**Research Article**

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# Development of Digital Literacy Tools in the Implementation of Science, Technology, Engineering, Art, and Mathematics (STEAM) Learning for the Implementation of the Independent Curriculum for Children Aged 5-6 Years

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DOI: https://doi.org/10.47353/ijedl.v2i5.137 | **received** May 22, 2024; **accepted** May 27, 2024; **online** May 30, 2024

**Abstract:** This research aims to describe the development of digital literacy tools in the implementation of science, technology, engineering, art and mathematics (STEAM) learning for the implementation of the Independent Curriculum. The type of research used in this research is development (Development research) which aims to produce a product. The development research procedure used is the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The data collection technique used in this research is a non-test instrument consisting of instrument validation sheets, feasibility sheets, effectiveness and usability of devices, interview sheets, observation sheets. Data analysis techniques are used to determine the feasibility, usefulness, and effectiveness of digital literacy tools. The research results of the digital literacy tools developed are very valid and reliable, so they are suitable for use in STEAM learning for implementing the independent curriculum for children aged 5-6 years. The digital literacy tools in STEAM learning that were developed are effective for use with children aged 5-6 years in the very high category. The digital literacy tools in STEAM learning that were developed are included in the very practical category based on the learning implementation observation sheet and teacher questionnaire.

**Keywords:** digital literacy, STEAM learning, independent curriculum

## Introduction

Early childhood education is an effort to nurture children by maximizing their growth and development so that they are ready to move into a more complex environment. In creating a system or learning process in early childhood education, it is necessary to analyze its strengths, weaknesses, opportunities and threats so that it will give birth to an accelerated learning process. In the learning process which must be carried out by paying attention to strengths, weaknesses, opportunities and threats, the process taken in building Indonesia's golden generation in 2045 as a concrete step in educational action, especially early childhood education, is a necessity.

Strengthening education as the spearhead of building Indonesia's golden generation is absolutely necessary. There are three main things that deserve attention from all parties so that every institution from all early childhood education units displays educational quality. These include teachers, curriculum and learning processes. (Nurussakinah D 2023). The existence of teachers in early childhood education is an undeniable role in the field of early childhood education. Improving the quality of teachers must be reflected from upstream to downstream, meaning that early detection for prospective teachers and those who have become teachers is absolutely taken into account by the government to get quality teachers. And apart from teachers, to achieve quality education, they are supported by the Curriculum. The curriculum is the main idea or soul of the educational process. In the world of education, changing the curriculum is a common

thing, but its implementation is not always easy to understand, especially for educators who are at the forefront of implementing the curriculum.

The preparation of an independent curriculum in PAUD units has a clear process and structure. The government, in this case the Ministry of Education and Culture, has provided the option for each PAUD unit to implement the independent curriculum in various versions depending on the readiness of each unit to implement the independent curriculum. In fact, the 2013 curriculum did not change completely and lost elements of the independent curriculum. In relation to learning objectives, learning outcomes and other terms, they are still related to the 2013 curriculum. The early childhood education unit displays the quality of education apart from teachers and curriculum, the learning process is the application of the educational curriculum and uses tools to convey learning, while in the independent curriculum there are fundamental changes. among teachers where teachers act as facilitators, no longer educational administrators who demand skillset, mindset and mastery of digital technology. However, what is happening now is that there are still many teachers who implement teacher centered. The Independent Curriculum is more flexible and gives teachers the freedom to develop learning, in reality there are still many teachers who find it difficult to move on from K-13 and still use themes.

