Perpustakaan UM Surabaya

Turnitin DEVELOPMENT OF STEAM-HOLISTIC LEARNING TEACHING MODULES

Gusmaniarti Journal of Lifestyle

DOSEN FKIP

Universitas Muhammadiyah Surabaya

Document Details

Submission ID
trn:oid:::1:3557688872

Submission Date
May 3, 2026, 8:31 AM GMT+7

Download Date
May 3, 2026, 8:34 AM GMT+7

File Name
2._PDF.pdf

File Size
550.9 KB

19 Pages

6,268 Words

35,917 Characters

14% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Bibliography
- Quoted Text
- Internet sources
- Publications

Match Groups

24 Not Cited or Quoted 11%
Matches with neither in-text citation nor quotation marks

4 Missing Quotations 3%
Matches that are still very similar to source material

0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

0 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

0% Internet sources
0% Publications
14% Submitted works (Student Papers)

Integrity Flags

1 Integrity Flag for Review

Hidden Text
2600 suspect characters on 19 pages
Text is altered to blend into the white background of the document.

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

Match Groups

- **24** Not Cited or Quoted 11%
  Matches with neither in-text citation nor quotation marks
- **4** Missing Quotations 3%
  Matches that are still very similar to source material
- **0** Missing Citation 0%
  Matches that have quotation marks, but no in-text citation
- **0** Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

0% Internet sources
0% Publications
14% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Student papers	Aegean College 4%
2	Student papers	Universitas Muhammadiyah Surakarta 3%
3	Student papers	Universiti Teknologi Petronas 2%
4	Student papers	Sriwijaya University <1%
5	Student papers	Universitas Nahdlatul Ulama Surabaya <1%
6	Student papers	Syntax Corporation <1%
7	Student papers	Argosy University <1%
8	Student papers	Universitas Negeri Padang <1%
9	Student papers	Universitas Negeri Manado <1%
10	Student papers	Colorado Technical University Online <1%

11 Student papers

University of Technology, Sydney <1%

JOURNAL OF LIFESTYLE & SDG'S REVIEW
e-ISSN: 2965-730X
THE GLOBAL GOALS

DEVELOPMENT OF STEAM-HOLISTIC LEARNING TEACHING MODULES

Badruli Martati[1]*
Shoffan Shoffa[2]
Gusmaniarti[3]

ABSTRACT

Objective: The purpose of the research is to develop a digital-based holistic-integrative STEAM learning model through a metacognitive approach for optimizing the intelligence abilities of basic education students.

Theoretical Framework: A learning strategy is needed in facing the 21st century that is in accordance with metacognition, namely the STEAM learning model.

Method: The development procedure in this study follows ten stages that refer to the system approach model according to Dick, Walter; Carey, Lou; Carey. Cognitive development both structurally and constructively contributes to building intelligence at every stage of a child's development. In fact, many teachers ignore the process of building students' intelligence abilities.

Results and Discussion: The results of the study obtained the syntax of the digital-based holistic-integrative steam learning model through a metacognitive approach, namely model and show, reflective discussion, learning journal, metacognitive questions, provide constructive feedback, activity-based learning environment engineering, self-questioning, involvement in assessment, evaluate learning outcomes.

Originality/Value: The development of teaching modules in student learning activities raises the characters of honesty, mutual cooperation and nationalism. The conclusion of the results of the teaching module states that it is very good, worthy of being used with minor revisions.

Keywords: cognitive, education, holistic, learning, steam, sustainable development goals (SDGs).

Received: Nov/15/2024
Accepted: Jan/17/2025
DOI: https://doi.org/10.47172/2965-730X.SDGsReview.v5.n03.pe04564

[1]Department of Basic Education, Faculty of Pancasila Education, Muhammadiyah University of Surabaya, Surabaya, Jawa Timur, Indonesia. E-mail: badrulimartati@um-surabaya.ac.id
[2]Department of Mathematics Education, Faculty of Educational Technology, Muhammadiyah University of Surabaya, Surabaya, Jawa Timur, Indonesia.
E-mail: shoffan.shoffa@um-surabaya.ac.id
[3]Department of Teacher Training and Education, Faculty of Teacher Training and Education, Muhammadiyah University of Surabaya, Surabaya, Jawa Timur, Indonesia.
E-mail: gusmaniarti@um-surabaya.ac.id

1 INTRODUCTION

The Primary education is a stage in education that is very vital, because students gain experience from a variety of physical, cognitive, social, emotional, and spiritual self-development. Children's developing cognition includes the scope of critical thinking, reasoning, and problem solving. Furthermore, their acquisition during basic education will make it easier to master general knowledge, so that they can function in broad social interactions. Cognitive development goes step by step towards perfection or maturity in thinking, memory, and processing information allows a child to gain knowledge, solve problems, and plan for the future. Thus, cognitive development both structurally and constructively contributes to building intelligence at every stage of child development (Rakesh *et al*., 2024).

