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Research Article

Supporting and Inhibiting Factors of Outdoor STEAM Learning in Early Childhood Education

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Abstract.
Research shows that it's important for kids to get out and play. By combining outdoor learning and STEAM, it will provide a new perspective on the lesson theme and can connect school content with the real-world problems. However, some things support and hinder outdoor STEAM learning in early childhood education. This study aims to determine the supporting and inhibiting factors of STEAM outdoor learning in early childhood education. The subjects of this research were 34 early childhood education schools in Central Java. This research data is qualitative, collected through observation, documentation, and interviews techniques. The observation technique was used to make direct observations in the field and documented them in the form of videos and photos. Research data management was carried out using the QSR NVivo software. The data analysis technique used was the qualitative data analysis technique from Miles and Huberman which includes data reduction, data presentation, and drawing conclusions. Testing the validity of the data in this research used source triangulation techniques through the cluster analysis and comparison diagram features in the QSR NVivo software. Based on the coding result of the research data using the help of NVivo QSR software, it is known that the biggest supporting factors of outdoor STEAM learning in early childhood education are environment, media, teachers, and infrastructure, while other supporting factors are area, cost, weather, new ideas, new experiences, and situations. The biggest inhibiting factors of outdoor STEAM learning in early childhood education are adaptability, security, and infrastructure, while other inhibiting factors areweather, support; environment, pollution, and situation. The results of this study can be used as a guideline for outdoor STEAM learning in early childhood education and make the inhibiting factors a challenge for teachers to facilitate outdoor learning as a form of maximizing the use of the environment as a learning resource in early childhood education.

Keywords: STEAM, outdoor learning, early childhood education

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1. Introduction

The world needs more problem solvers and innovators to be able to overcome important problems plaguing the earth, such as climate change, health pandemics, poverty, and other complex problems. Therefore, having knowledge in one area only is no longer enough – future generations need to be equipped with interdisciplinary knowledge, critical thinking and a collaborative spirit [1]. This knowledge and skills can be obtained by implementing STEAM (Science, Technology, Engineering, Art, Math) education, because STEAM education equips the younger generation with the knowledge and skills to solve problems, understand information, know how to collect evidence and evaluate evidence to make decisions [2] as well as preparing students for the complex roles required in the future [3]. STEAM education needs to be implemented from early years because it has a greater impact on the competencies development of children aged 3-6 years [4] and STEAM education is the main key to high quality early childhood education [5]. The results of research conducted by DeJarnette [6] also emphasized the importance of STEAM education in early childhood.

Science can help students understand how the world works, develop higher-order thinking skills, have broad intellectual and social-emotional benefits [7] improve reasoning and planning skills [8] observation and analysis [9]. Technology can help students apply their knowledge in practical ways [10]. Engineering can bridge the achievement gap between students when studying other disciplines [9]. In addition, Integrated engineering is seen as a motivation booster for students because it allows them to achieve a better understanding so that they can have a positive impression of other disciplines [11]. Art is a means to achieve better learning outcomes in a fun way [12] because art can help students to develop various types of creativity, intelligence, communication and skills that will help them throughout their education and their future [13] Mathematics can improve critical thinking skills, develop positive attitudes [14], improve analytical, reasoning and problem-solving skills in students [15].

Research conducted by Voicu, et al [16] on STEAM education in early childhood and elementary schools in six countries, namely Turkey, Romania, Greece, Bulgaria, Poland and Lithuania, which was conducted using the focus-group interviews method, shows that teachers , STEAM professionals, and parents have a positive perception of STEAM and they believe that STEAM increases children's motivation and engagement in learning regardless of the child's gender, increases creativity, self-confidence and provides good learning opportunities for boys and girls, by considering children's emotional and social needs and abilities. The same thing was also found in research conducted by

Alghamdi [17] regarding the perceptions of early childhood education teachers towards STEAM education in Saudi Arabia, which was conducted using a quantitative survey method. The results of Alghamdi's research [17] shows that there is an overall positive belief in STEAM education for early years. Both researches studied STEAM education in the classroom in early childhood education and both discussed STEAM from teacher perceptions, so they are different from this research. The differences are a) this research discusses outdoor STEAM education in early childhood education; b) this research discusses factors that support and hinder outdoor STEAM learning in early childhood education; c) qualitative data was collected through observation, documentation and interview techniques.