STEAM actually exists in our daily lives, but we rarely realize it. Therefore, STEAM is very well taught to early childhood so that children become innovators and critical thinkers (Achmad, 2022). STEAM learning encourages children to explore their world, become researchers and independent learners which creates an inclusive learning environment where all children can be involved and contribute (Maharani & Zulminiati, 2021). The STEAM approach prioritizes collaborative learning, therefore the classroom is designed not rigid, such as tables and chairs not arranged in rows, but flexible (can be moved) to produce a fun and interactive learning atmosphere. The STEAM learning method refers to comprehensive technological developments that can be applied by collaborating science with the environment around the child, which means teachers are required to be able to integrate the components in the learning theme covering the five STEAM disciplines (Sa'ida, 2021). STEAM involves a process of critical thinking, analysis and collaboration where children will integrate processes and concepts in a real world context of knowledge, skills and competencies that can be utilized later for college, career and life, very suitable for supporting children to be more creative and independent (Septiani & Love, 2021).

In the 21st century, literacy is no longer only understood as the ability to read, write and count, but as a life skill that covers all aspects of life so that in 2015 the World Economic Forum agreed on the need to master six basic literacies, namely reading and writing literacy, numeracy literacy, and literacy. science, digital literacy, financial literacy, and cultural and civic literacy (Kemdikbud, 2019). Of the six basic literacies, in this study, researchers limited their research to digital literacy in early childhood. Digital literacy is the ability to use information and communication technology to find, evaluate, utilize, create and communicate content with cognitive and technical skills. In early childhood learning, digital literacy is seen as attitudes, knowledge and skills in using digital media around them to search for and utilize information, learn, play or get healthy entertainment with assistance from adults around them (Trimuliana, 2023 ). Literacy in early childhood can be done through drawing, telling stories, counting and reading activities (Arsa, 2019).

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but as a life skill that covers all aspects of life so that in 2015 the World Economic Forum agreed on the need to master six basic literacies, namely reading and writing literacy, numeracy literacy, and literacy. science, digital literacy, financial literacy, and cultural and civic literacy (Kemdikbud, 2019). This is in accordance with the phenomenon that occurs in the field where teachers and children access internet content in classroom learning, including YouTube, Sanford Harmony, Class Dojo, Dodo - Syamil films, Pinterest, learning videos, stories of the Prophet, creative gymnastics for children. , Google, Clean and Healthy Living Habits, Teachers share, Natural geographic kids, The kids page (Munawar et al., 2021). As the most basic level of education, PAUD is a strategic step to create a generation that is digitally literate (Kemdikbud, 2020). Apart from using easy-to-use technological media, which can be obtained from Google Playstore to attract the interest of young children, (Purnomosari et al ., 2022) digital literacy learning can also be done by coding.

Based on the results of research conducted by (Munawar M., et al. 2023), it shows that evaluating the digital literacy education program in PAUD through the Robokids STEAM coding game requires basic policies at both the macro and meso levels, training for all school members, and reading materials. as well as digital-based props or games in class. This research also contributes to introducing Robokids STEAM as a robotics game for learning coding and digital literacy in early childhood classes. Apart from that (Putri Diah Motimona & Ika Budi Maryatun 2022) also conducted research on the Implementation of the STEAM Learning Method in the Independent Curriculum for PAUD. The results of the research show that with the STEAM approach, children will develop science and technology-based ideas by engaging in problem-solving activities originating from five interconnected scientific disciplines. The implication of this research is to increase teacher knowledge regarding the steps for implementing the STEAM method in the independent curriculum.

## Literature Review

### Digital Literacy

Digital literacy is a fundamental skill needed to be able to contribute in today's digital world. According to a statement from (Nasrullah 2017), digital literacy is very important to develop as a need to participate in the world of digitalization such as reading, writing, arithmetic and other knowledge. Digital literacy is important to pay attention to in children. In early childhood, the importance of digital literacy. Digital literacy in the educational context plays a role in developing a child's knowledge (cognitive) through stimulating the child's sense of curiosity and creativity (Yusuf 2023).

### STEAM Learning

STEAM is an acronym for science, technology, engineering, art and mathematics." STEAM learning is the integration of science, technology, engineering, arts and mathematics; it is an interdisciplinary and applied approach combined with real-world, problem-based learning. STEA Learning encourages children to develop curiosity and open up to experiences. and asking questions so that children can build knowledge around them by exploring, observing, discovering and investigating things around them (Zaeni A. 2023).