The fact is that many teachers, especially in primary education, ignore the process of building students' intelligence. This is very detrimental to the development of the younger generation in the future. In addition, the covid-19 pandemic requires teachers to carry out online learning, so that teachers are preoccupied with making digital-based teaching materials, while now after the covid-19 pandemic offline learning has been carried out which causes teachers to be preoccupied with preparing teaching materials for face-to-face. The shift in the learning process and learning activities of students from online learning to offline learning causes teachers to put aside the development of children's intelligence abilities (Zhao & Watterston, 2021).

Facing the industrial era 4.0 as a teacher is required to be ready and able to develop students' abilities in facing the 21st century. Where 21st century abilities that must be met by students include collaborative abilities, communication, creativity, critical thinking, problem solving, and emotion intelligence and others. To develop these abilities, teachers must not abandon digital technology in packaging a lesson even though learning is already offline. Here teachers are required to be able to collaborate the development of students' intelligence abilities through digital technology. Digital literacy is very important to be developed by all elements in the world of education in order to carry out learning well (Teo *et al*., 2021).

A learning strategy that combines science and technology to develop 21st century learners' ability in metacognition is the STEAM (Science, Technology, Engineering, Art, and Mathematics) learning model. It is an interdisciplinary learning model where science, technology, art, and mathematics are integrated with a focus on the process of solving problems in life a learning model that totally involves students in exploring and understanding the substance of the meaning of the lesson (Pahmi *et al*., 2022).

The holistic-integrative STEAM learning model in basic education as a learning model that adopts Presidential Regulation No. 60 of 2013, where the principles developed are learning that is comprehensive and integrated, sustainable and consistent, no discrimination in services, affordability, and acceptable to the community based on a constructive culture. The holistic-integrative application of STEAM through games can increase the concentration of hyperactive children so that children concentrate longer for approximately one hour. It can be understood that holistic-integrative as a support for educational innovation in the organization of teaching materials, delivery methods, and management of activities by taking into account the goals, obstacles Wahyuningsih *et al*. (2020), and characteristics of students so that effective, efficient results are obtained, and learning attractiveness is revealed.

To strengthen the STEAM learning model in a holistic-integrative manner, a special approach is needed, where students can develop awareness and ability to learn, assess the difficulty of a problem, observe the level of understanding, and use various information to achieve a goal independently. The special approach is metacognitive. Where the metacognitive approach has an important role in regulating and controlling one's cognitive processes by learning and thinking, so that one's learning and thinking processes become more effective and efficient. Metacognition has the ability to plan, monitor, control, and evaluate (Wahba *et al*., 2022). The metacognition approach according to Pinritch. includes knowledge of strategies as well as contextual and conditional knowledge so that individual variables related to cognitive components and performance motivation also support the student learning process which does not only stop at remembering material, but also constructs

a framework of knowledge, retains, and transfers knowledge. Some of the main points contained in the metacognitive approach include: metacognitive awareness inventory (MAI), memory and reasoning competence inventory (MARCI), motivated strategies for learning questionnaire (MSLQ), and knowledge monitoring assessment (KMA). With the metacognitive approach through a holistic-integrative STEAM learning model, it can train students in improving their intelligence, especially reasoning, critical thinking and problem solving skills. Some of the main points contained in the metacognitive approach include: metacognitive awareness inventory (MAI), memory and reasoning competence inventory (MARCI), motivated strategies for learning questionnaire (MSLQ), and knowledge monitoring assessment (KMA) (Haddad *et al.*, 2022).

Based on the description above, the researcher wants to develop a digital-based holistic-integrative STEAM learning model through a metacognitive approach for optimizing the intelligence abilities of basic education students. The results of this research are expected to be able to answer the challenges of teachers in utilizing technology in learning in order to improve the intelligence abilities of basic education students. Especially in mathematics learning integrated with a focus on the realm of critical thinking, reasoning and problem solving (Ammar *et al.*, 2024). The formulation of the problem in this study is how the quality of the digital-based holistic-integrative STEAM learning model through a metacognitive approach can improve the intelligence abilities of basic education students and whether the digital-based holistic-integrative STEAM learning model through a metacognitive approach can improve the intelligence abilities of students in basic education.