School yard is an important space for students' informal and formal learning because it can develop their social skills and foster their identity [18–20]. However, compared to other educational spaces, schoolyards are less frequently used for the learning process [21]. Therefore, this research aims to determine the supporting and inhibiting factors of outdoor STEAM learning in early childhood education. The results of this research can be used as a guide for outdoor STEAM learning in early childhood education as well as making inhibiting factors a challenge for teachers to facilitate outdoor learning as a form of maximizing the use of the environment as a learning resource in early childhood education.

2. Method

This research type is qualitative research which seeks to explore the factors that influence outdoor STEAM learning in early childhood. The subjects of this research were 34 early childhood education schools in Central Java. This research data is qualitative data collected through observation, documentation and interview techniques. Research data management was carried out using the QSR NVivo software, so that data analysis and interpretation could be done easily [22]. Data analysis in qualitative research is carried out while data collection is in progress and after data collection is complete within a certain period. In this research, the data analysis technique used was the qualitative data analysis technique from Miles and Huberman, including data reduction, data presentation, and drawing conclusions [23]. Testing the validity of the data in this research used source triangulation techniques through the Cluster Analysis and Comparison Diagram features in the QSR NVivo software [22].

3. Result and discussion

3.1. Result

Collecting data from 34 early childhood education schools in Central Java through observation, documentation and interviews, which was then processed using QSR NVivo analysis showed the following results:

TABLE 1: Sub Focus, Indicators and Coding amounts.

No	Sub Focus	Indicators	Coding amounts
1	Supporting factors	Area Cost Weather Teacher New ideas Environment Media New experiences Infrastructure Situation (place and time)	5 1 4 13 2 21 13 9 11 5
2	Inhibiting Factors	Adaptation Weather Support Safety Environment Pollution Infrastructure Situation (place and time)	14 6 4 12 4 1 6 1

The most dominant sub-focus that emerged in the research was supporting factors which has 84 codings and inhibiting factors which has 48 coding

3.1.1. Supporting Factors of Outdoor STEAM Learning in Early Childhood Education

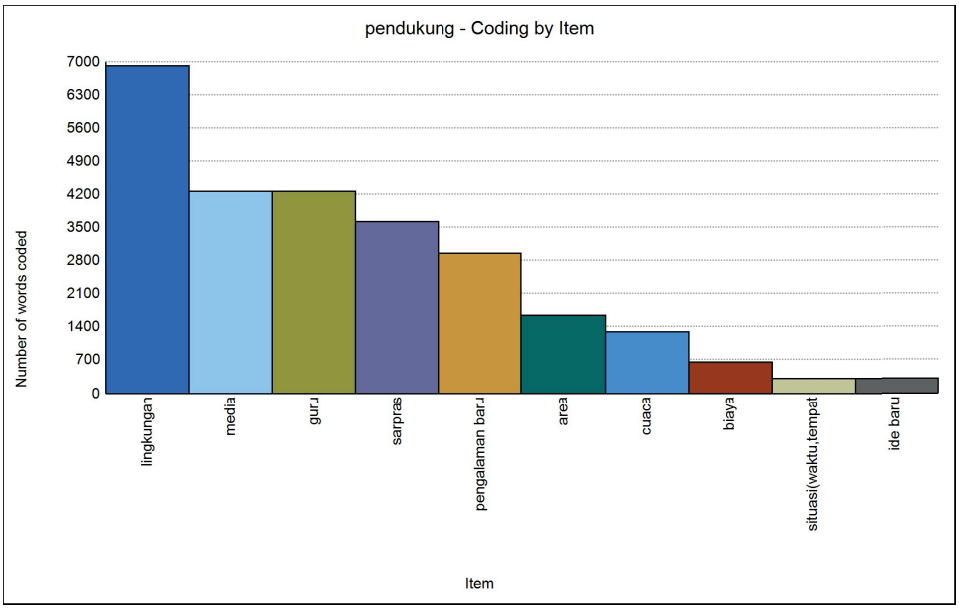

Figure 1: Supporting Factors of Outdoor STEAM Learning in Early Childhood Education.

Figure 1 shows sub-focus of the biggest supporting factors of outdoor STEAM in early childhood education are environment totaling 6909 coding; media totaling 4277 coding, teachers totaling 4277 coding; and infrastructure totaling 3619 coding. Based on the supporting factors above, it is known that the correlation coefficient between infrastructure and environment is 0.724605, which means excellent agreement; and other supporting factors such as environment, teachers, media, area, new experiences, situations (place, time), new ideas and adaptation have a correlation coefficient between 0.434261 – 0.681232 with a fair to good agreement interpretation. This can be interpreted that the data obtained has reached the saturation point, so it is close to the desired research concept, that is, this data already represents the research objectives as presented in table 2.

