

# Implementation of Mathematics Learning Through Hydroponic Farming to Improve Mathematics Ability in Early Childhood

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## ABSTRACT

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This study aims to produce and determine the feasibility of early mathematics learning media through hydroponic farming for Early Childhood. The type of research carried out is development research, because in this study an initial mathematics learning media was developed through hydroponic farming for Early Childhood. The research instruments used were media validation sheets and teacher response questionnaires. The data analysis used is descriptive quantitative. The product produced in this study is a medium for early mathematics learning through hydroponic farming for Early Childhood that meets valid and practical criteria. This study took subjects in Early Childhood at Kartika Kindergarten, Peguyangan Kaja Village. The results of this study regarding media validation showed that the initial mathematics learning media through hydroponic farming for Early Childhood had met the valid criteria. Judging from the results of the analysis of the teacher's response to learning media, namely the teacher's response to the use of media, it shows 75.8% in the good category. This shows that the media can be implemented practically by the teacher.



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## A. INTRODUCTION

Mathematics is a science that is often used in everyday life. At every level of education, mathematics is always a mandatory material that must be given to students. Mathematics is one of the most useful subjects in human life. With mathematical knowledge, humans can explain everything that happens in the world. (Raj Acharya, 2017). Modern technology plays an important role in changing student learning methods (Jdaitawi, 2019). However, students still find Mathematics scary. Mathematics today tends to be a subject that is feared by some students. Mathematics is seen as a difficult material to learn. This shows that mathematics is still a scary subject matter to learn among students.

Kindergarten is one form of early childhood education, starting from the age of 4 to 6 years. Kindergarten education has a very important role for the child himself in shaping the child's personality, as well as preparing the child to enter elementary school education. (Muslihudin et al., 2019). Early Childhood Education is a coaching effort aimed at children from birth to the age of 6 (six) years. Mathematics in Early Childhood is important to be given as a form of the initial introduction to Mathematics at the elementary school level (Rahayu,

Putri, Zulkardi, & Hartono, 2019). However, the model of learning mathematics in early childhood needs to be done in a fun way, because this is the initial foundation for children in forming their mindset about mathematics.

In cognitive development in Kindergarten children, it can be done through the introduction of objects around them according to shape, type, size, introduction of scientific concepts, introduction of geometric shapes, introduction of the concept of time, introduction of simple mathematical concepts, introduction of numbers, especially introduction of the concept of numbers with object. Counting can be applied to Early Childhood, because mathematics and numeracy are the first steps for children to find out other sciences that they will learn in adulthood.

The pandemic makes changes in social life (Long et al., 2021)(Wang, 2020). Residents had to work from home and were laid off with pay cuts. School children who have to be at home will feel bored and many are tempted to play games and watch TV or YouTube (Hermanus, Sudrajat, & Rahardjanti, 2021). To overcome this, it is necessary to provide interesting activities for students. One of the activities that can be done between students and teachers or parents is gardening. Gardening activities can be used as a learning medium for early childhood (Fitriah, Iriani Putri, Nur, Dini Kurnia Vitasari, & Kismawati, n.d.)(Gustiana, Mawaddah, & Jayanti, 2019)(Mirawati & Nugraha, 2016) (Banoet, Sutarto, Sularti, & Handayani, 2019). One that can be chosen is hydroponic gardening. Hydroponics is known as plant cultivation without using soil media (Heckman, Pinto, & Savelyev, 2019). This makes gardening fun because it doesn't get dirty.

Indonesia is an agrarian country where most of the population are farmers. Most of the land in Indonesia is used for agriculture (Hidayanti, Rahmah, & Sahro, 2020). Therefore, gardening is not a problem for Indonesians. So that gardening from an early age is something that must be given to Indonesian children.

Hydroponics is one way of farming that can be done on a small area of land. Urban is synonymous with the availability of narrow land, so farming using the hydroponic model is suitable. People in urban areas generally prefer clean farming. Hydroponics is a method of farming that does not use soil, so it is cleaner than conventional farming (Suryaningprang, Suteja, Mulyaningrum, & Herlinawati, 2021). In hydroponic farming there are several processes that are passed, namely seeding, transplanting, maintenance, and harvesting. This process can be used to help children learn, especially in learning mathematics. Because mathematics is still known as a difficult and scary subject. Children can be involved in every process of hydroponic farming, so that students can be actively involved in learning activities. In learning activities, teachers must realize that each student has an optimal and different way of learning to understand new information. Students need to be taught other ways of standard learning methods that already exist to maximize understanding of the material in teaching and learning activities (Malmia et al., 2019).