### Independent Curriculum

The independent curriculum is a curriculum with intracurricular learning that is more optimized for varied learning content, providing sufficient time for students to explore knowledge concepts and strengthen their competencies (Kemdikbud, 2022). The independent curriculum is a new breakthrough for the Minister of Education and Culture of the Republic of

Indonesia, where the learning offered becomes more effective and efficient by prioritizing students' interests and talents. In this way, the learning process or results become more enjoyable.

## Method

### Types of Research

The type of research used in this research is development (Development research) which aims to produce a product. The product that will be produced in this research is the development of digital literacy tools in STEAM learning in early childhood education for the implementation of the independent curriculum.

### Research procedure

The development research procedure used is the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). Researchers chose the ADDIE model development model in this research based on the assumption that this model has clear stages and is easy to understand, is a general learning model and is suitable for use in development research.

### Development of the ADDIE Model

The ADDIE Development Research Model, as the name suggests, is a model that involves stages of model development with five steps/development phases:

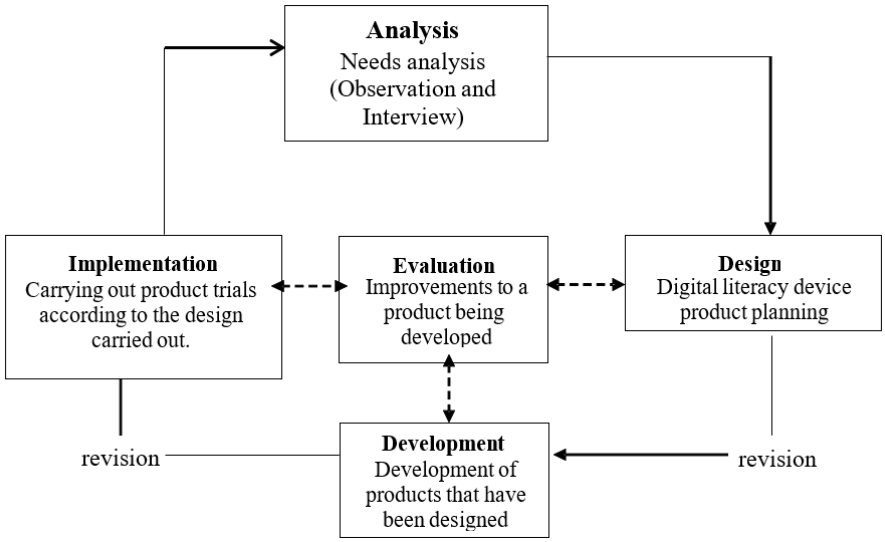


**Figure 1. Schematic of the ADDIE Model**

### Data collection technique

According to Siregar (2014:17) data is a collection of facts, figures, or anything whose truth can be trusted, so that it can be used as a basis for drawing conclusions. The data collection technique used in this research is a non-test instrument consisting of instrument validation sheets, feasibility sheets, effectiveness and usability of devices, interview sheets, observation sheets.

### Data analysis technique

Data analysis techniques are used to determine the feasibility, usefulness and effectiveness of the digital literacy tools that have been developed: feasibility analysis, practicality analysis and effectiveness analysis.