Table 2: Correlation Coefficient of Supporting Factors of Outdoor STEAM Learning in Early Childhood Education.

Node A	Node B	correlation coefficient	Interpretation
Infrastructure	Environment	0,724605	*Excellent agreement*
Infrastructure	Teacher	0,681232	*Fair to good agreement*
Environment	Teacher	0,626031	*Fair to good agreement*
media	Teacher	0,575745	*Fair to good agreement*
media	Environment	0,53618	*Fair to good agreement*
Teacher	Area	0,505561	*Fair to good agreement*
New experience	Environment	0,455276	*Fair to good agreement*
Situation (time, place)	Environment	0,451831	*Fair to good agreement*
Media	Area	0,449321	*Fair to good agreement*
Infrastructure	Media	0,434542	*Fair to good agreement*
Situation (time, place)	New experience	0,434261	*Fair to good agreement*

3.1.2. Inhibiting Factors of Outdoor STEAM Learning in Early Childhood Education

Figure 2 shows sub-focus of the biggest inhibiting factors of outdoor STEAM learning in early childhood education, are adaptability totaling 4564 coding; safety totaling 3912 coding, and infrastructure totaling 1946 coding. Based on the correlation coefficient in table 3, it is known that infrastructure vs parental support has a value of 0.575747 with a fair to good agreement interpretation. Meanwhile, other inhibiting factors such as support, weather, safety, adaptation have a value of 0.418254 – 0.54701 with a fair to good agreement interpretation. This can be interpreted that the data obtained has

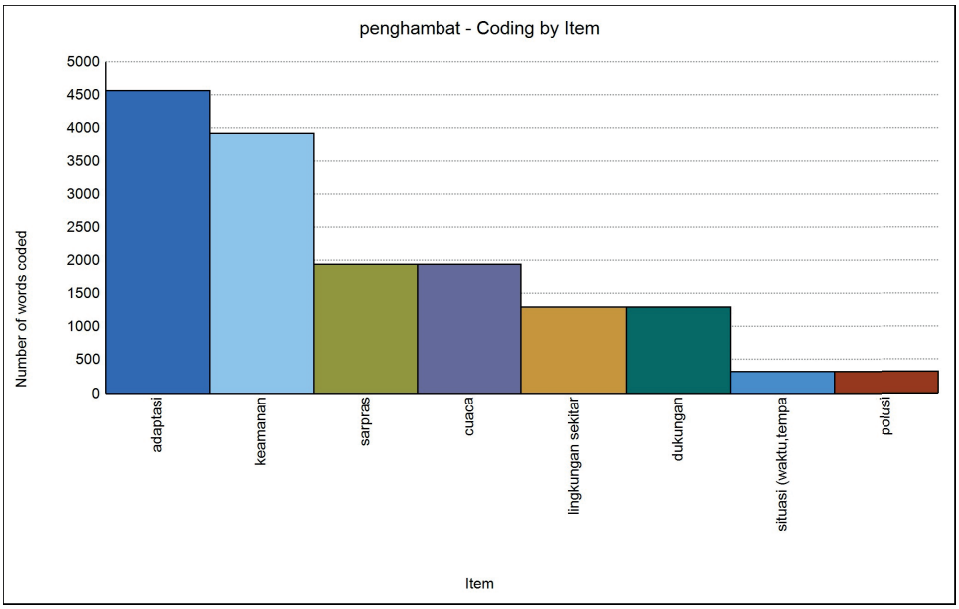

Figure 2: Inhibiting Factors of Outdoor STEAM Learning in Early Childhood Education.

reached the saturation point, so that it is close to the desired research concept, that is the existing data already represents the research objectives.

TABLE 3: Correlation Coefficient of Inhibiting Factors of Outdoor STEAM Learning in Early Childhood Education.

Node A	Node B	correlation coefficient	Interpretasi
Infrastructure	Safety	0,408788	*Fair to good agreement*
Infrastructure	Support	0,575747	*Fair to good agreement*
Safety	Support	0,523758	*Fair to good agreement*
Support	Weather	0,544651	*Fair to good agreement*
Safety	Weather	0,454932	*Fair to good agreement*
Infrastructure	Weather	0,418254	*Fair to good agreement*
Safety	Adaptation	0,54701	*Fair to good agreement*
Support	Adaptation	0,450159	*Fair to good agreement*

4. Discussion

The research results show that the biggest supporting factors of outdoor STEAM learning in early childhood education are environment, media, teachers and infrastructure, while other supporting factors are area, cost, weather, new ideas, new experiences, situations. Meanwhile, the biggest inhibiting factors of outdoor STEAM learning in early childhood education are adaptability; safety; and infrastructure, while other inhibiting factors are weather; support; environment; pollution; and situation.