Seeing the importance of mathematics and the greatness of gardening with hydroponics, to make students interested in learning mathematics and participating in gardening, mathematics and hydroponics are combined in the learning module. A good learning module can give positive things to student learning outcomes (Prawita, Prayitno, & Sugiyarto, 2019). The results of other research conducted by (Dewi & Primayana, 2019) show that students who receive learning modules have better learning outcomes than students without learning modules. In addition, by combining mathematics and gardening, students can see the application of mathematics in the real world. A more scientific approach, involving students in direct learning activities and helping them relate academic learning to real everyday life (Firman, Baehowi, & Murtini, 2018).

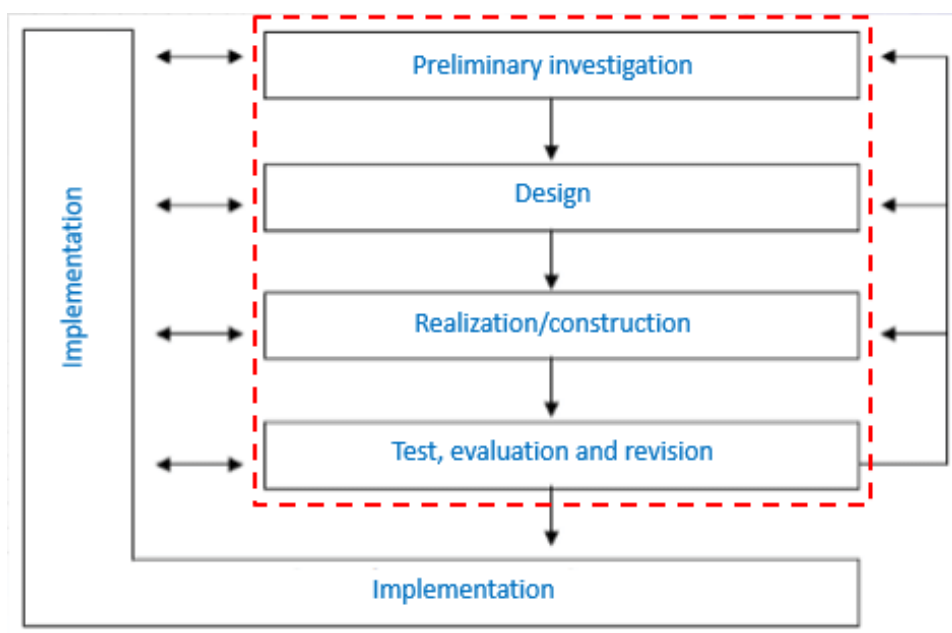
Based on the explanation above, the researcher is interested in developing a learning module for early childhood children, which combines mathematics with gardening.

Considering that the plantation model chosen is hydroponic, the research location is selected in the city. The narrow land makes the hydroponic model suitable to be applied to schools in the city. Early Childhood schools located in urban areas will still be able to adopt the early mathematics learning model even though they have limited gardening land. Based on the results of discussions with teachers at Kartika Kindergarten, Peguyangan Kaja Village, there is no initial mathematics learning media available, which is expected to be able to help students in learning mathematics. And the school also has land for gardening but it has not been used optimally.

## B. METHODS

The type of research carried out is development research, because in this study an initial mathematics learning media was developed through hydroponic farming activities for Early Childhood. The product produced in this study is an initial mathematics learning media through hydroponic farming activities that meet valid and practical criteria.

Media development in this study is guided by the procedure for developing learning devices according to Plomp. The Plomp model (Rosmiati, Mahmud, & Talib, 2016) consists of five stages, 1) preliminary investigation; 2) design; 3) realization/construction; 4) test, evaluation and revision; 5) implementation as show in Figure 1. The implementation phase in this research was not carried out. This research only carried out a limited trial, namely an effort to evaluate and revise in order to obtain media that are ready to be implemented in a wider scope.



**Figure 1.** Plomp Model

The media validity test is carried out by a competent validator. The validators who assess this media are material expert validators from Early Childhood Education and learning design expert validators. Furthermore, the validator is asked to give an assessment of the media created. The validity test is carried out in relation to the suitability of the device design with the established media validity criteria. Based on the results of the validity test, then revisions were made to obtain the media in the form of a prototype 2. The validation step was carried out until a prototype that met the valid criteria was obtained. From the calculation of the validity of the media obtained validity in accordance with the expected indicators. The

research instruments used (1) For the validity of the expert constructs a validation sheet is given, where the validation sheet contains several aspects which include: Media content, presentation method, and physical form of the media. (2) regarding the practicality of the developed media, it was obtained from the teacher's response questionnaire to the learning media.