## Results and Discussion

### Development of Digital Literacy Tools in STEAM Learning

a. **Analysis Stage.** The interview results show that there is still a lack of teacher guidebooks in STEAM learning in the classroom and when STEAM learning in the classroom does not involve students. STEAM learning activities in implementing the independent curriculum in schools are still not said to be effective because they do not facilitate students in working, even in STEAM learning activities for implementing the independent curriculum children are required to have work results and their learning is project-based, in this case it also needs to be emphasized in children's STEAM learning Group B learning activities can be carried out through experimental activities, learning using audio-visual media, and nature-based learning by utilizing the surrounding environment.

b. **Design Stage.** In designing STEAM learning activities for implementing the independent curriculum, learning activities are adapted to the child's age and in this guidebook the focus is on children aged 5-6 years and usually called group B children. The description of each STEAM learning activity is adapted to learning outcomes in curriculum implementation independent. The learning designed in STEAM activities is a project and can produce work in STEAM learning activities.

c. **Development stage.** The purpose of validation is to find out the quality of the digital literacy tools in the form of guidebooks in STEAM learning for implementing the independent curriculum that have been made, whether they are suitable for use or not and whether improvements still need to be made. This product validation is carried out by two people, one lecturer as an expert validator and one teacher as an expert validator. The intended product validation is the validation of digital literacy tools in the form of books in STEAM learning for the implementation of the independent curriculum.

d. **Implementation Stage.** At the implementation stage, trials are carried out on products that have been developed and which have been validated by experts. Product implementation is carried out to determine the practicality and effectiveness of the product being developed. Product implementation was carried out at the Sholeh Praya Children's TKIT in group B, totaling 25 students.

e. **Evaluation Stage.** The evaluation in question can be interpreted as the process of determining the useful value of an object and the object assessed in this research is a digital literacy tool in STEAM learning for implementing the independent curriculum for children aged 5-6 years. This evaluation stage is divided into two, namely formative evaluation and summative evaluation. Summative evaluation is carried out after all stages of ADDIE development have been carried out.

### Feasibility of Digital Literacy Tools in STEAM Learning

The feasibility of digital literacy tools in STEAM learning is obtained based on the validity and reliability results obtained based on the assessment sheet for the digital literacy tools developed.

**Table 1. Device Validity Results For Experts And Practitioners**

| No | Aspect | N Item | Max Value | A | B | C | D | Total | Calculation Results | Percentage |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Book Contents | 6 | 24 | 0 | 0 | 0 | 6 | 6 | 1 | 100% |
| 2 | STEAM Integrity | 7 | 28 | 0 | 0 | 0 | 7 | 7 | 1 | 100% |
| 3 | Device Eligibility | 6 | 24 | 2 | 0 | 0 | 5 | 7 | 0.714285714 | 71% |
| 4 | Practical | 5 | 20 | 0 | 0 | 0 | 5 | 5 | 1 | 100% |
| 5 | Effective | 5 | 20 | 0 | 0 | 0 | 4 | 4 | 1 | 100% |
| | Overall validation | 29 | 116 | 2 | 0 | 0 | 27 | 29 | 0.931034483 | 93% |

The results of the assessment carried out by expert validators and practitioners obtained a very valid assessment with an assessment score of 0.93 in the very valid category.

**Table 2. Results of Product Reliability analysis**

| No | Aspect | A | B | PA % | Information |
|---|---|---|---|---|---|
| 1 | Book Contents | 24 | 23 | 97.87 | Reliable |
| 2 | Learning Integrity | 23 | 23 | 100 | Reliable |
| 3 | Book Eligibility | 24 | 24 | 100 | Reliable |
| 4 | Practicality | 20 | 20 | 100 | Reliable |
| 5 | Effectiveness | 20 | 20 | 100 | Reliable |

Based on the results of this analysis, the product developed in terms of the contents of the device, the integrity of STEAM learning, the suitability of the device, the practicality of the device and the effectiveness of a device are at a percentage of >90%, which means that digital literacy tools in STEAM learning are in the form of guidebooks that are reliable and suitable for use.

**Practicality of Digital Literacy Tools in STEAM Learning**

The practical results in this research were obtained based on observation data on learning implementation as well as teacher response questionnaires when the device was implemented.

1. Implementation of Learning: The STEAM learning activities carried out are in accordance with the contents of the guidebook that has been developed, including STEAM learning activities using loss parts and experimental activities using plasticine.



