

A Study of Experiments in Improving Science Literacy and Disciplinary Behavior of 6 Year-Old Children (Processing Organic Waste Using *Black Soldier Fly* Magot)

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ABSTRACT

Early childhood needs to process an understanding of natural phenomena and the world around them. Children are not yet aware of environmental problems because they are developing various skills such as science literacy skills and mindsets that are reflected in disciplinary attitudes. The purpose of the study was to determine the significance of increasing science literacy and disciplinary behavior of 6-year-old children by processing organic waste using black soldier fly maggots. The research method uses a quantitative approach through a quasi-experimental study process with the research from Nonequivalent Control Group Design. The results of theoretical research based on the comparison between the t count and t table show the t count of $3.792 > 2.306$, and the significant result is $0.001 < 0.05$, then H_a is accepted. So it is said that there is an increase in science literacy skills and disciplinary behavior of children aged 6 years, through organic waste processing experiments using black soldier fly maggot.

Keywords: *scientific literacy, disciplined behavior, processing organic waste.*

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INTRODUCTION

Children need to process to understand natural phenomena and the world around them, children are not yet aware of environmental problems because they are developing various skills such as science literacy skills and mindsets that are reflected in disciplinary attitudes. Children's lack of understanding leads to their lack of awareness about responsibility for the environment, early childhood is a critical period in the formation of children's behavior and character. Science literacy in early childhood can be improved through interesting and experience-based approaches, such as simple experiments, and nature observation as well as disciplinary behavior, such as perseverance and consistency in learning, also need to be instilled early on through supportive approaches and positive reinforcement. Thus, children will have a strong foundation in science literacy and disciplined behavior that will help them learn and face future challenges.

Based on the results of observations made at the hobihobi Islamic School, researchers found that there was already organic waste processing using Black Soldier Fly (BSF) maggot, but there was no program that synergized or intersected with science literacy skills. Children are still seen throwing garbage not under the classification of the trash can, and disciplinary behavior has not been formed from student awareness. This is what supports researchers to conduct research on science literacy skills and disciplinary behavior of 6-year-old children at hobihobi Islamic School.

Science literacy in early childhood science is the ability to be interested in science topics and science ideas so as to explain a phenomenon scientifically by evaluating and designing scientific methods and interpreting data and evidence scientifically (OECD, 2019). According to Bybee cited by Greenberg (2022), science or science literacy can be further broken down into the following categories: functional, which involves reading, writing, and speaking science vocabulary and understanding its meaning; conceptual and procedural, which consists in understanding the big ideas and practices of science; and multidimensional, which involves scientific history, the nature of science, and science in our lives.

Adult support and the educational environment can help children learn to hone science literacy skills, form disciplined behavior, and think critically about environmental issues. Mini (2011) Applying discipline to children aims for children to learn as social beings. At the same time, children achieve optimal growth and development. The initial goal of discipline is to make children trained and controlled. Still, according to Rose Mini as cited in the thesis (Rohmi, 2022) The best way to discipline children is to use a positive approach. For example, providing examples, encouragement, communication, praise, and gifts. Negative ways to discipline children include scolding, hitting, or making children angry so that the learning process is less than optimal. Parents and teachers are the models that children will imitate and emulate, both in words and deeds. Character planting in children can be done through advice, habituation, exemplary, and reinforcement. (Darmeinis et al., 2024) Disciplinary behavior affects early childhood social skills as explained The habituation method is very satisfying (Zetira & Kamtini, 2019). This can be seen from the increase in children's discipline which is characterized by the habit of children throwing garbage in its place, getting used to queuing discipline to wash hands, and getting used to cleaning up their equipment after use. A different study (Mardhiati, 2019) showed the results of brainstorming with early years teachers regarding the material needs of early childhood Clean and Healthy Lifestyle education. Efforts to increase early childhood health knowledge for early years teachers that are sustainable and planned must be carried out in the form of routine training activities such as early childhood health promotion and prevention.

METHOD

Using a quantitative approach, this research went through an experimental study process by dividing into two groups. Experimental designs systematically manipulate one or more variables to evaluate how this manipulation impacts the desired outcome (or

outcomes). Importantly, the experiment isolates the effect of this manipulation by keeping all other variables constant. When one group receives treatment and the other does not (which is the manipulated variable of interest), the experimenter can isolate whether it is the treatment and not other factors that influence the outcome (Creswell & Creswell, 2018).

FINDING AND DISCUSSION

The data obtained from this study are science literacy skills and disciplinary behavior, after processing organic waste using BSF magot and conventional learning (without providing special treatment). The students involved in this study totaled 11 students, aged 6 years. The experimental class consisted of 6 children, and the control class consisted of 5 children. All students followed the learning process until the end and completed the post-test. The data analysis used in this study is a different test using the *Sample T-test*. This *T-test* is to decide whether the research hypothesis is accepted or rejected.

t-Test: Two-Sample Assuming Equal Variances		
	<i>experimental class</i>	<i>control class</i>
Mean	117	90,8
Variance	187,5	51,2
Observations	5	5
Pooled Variance	119,35	
Hypothesized Mean Difference	0	
df	8	
t Stat	3,791928013	
P(T<=t) one-tail	0,002648623402	
t Critical one-tail	1,859548033	
P(T<=t) two-tail	0,005297246804	
t Critical two-tail	2,306004133	