2 METHODOLOGY

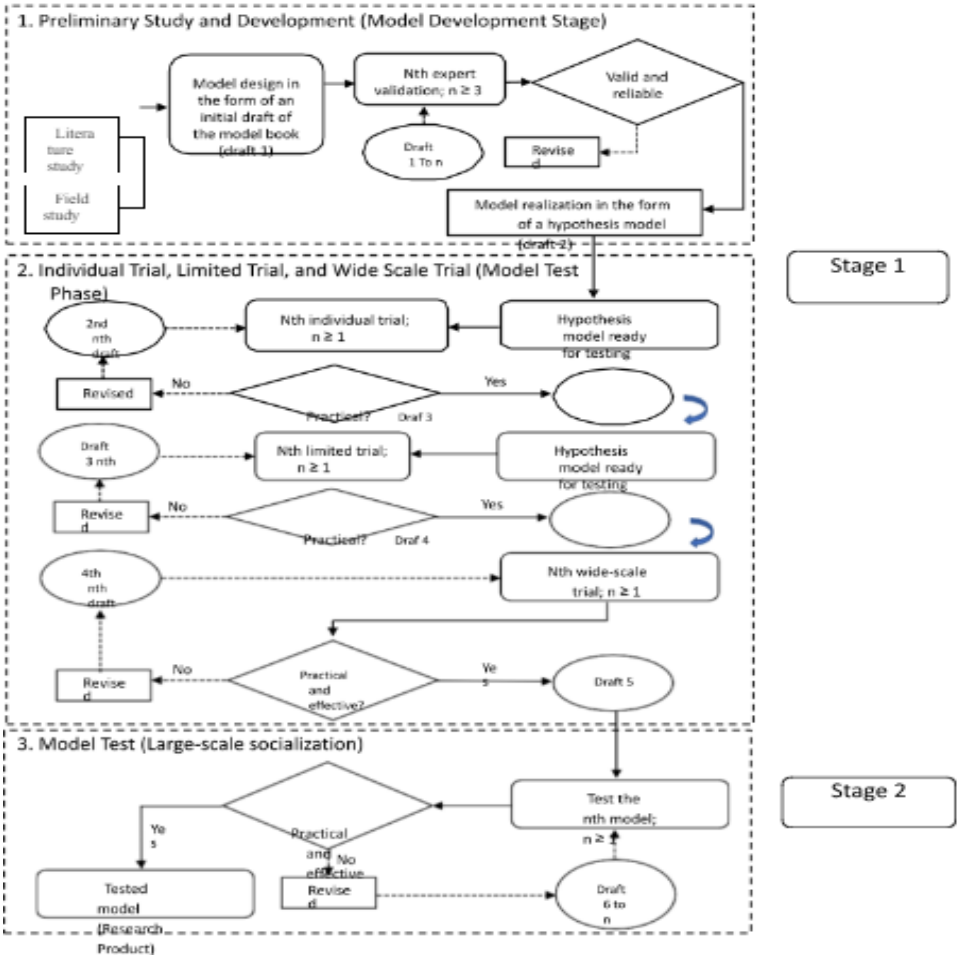
The Research and development in this study is oriented towards developing a particular product and testing the quality of the product. The product referred to in this study is a digital-based holistic-integrative STEAM learning model book through a metacognitive approach for optimizing the intelligence abilities of basic education students that is feasible (valid), practical, and effective as an effort to improve learner-centered learning,

especially mathematics learning integrated with a metacognitive approach for optimizing the intelligence abilities of basic education students. On a metacognitive approach for optimizing the intelligence abilities of basic education children (Yulianti *et al*., 2024).

The development procedure in this study follows ten stages that refer to the system approach model according to Dick, Walter which are as follows. (1) identify general learning objectives, (2) conduct learning analysis, (3) analyze learners and learning context, (4) write specific learning objectives, (5) develop learning instruments, (6) develop learning strategies, (7) develop and select teaching materials, (8) design and conduct formative evaluation of learning, (9) revise learning, (10) design and conduct summative evaluation of learning (Khoiron *et al*., 2020).

Figure 1

Preliminary Study and deveopment (model development Stage)



3 RESULTS

3.1 TEACHING MODULE

Figure 2

Teaching Module for Grade 2 Mathematics

This module is prepared for three meetings, with learning development through the STEAM-Holistic Integrative learning model with a Metacognitive approach. The learning model was chosen because of its characteristics in understanding a concept and relationship through mental processes to the conclusion and encouraging students to explore information in various forms of learning outcomes. In addition, learning is also done in groups to develop the ability to explain ideas, convey arguments and provide responses so as to foster collaboration to solve problems. Thus, being able to understand the meaning and representation of numbers, and develop the ability to use numbers (Chen *et al*., 2024).