Media validity is said to be valid, if it has met the media validity indicator, namely the average media validity score has reached a minimum score of 2.5 (Putri, Wardika, Kencana, & Adnyana, 2021). Further revisions were made in accordance with the validator's suggestions and learning media was obtained in the form of prototype 2. After obtaining prototype 2, field trials were then carried out. The field trial aims to determine the usefulness of the resulting media (media practicality) on the quality of learning media. The field trial was carried out with a limited trial, namely with a teacher response questionnaire to the initial mathematics learning media through hydroponic farming activities for Early Childhood that had been made. The assessment of the practicality of the media was carried out by assessing the teacher's response questionnaire. The media that has been successfully developed will be described as follows. The media that was successfully developed in this study was the Beginning Mathematics learning media through hydroponic farming activities for Early Childhood.

## C. RESULT AND DISCUSSION

### 1. Media Development Process

The media development process referred to in this case aims to produce valid and practical learning media. The development of learning media in this study refers to the product development procedure of Plomp. The development procedure in question is described as follows. At this stage a preliminary investigation is carried out which aims to identify problems in learning mathematics at Kartika Kindergarten. The results of the investigation show that learning mathematics is done by using teaching aids in the classroom. The teacher explains using props in front of the class, while the children listen to the explanation given by the teacher. This causes children to tend to be passive because they are not directly involved in learning activities.

The next stage is the Design Stage. At this stage, the design of mathematics learning media that is able to actively involve children in learning activities is carried out. Children need to experience directly the activities in learning mathematics, so that children actually do not even know that they are learning. Hydroponic farming activities can be a fun way to learn math for children. Children can be involved in matching, grouping and sorting plants in hydroponic farming. Matching, grouping, and sorting are basic concepts for studying mathematics at the next level. The purpose of the design stage is the design of mathematics learning media through hydroponic farming activities for PAUD and its instruments, including: (1) a complete hydroponic starter kit media design equipped with an Early Mathematics Learning Module, (2) the draft instrument compiled is a media validity sheet consisting of from (a) material expert validation sheet, (b) media design expert validation sheet, (3) media practicality sheet.

After that, the Test, Evaluation and Revision Phases were carried out. Prototype 1 which is produced at the realization stage is then tested for validity by a validator who is competent in the field of PAUD and the field of media design. Based on the validity test, prototype 2 was obtained which would then be tested. The trial activity was carried out on PAUD students at Kartika Kindergarten. Field trials were conducted to see the practicality of the media that had been developed. The practicality of the media is measured by a questionnaire of teacher and student responses. Based on the test results obtained a final prototype that meets the criteria of practicality. While the summary of the results of the media validation analysis can be seen in Table 1.

**Table 1.** Summary of Media Validation Analysis Results

No	Validation	Validator Score Average	Category
1	Material Expert	3,67	Very Valid
2	Design Expert	3,83	Very Valid

In Table 1 it can be seen that the validity of the media is in the very valid category. Thus the media developed is valid, because it has met the indicators of media validity. The last stage carried out is the Implementation Stage. The purpose of the implementation stage is to teach children to match, sort, and group in math lessons through hydroponic farming activities. Children are involved in every process in hydroponic farming including seeding, transplanting, maintenance, and harvesting. The types of plants used in this activity are spinach, kale, and pockcay. In the matching activity, children look for the same type of plant seeds to sow. In addition, the children matched the appropriate rockwall size and the number of netpots that were adjusted to the number of planting holes. In the sorting activity, children arrange the same types of plants according to their size, from small to large. In grouping activities, children collect similar plants in groups on hydroponic growing media. In this activity, children can learn mathematics directly by being actively involved, as well as learning about a plant life process from seed to harvest. Learning experiences like this become very enjoyable for students, because students actually do not know that they are doing math learning activities.

## 2. Results Regarding Media Quality

Nieeven (Wayan et al., 2014) suggests that the criteria for assessing media quality are based on validity and practicality. The results regarding the media in terms of the two aspects above are described as follows. The results of Media Validity as shown in Table 1 obtained the validity value of the Material Expert Validator with an average validity score of 3.67 with a very valid category. From the design expert validators obtained an average validity score of 3.83 with a very valid category. From the scores obtained, it shows that the learning media made are classified as very valid. Meanwhile, the practicality of the media is measured by the teacher's response questionnaire to the learning media. is the teacher's response to the learning media, namely the teacher's response to the use of the media, which is 75.8% in the good category. This means that practical media are used in early mathematics learning through hydroponic farming.