Table 1: Sample T-Test

This study aims to analyze organic waste processing experiments on science literacy skills and disciplinary behavior in 6-year-old children. Based on the data analysis that has been done, it can be seen that the average difference between the experimental class and the control class. In the descriptive analysis, it can be seen that the *mean* for the experimental class is 119.5, and for the control class is 90.8, meaning that the average scientific literacy ability and disciplinary behavior of the experimental class are higher than

the average of the control class. The final results of the two groups showed an average difference of 26.2 and the test results showed that the difference was significant. Hypothesis proof based on the comparison between t count and t table shows t count of $3.792 > 2.306$, and the significance result is $0.001 < 0.05$, then H_a is accepted. So it is said that there is an increase in science literacy and disciplinary behavior of 6-year-old children with organic waste processing experiments using *black soldier fly* maggot. The coefficient for the science literacy variable has a value of 2.725. The coefficient for the disciplinary behavior variable has a value of 3.041. Indicating an increase in scientific literacy of 2.725 and an increase in disciplinary behavior of 3.041. So it can be concluded that the variable of disciplinary behavior is more affected in children aged 6 years from organic waste processing experiments using *black soldier fly* maggot. The increase in science literacy and disciplinary behavior of 6-year-old children with organic waste processing experiments using *black soldier fly* maggot is due to, among others (1) Children learning about the life cycle of insects and how organic waste is separated. (2) Children can improve their observation and analysis skills by witnessing the decomposition process of waste and maggots. (3) This experiment can help children understand basic concepts about ecosystems, such as how producers, consumers, and decomposers interact with each other. (4) Children can learn about responsibility and consistency in protecting the environment. (5) Children know the benefits of waste management and realize the importance of environmentally friendly practices.

These findings are in line with the findings conducted by Herawati et al. in 2023, entitled Improving Environmental Literacy of 5–6 Year Old Children Through *Eco Enzyme* Projects, showing success in increasing environmental understanding in children aged 5–6 years through *eco enzyme* projects. Efforts to utilize students' free time and teacher creativity in utilizing surrounding tools and materials are success factors in teaching children about the importance of protecting the environment (Herawati, Putra, & Suyanta, 2023). Febriyanti and Putra in 2023 designed an interactive book with the theme of waste management, which was reviewed in a study entitled Designing Interactive Storybooks to Know and Manage Waste for the Golden Age. Children can feel the texture of waste with different groups which can help *golden-age children* recognize the types of waste that exist by relying on their sensory nerves and memory (Febriyanti & Putra, 2023). Laila Cahyani's research in 2022 showed that gardening affects the *green behavior* of group B children at Khairunnisa Tangerang Kindergarten (Cahyani, 2022). In 2020, Lopez Alcarria et al. conducted research focusing on curriculum innovation and teacher training. A group of early childhood education teachers in various institutions worked under a collaborative action research model for a full year, focusing on the following: (1) water, solid waste, and energy management in the institution; (2) planning of innovation activities related to water, solid waste, and energy; and (3) participation in transformative actions that involve families and impact their neighborhoods. The experience enabled the construction of a theoretical model of teacher training aimed at acquiring action skills from a comprehensive perspective of triple-helix environmental literacy (management, research/innovation, and teaching) that influences their commitment to environmental

resource management, environmentalism, and sustainability. eco-school audits, curricular greening activities, updating educational programs, and conducting action research focused on sustainability-related aspects (López-Alcarria, Poza-Vilches, Pozo-Llorente, & Gutiérrez-Pérez, 2021). Bibliometric research conducted by Syahmani et al. in 2021 showed that published research on the topics of "environmental literacy," "STEAM," and "waste management" has been scarce in the last 51 years and requires further study to strengthen the concept. STEAM can be considered as a way to develop students' environmental literacy in waste management (Syahmani, Hafizah, Saugina, Adnan, & Ibrahim, 2021).

CONCLUSION

Based on the results of research and discussion, the researcher can conclude that there is an increase in science literacy and disciplinary behavior in children aged 6 years with organic waste processing experiments using black soldier fly maggot. Significant increase in science literacy and disciplinary behavior of children aged 6 years with organic waste processing experiments using black soldier fly maggot. With a significance decision of $0.001 < 0.005$ and t-count and t-table showing t-count of t-table, namely $3.7919 > 2.306$. Disciplinary behavior variables are more affected in children aged 6 years with organic waste processing experiments using black soldier fly maggot. The coefficient for the science literacy variable has a value of 2.725. The coefficient for the discipline behavior variable has a value of 3.041. It indicates an increase in scientific literacy of 2.725 and an increase in disciplinary behavior of 3.041. Based on the above conclusions, the researchers provide the following suggestions: For teachers, it can be implemented in the learning program to support students' science literacy skills and disciplinary behavior. For parents, it provides practical benefits that can be developed to achieve optimal child development. For schools, this research may be useful for school literature, providing theoretical benefits in developing learning innovations that have an impact on science literacy skills and disciplinary behavior, and developing measurements of learning outcomes. For other researchers, hopefully, it can be a reference for research in the same field and can be developed.

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