**Figure 2. STEAM Learning Activities**

**Table 3. Average Learning Implementation**

| Meeting | Average % |
|---|---|
| First | 84% |
| Second | 89% |
| Third | 94% |

2. Response questionnaire, Practicality is gained not only through implementing learning but also using response questionnaires to fill out response questionnaires.

**Table 4. Teacher Response Questionnaire**

| No | Statement | Answer | |
|---|---|---|---|
| | | R1 | R2 |
| 1 | Clarity of tools in STEAM learning for implementing the independent curriculum | 1.00 | 1.00 |
| 2 | Clarity of STEAM learning materials for implementing the independent curriculum | 1.00 | 1.00 |
| 3 | The syntax in the STEAM learning guide is written clearly | 1.00 | 1.00 |
| 4 | The pictures and descriptions in the guidebook are clear and easy to understand | 1.00 | 1.00 |
| 5 | The video links in the STEAM learning guidebook have clear and understandable resolution | 1.00 | 1.00 |
| 6 | The appearance and size of the guidebook are proportional | 1.00 | 1.00 |
| 7 | Digital literacy tools in the form of guidebooks can be used repeatedly | 1.00 | 1.00 |
| 8 | The letter color and font selection in the guidebook are appropriate and can be read well | 1.00 | 1.00 |
| 9 | The language used in the guidebook is easy to understand and does not give rise to multiple interpretations | 1.00 | 1.00 |

| | | | |
|---|---|---|---|
| 10 | Access the guidebook using the link in the lesson and it's quite easy | 1.00 | 1.00 |
| 11 | With the guidebook, the teacher's intensity in teaching increases | 1.00 | 1.00 |
| 12 | The guidebook was created to make it easier for teachers to learn STEAM | 1.00 | 1.00 |
| 13 | The guidebook was created to develop teacher creativity in providing STEAM learning | 1.00 | 1.00 |
| 14 | Guidebooks using links can make it easier for teachers to access STEAM learning | 1.00 | 1.00 |
| 15 | The guidebook created facilitates teachers in developing children's creativity | 1.00 | 1.00 |
| **Average Score (100%)** | | 100 | 100 |

**The Effectiveness of Digital Literacy Tools in STEAM Learning**

The effectiveness of the learning tools that have been created is measured through tests in STEAM learning. The device developed can be said to be effective if there is an increase from pretest to posttest.

STEAM learning activities in implementing the independent curriculum. The level of increase in STEAM learning activities in implementing the independent curriculum using guidebooks can be seen through analysis of pretest and posttest scores. These pretest and posttest scores are used to obtain a standard gain score. Based on the analysis that has been carried out, it is found that the average gain for children aged 5-6 years is 0.79. The score obtained is based on the standard gain interpretation in Table 4, that the increase in STEAM learning using guidebooks for children aged 5-6 years is in the very high category. The following is a summary of improving STEAM learning using a guidebook using the N-gain standard.

**Table 5. Pretest posttest results**

| Pretest | Posttest | N-Gain | Category |
|---|---|---|---|
| 62.12 | 80.52 | 0.71 | Tall |

Based on the statistical test results above, it can be concluded that STEAM learning using digital literacy tools in the form of guidebooks is effective in increasing students' knowledge or skills. Recommendations If the results are positive, consider applying the same learning method to other groups or in a broader context. If results are not significant, reevaluate learning methods and look for areas for improvement.

## Conclusion

Based on the results of the research and discussion in the previous chapter, it can be concluded as follows:

1. The digital literacy tools developed are very valid and reliable so they are suitable for use in STEAM learning for implementing the independent curriculum for children aged 5-6 years.
2. The digital literacy tools in STEAM learning that were developed are effective for use with children aged 5-6 years in the very high category.
3. The digital literacy tools in STEAM learning that were developed are included in the very practical category based on the learning implementation observation sheet and teacher questionnaire.

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