The results of this research strengthen the results of several previous studies, namely research conducted by Dimitra, et al [24], Oberle, et al [25] and Dabaja [26]. The research results of Dimitra, et al [24] show that the supporting factors of outdoor learning are the environment, materials (media), and teachers, while the inhibiting factors of outdoor learning are the environment, teachers, school policies, time, space, health and safety. The research results of Oberle, et al [25] show that there are four factors and sub-factors supporting and inhibiting outdoor learning, namely: 1) Teacher characteristics: interest/motivation in teaching outdoors, readiness, confidence in handling risks; 2) Systemic factors: school principal support, school/district policies, funding/resources, curriculum, school schedule; 3) Culture: school culture, people's beliefs about education, family background; 4) Environmental factors: weather, natural environment/buildings, danger. The results of Dabaja's research [26] state that there are obstacles in implementing outdoor learning, namely safety, curriculum, costs and weather.

As mentioned above, the results of this research show that the biggest supporting factors of outdoor STEAM learning in early childhood education are the environment, media, teachers and infrastructure, meanwhile, the biggest inhibiting factors of outdoor STEAM learning in early childhood education are the adaptability; safety; and infrastructure.

Environmental factor

Outdoor learning environments are ideal places to facilitate many aspects of STEAM learning [27] The school's outdoor environment includes parks, playgrounds, or forests [28]. In this research, the outside school environments used for outdoor STEAM learning are the playground, field and school yard.

A study conducted by Sarah, et al, [29] revealed that outdoor schools which are used as a place for teaching, playing and exploring various experiences offer formal and informal learning opportunities, encourage children to engage with each other, engage with inanimate objects and challenge them physically, cognitively, perceptually and socially. Apart from that, playgrounds in schools also play an important role in improving children's health [30], emotional well-being, creativity and children's learning motivation [26]. Recent research also shows that student performance improves in schools with better physical learning environments [31].

Media factor

Learning media are resources used for pedagogical purposes that facilitate learning [32]. The variety of outdoor learning activities is greatly supported by the availability of media. The media can be man-made or natural, such as twigs, wood, stones, sand and so on [7].

Teacher factor

In outdoor learning, teachers act as supervisor [33] and motivator in which the teachers act as a guide so that students learn actively, effectively, creatively, and become familiar with the environment [34]

Infrastructure factor

School infrastructure influences the quality of education and student performance [35]. Thus, school infrastructure must be able to facilitate student learning, especially supporting teachers and students in learning so that learning in the classroom and outside the classroom can run optimally [36].

According to Barrett et.al [31], quality school infrastructure must be characterized by being easily accessible, providing a safe and healthy environment, and offering optimal learning space. These characteristics can be grouped into two main categories: functionality and safety. Functionality focuses on optimal learning environments and health conditions; Safety focuses on the structural stability of buildings in the event of natural hazards.

Adaptability factor

Adaptability is a person's ability to make "appropriate cognitive, behavioral, and/or affective adjustments in facing uncertainty and new things" [37]. Other researches show that adaptability plays an important role in education namely improving student behavior to be more positive, predicting a number of student academic and non-academic outcomes, increasing student participation in the learning process, increasing academic achievement, and increasing general life satisfaction [37–40].

Safety factor

A safe and conducive school environment can minimize the risk of bad things happening (bodily injury), as well as emotional trauma and psychological stress. Emotional and psychological trauma can cause a lack of self-esteem which can result in poor performance in school. Therefore, meaningful teaching and learning cannot be implemented in an environment that is not safe and peaceful for both students and teachers [41].

5. Conclusion

The research results show that the biggest supporting factors of outdoor STEAM learning in early childhood education are the environment, media, teachers and infrastructure, while other supporting factors are area, weather, new ideas, costs, new experiences, situations. Meanwhile, the biggest inhibiting factor of outdoor STEAM learning in early childhood education are adaptability; safety; and infrastructure, while other inhibiting factors are the weather; support; environment; pollution; situation. The results of this research can provide support for outdoor STEAM learning in early childhood education. Therefore, it is necessary to conduct development research related to media and infrastructure that facilitate children's adaptability and pay attention to environmental safety in supporting outdoor STEAM learning in early childhood education. Considering that adaptability and providing a safe environment play an important role in education because they will have a positive impact on student behaviour and achievement.

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