Based on literature studies, field studies and inviting mathematics experts (lecturers) and practitioners (teachers) of elementary schools who teach mathematics, after discussing (FGD) and finding an understanding of the meaning of holistic which means integrating various aspects of learning to provide a comprehensive understanding. The metacognitive approach, on the other hand, was agreed upon as encouraging learners to reflect on and organize

their thinking processes, including their understanding of their own learning. Next, the research team formulated the syntax of the digital-based holistic-integrative STEAM learning model through a metacognitive approach (Bakar & Ismail, 2020).

The learning model used as a reference in the preparation of the Teaching Module is based on the following syntax:

Table 1

Syntax

No.	Syntax	Learning activities
1	Model and Demonstrate	Through the activity of observing pictures, learners can trace (C4) with their own thinking process when solving tasks or problems.
		Demonstrate explicit thinking and decision-making steps
2	Reflective Discussion	Educators divide groups heterogeneously
		In groups, learners can discuss their observation and thinking process in decision making.
3	Learning Journal	Learners keep (C6) learning journals by recording their learning experiences, difficulties encountered and strategies in examining the problems solved.
		Learners can provide guidance or reflective questions as guidance
4	Metacognitive questions	Ask questions that encourage metacognitive thinking where learners are required to be independent to think, namely to instill confidence that their thinking is correct.
5	Give Constructive Feedback	Give constructive feedback, not only about the final result but also about the learning process Give rewards in the form of sincere reinforcement sentences.
		Encourage learners to reflect on the feedback as an opportunity to improve their understanding
6	Activity Based Learning Environment Engineering	Involve learners in engineering the teaching environment by engaging in planning, implementing, and evaluating problems
		Focus on the process they go through during the activity.
7	Self-Questioning	Teach learners to ask reflective questions about engineering the learning environment
		Questions revolve around "how", "why", "what happened"
8	Engagement in Assessment	Involve learners in the assessment of cognitive, affective, and psychomotor aspects
		Give learners tools to monitor their own progress, such as checklists or progress charts
9	Evaluating Learning Outcomes	Together with the learners, the educator summarizes the learning
		Educators carry out evaluation of learning outcomes

The syntax compiled is a reference in compiling Teaching Modules for grade 2 elementary school students. Sequence of Learning Materials: 1. Understanding the Concept of Numbers 1 to 10,000 and How to Count Sub

Theme: "I am an Honest Child" 2. Understanding the Concept of Numbers 1 to 10,000 and How to Count Subtheme: "Playing with Friends" 3. Whole Number Operations and Measurement Sub Theme: "Gotong Royong in the Community Assessment Plan "Formative assessment (group)", formative assessment is used during the learning process. Formative assessments are designed to be carried out in groups. "Summative assessment (individual)", summative assessment is used at the end of learning and is designed to be carried out individually to measure students' understanding of the material that has been taught (Bedeker, 2023).

The Learning Steps General Topic Numbers and Counting Theme "Me and My Environment" Topic Meeting 1 Numbers 1 to 10,000 and How to Count Sub Theme: "I am an honest child" Topic Meeting 2 Numbers 1 to 10,000 and How to Count Sub Theme: "Playing with Friends" Topic Meeting 3 Whole Number Operations and Measurement Subtheme: "Gotong Royong in the Community" Learning Outcomes By the end of phase A, learners can demonstrate understanding and have number sense of numbers up to 100, including composing and decomposing them. They can perform addition and subtraction operations on non-numerical numbers up to 20, and can understand half and quarter fractions. They can recognize, imitate and continue non-number patterns (Bisaillon, 2023). They can compare length, weight and time duration, and estimate length using non-standard units. Learners can recognize various flat and spatial shapes, and can construct and decompose flat shapes. They can determine the position of objects relative to other objects. The following Learning Objectives: 1) Be able to explain the meaning and representation of numbers, and develop the ability to use numbers. 2) Able to count by grouping objects in the same size for each group. 3) Understand how to represent numbers by writing their number symbols up to thousands, and can sort numbers. 4) Able to understand the relative size of numbers such as seeing numbers in tens or hundreds. Meaningful understanding after following this lesson learners will understand how to count and classify objects in the same size for each group, understand how to represent numbers by writing their symbols up to thousands and can sort numbers, understand the relative size of numbers such as seeing numbers in tens or hundreds.

Figure 3.