The first stage of media development is the initial investigation stage. At this stage, an analysis of the situation and problems that occurred in mathematics lessons was carried out in this study at Kartika Kindergarten. The purpose of this stage is to examine the learning media used so far. The results of the initial investigation show that there is no media for early mathematics learning through hydroponic farming for Early Childhood. The second stage is the design stage. At this stage, activities are carried out to prepare a draft of the required instrument. It aims to overcome the problems found in the initial investigation stage. The draft instrument includes (1) learning media for hydroponic farming for Early Childhood children, namely the "Happy Grow" hydroponic starter kit which is complete with planting media, seeds, nutrition, and hydroponic guides for children, and an early mathematics learning module for Early Childhood (2) validation sheets, namely material expert validation sheets, media design expert validation sheets and (4) teacher response questionnaires to learning media. After drafting the learning instrument draft, the third stage is carried out, namely the realization/construction stage. At this stage, the realization of the draft that has been prepared is carried out. The results of the realization of the draft at this stage are still in the form of prototype 1. After obtaining prototype 1, the stages of testing, evaluation, and

revision are carried out. This stage aims to test the quality of prototype 1 that has been obtained by reviewing from two aspects, namely validity and practicality. The learning device in the form of prototype 1 was tested for validity by the validator. The validators in question are Early Childhood school supervisors from UPT DISDIKPORA South Kuta for Early Childhood material experts, and design lecturers from STMIK STIKOM Indonesia for design experts. The validity test is related to the suitability of the media design with the established validity criteria. Based on the results of the validity test, then revisions are made (if needed) so that the media is obtained in the form of prototype 2 with a valid category. Likewise, instruments that have met the eligibility to use. The valid prototype 2 is then tested. The trial was conducted to determine the practicality of the developed media. After the trial, a revision was made to prototype 2 so that it became the final prototype of the early mathematics learning media through Early Childhood hydroponic farming. The implementation stage of the developed media in the form of a final prototype will be submitted to the school that is the place of research.

The validator also tests the validity of the instrument used to determine the feasibility of the instrument. The validity test is related to the suitability of the media design with the established validity criteria. Based on the results of the validity test, then revisions are made (if needed) so that the media is obtained in the form of prototype 2 with a valid category. Likewise, instruments that have met the eligibility to use. The valid prototype 2 is then tested. The trial was conducted to determine the practicality of the developed media. After the trial, a revision was made to prototype 2 so that it became the final prototype of the initial mathematics learning media through hydroponic farming for Early Childhood. The implementation stage of the developed media in the form of a final prototype will be submitted to the school that is the place of research.

Based on the results of the validity test that has been carried out, it is found that the initial mathematics learning media through hydroponic farming for Early Childhood has met the valid criteria. This is caused by several factors, including: indicators/descriptors that have been set on the media validity instrument, so that after the score conversion is carried out the average media validity score is in the valid category ( $2.5 = Sr < 3.5$ ). Second, the media that has been successfully developed has been arranged so that students can easily learn early mathematics through hydroponic farming in a fun way. This causes the developed learning media to meet the valid criteria. So that it can be said that both in terms of content and construction, the developed learning media has met the expected validity criteria.



**Figure 2.** Hydroponic starter kit hydroponic growing media "Happy Grow"

As previously stated, to find out the practicality of learning tools in terms of the teacher's response to learning media. Therefore, the discussion of the practicality of this media is described as follows. Judging from the teacher's response, it shows 75.8%. This shows that the media can be implemented practically by the teacher. Teachers find it easy and fluent in operating interactive learning media, its application is very in accordance with the learning time and can be repeated according to the wishes of the users, able to help students understand the material, and make it easier for teachers to teach. Based on the description above, it can be said that the initial mathematics learning media through hydroponic farming has met the practicality of the media as expected.

#### **D. CONCLUSION AND SUGGESTIONS**

From the results of the research that has been done, it can be concluded that the media for early mathematics learning is through hydroponic farming for Early Childhood. This learning media is classified as good as a learning medium. This is shown by the score given by the material expert validator with an average validity score of 3.67 with a very valid category. From the design expert validators obtained an average validity score of 3.83 with a very valid category. So this learning media is very valid to be used for starting mathematics material for Early Childhood students. The practicality of the media is measured by the teacher's response questionnaire to the learning media. The results of the analysis of the teacher's response to the learning media, namely the teacher's response to the use of the media, showed 75.8% in the good category. This means that practical media are used in early mathematics learning through hydroponic farming.

Based on the conclusions above, the suggestions that can be made are as follows. For Early Childhood teachers at Kartika Kindergarten, Peguyangan Kaja Village, it is recommended to use this learning media to teach beginner mathematics. And to other researchers, it is hoped that they will continue to carry out development research like this. To make other learning media, both in different schools or on different materials. So that there will be many choices of learning media to teach students so that learning outcomes are close to optimal.

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