the dyes used are also natural dyes. Furthermore, this STEAM-based batik activity can improve the ability to solve problems, think critically, develop reasoning power, and make decisions.

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Reference

- Adhe, K. R., Widayati, S., Simatupang, N. D., & Maulidah, E. C. (2023). Pengaruh Kegiatan Membatik Teknik Cap Berbasis Loosepart terhadap Kreativitas di Sekolah Indonesia Kuala Lumpur. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 7(6), 7777-7784. <https://doi.org/10.31004/obsesi.v7i6.5492>
- Azizah, A., Munawar, M., & Khasanah, I. (2022). Implementasi Pembelajaran Berbasis Steam Dalam Menumbuhkan Keterampilan Berpikir Kritis Anak Usia 5-6 Tahun Di Tkit Harapan Bunda Semarang. *Wawasan Pendidikan*, 2(2), 593-599. <https://doi.org/10.26877/wp.v2i2.10059>

- Başaran, M., & Bay, E. (2023). The effect of project-based STEAM activities on the social and cognitive skills of preschool children. *Early Child Development and Care*, 193(5). <https://www.tandfonline.com/doi/abs/10.1080/03004430.2022.2146682>
- Beaty, J. J. (2013). *Observasi Perkembangan Anak Usia Dini*. Kencana.
- Creswell, J. (2014). *Research Desain; Pendekatan Metode Kualitatif, Kuantitatif, dan Campuran*. Pustaka Pelajar.
- Handayani, W., Kuswandi, D., Akbar, S., & Arifin, I. (2023). Pembelajaran Berbasis STEAM untuk Perkembangan Kognitif pada Anak. *Murhum: Jurnal Pendidikan Anak Usia Dini*, 4(2), 770–778. <https://doi.org/10.37985/murhum.v4i2.390>
- Hidayati, N., & Zaman, B. (2021). Is it Necessary to Ban Gadget in Early Childhood? *Proceedings of the 5th International Conference on Early Childhood Education (ICECE 2020)*, 538(Icece 2020), 270–273. <https://doi.org/10.2991/assehr.k.210322.057>
- Khodijah, S., & Mulyaningsih, T. (2023). Penggunaan pendekatan steam (science, technology, engineering, art, and mathematics) terhadap kecerdasan logika matematika anak di tk labschool stai bani saleh kota bekasi. *Jurnal Pendidikan Dan Pengajaran*, 2(1), 10–26.
- Klingerg, T. (2013). *The Learning Brain*. Oxford University Press. [http://repo.iain-tulungagung.ac.id/5510/5/BAB 2.pdf](http://repo.iain-tulungagung.ac.id/5510/5/BAB%202.pdf)
- Kohler, R. (2008). Jean Piaget. In *Angewandte Chemie International Edition*, 6(11), 951–952. Bloomsbury Academic. [http://repo.iain-tulungagung.ac.id/5510/5/BAB 2.pdf](http://repo.iain-tulungagung.ac.id/5510/5/BAB%202.pdf)
- Morrison, G. S. (2012). *Dasar Dasar Pendidikan Anak Usia Dini*. Person Education.
- Mulyasa. (2012). *Manajemen PAUD*. PT Remaja Rosdakarya.
- Muntomimah, S., & Wijayanti, R. (2021). The Importance of STEAM Loose Part Learning Effectiveness in Early Childhood Cognitive Learning. *Proceedings of the 2nd Annual Conference on Social Science and Humanities (ANCOSH 2020)*, 542(Ancosh 2020), 47–52. <https://doi.org/10.2991/assehr.k.210413.012>
- Peraturan Menteri Pendidikan dan Kebudayaan Republik. Indonesia Nomor 137 Tahun 2014, (2014).
- Pertiwi, A. D., Wahyuningsih, T., Layly, A. N., & Pertiwi, F. D. (2022). Implementasi Pembelajaran Membatik Berbasis Budaya pada Anak Usia Dini. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 6(6), 6225–6236. <https://doi.org/10.31004/obsesi.v6i6.3298>
- Puri, R. R., & Rohmalina, R. (2023). Meningkatkan Kemampuan Sosial Emosional Anak Melalui Kegiatan Membatik Menggunakan Cotton Buds. *Cimahi, Jawa Barat*, 6(5), 542–550.
- Putri, Y. F., Marlina, L., & Wulandari, Y. T. (2023). Pengaruh Penggunaan Media Balok Angka Terhadap Perkembangan Kognitif Pada Anak Usia 4-5 Tahun. *Raudhatul Athfal: Jurnal Pendidikan Islam Anak Usia Dini*, 6(2), 153–163. <https://doi.org/10.19109/ra.v6i2.15503>

- Santrock, J. W. (2012). *Life Span Development perkembangan masa hidup edisi ketigabelas jilid 1*. Erlangga.
- Sugiyono. (2012). *Metode Penelitian Kuantitatif Kualitatif dan R&D*. Alfabeta.
- Suyadi, & Ulfa, M. (2015). *Konsep Dasar PAUD*. Remaja Rosdakarya.
- Tiasna, S., Betari Athillah, N., & Putri Yolanda, V. (2023). Implementasi Model Pembelajaran Berbasis Steam Melalui Budaya Lokal “Batik Jumput’ Di Sekolah Dasar. *Jurnal Review Pendidikan Dasar : Jurnal Kajian Pendidikan Dan Hasil Penelitian*, 9(1), 17–22. <https://doi.org/10.26740/jrpd.v9n1.p17-22>
- Umroh, S., Mustaji, & Hasibuan, R. (2021). Effectiveness Of Using Steam Learning Approach to Improve Language And Cognitive Development Of Group B Kindergarden Children In Waru District Sidoarjo Regency. *International Journal of Education and Social Science Research*, 3(06), 127–143.
- Valentina Dewi, E. R., Hibana, H., & Ali, M. (2023). Pengaruh Penggunaan Media Loose Parts terhadap Perkembangan Kognitif Anak Usia Dini. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 7(1), 267–282. <https://doi.org/10.31004/obsesi.v7i1.3451>
- Winarti, E. (2022). Pengaruh Penerapan Percobaan Sains Terhadap Perkembangan Kognitif Anak Usia 5-6 Tahun di RA Atto’ah Desa Sipatuhu Kecamatan Banding Agung Kabupaten OKU Selatan. *Raudhatul Athfal: Jurnal Pendidikan Islam Anak Usia Dini*, 5(2), 179–189. <https://doi.org/10.19109/ra.v5i2.11233>
- Yoni, A. (2010). *Menyusun Penelitian*. Familia.