Sparking question

In meeting 1, the teacher asked the triggering questions, "Are the numbers in order from 1 to 100?" "Can you read and name the numbers from 1 to 100?" "Can you categorize the numbers from units, tens, and hundreds?"

Figure 4

Learning media for grouping

Meeting 2 the picture above is paper money from Indonesia. "Can you read and say how much money there is?". "Can you say which denomination the picture belongs to?" "Units, tens, hundreds or thousands?"

Figure 5

Price List Learning Media

Take a look at the price list from the cleaning supply store! "If Aisyah buys a broom and gloves" "How much does Aisyah have to pay?" "If Budi buys two gloves, a broom and a trash can". "What is the price Budi has to pay?".

The Pancasila Learner Profile set is faith and piety towards God Almighty, critical thinking, and mutual cooperation . While preparing for learning as an effort to make the learning process effective, students and teachers make 1). learning contracts, namely arriving on time, dressing neatly and not making noise and doing assignments 2) (De & Suastra, 2024). dividing students into small groups 3). preparing learning tools and materials.

4 DISCUSSION

The sequence of Learning Materials in the teaching module begins with understanding the concept of numbers 1 to 10,000 and how to count sub themes: "I am an honest child", followed by understanding the concept of numbers 1 to 10,000 and how to count sub-theme: "playing with friends", as well as whole number operations and measurement sub-theme: "mutual cooperation in the community" (Dewi *et al.*, 2023). The application of the material sequence 1-10,000 and continued integer operations is in accordance with Phase A, grade 2 elementary school students in the Merdeka Curriculum. The learning outcomes at the end of phase A are that students can demonstrate understanding and have number sense in numerical numbers up to 100, including composing (composing) and decomposing (decomposing) these

numbers. This learning activity reflects learners' metacognitive and holistic-integrative processes by playing games in learning. This is in accordance with Gredler's opinion that learning can be done through play, which can be designed deliberately to achieve learning objectives (games based learning). Learning is a multi-faceted process that is generally taken for granted, until individuals find difficulty in dealing with complex tasks (Neupane *et al*., 2020). In this activity, a snakes and ladders game is used, so that it will make students happy and motivated.

Metacognition has as its theoretical foundation one's ability to use knowledge to plan strategies for approaching learning tasks, take the necessary steps to solve problems, reflect and evaluate results, and modify one's approach as needed (Lukitasari *et al*., 2014). Metacognitive skills are thinking skills, knowing what we know and what we don't know, learning how to learn and developing sustainable thinking processes, where these can be used to solve problems. In the realm of education, holistic education is an educational method that builds humans as a whole and whole by developing all human potential which includes social, emotional, intellectual, moral or character, creativity, and spiritual potential. The character of gotong-royong is raised as a theme to develop empathy, care and cooperation (Dewantara, 2017).

In the developed teaching module, there is a triggering question, where the triggering question given by the teacher is a question used to increase listener participation and get listeners to enter the topic being discussed. In this activity, the teacher provides questions about numbers or numbers that have been commonly found by students everyday (numbers 1- 100). The teacher's ability to design triggering questions is key in developing meaningful learning (Huang *et al*., 2011). This principle is in accordance with the results of research, after the action in the form of a lighter question is better, which is shown by children daring to answer even though it is not correct, asking the teacher, daring to express differences of opinion and being able to briefly explain a topic or theme studied (Festiawan *et al*., 2021).

The presentation of learning media in the form of rupiah banknotes, not foreign money (dollars, ringgit or real) is an effort to develop nationalist character, namely loving the nation's identity and the fact that rupiah money

is used daily. The presentation of this learning media based on character education should bring students to cognitive value recognition, affective value appreciation, and finally to real value practice. In accordance with Lickona's opinion about moral knowing, moral feeling, and moral action. The nationalist attitude is shown through the attitude of appreciation of the nation's own culture, protecting the nation's cultural wealth, willing to sacrifice, excel, and excel, love the country, protect the environment, obey the law, discipline, respect for cultural, ethnic, and religious diversity (Naufal & Maksum, 2024). By paying attention to the numbers or numbers printed on rupiah banknotes, it is possible that students can easily classify numbers. In accordance with the function of learning media can clarify the presentation of messages and information so that it can facilitate and improve the learning process and results.

In implementing shopping list activities so that students are interested, video is used, as a technology-based learning medium. In accordance with the demands in the Merdeka Curriculum to be able to combine the use of concrete learning media and technology-based learning media. This is necessary so that students are not left behind with technological developments. It is known that technological developments have created various services such as information, communication, games, and many other functions offered therein. The more technological facilities offered, the more benefits for its users. Therefore, technological advances are considered important to be applied in various fields, one of which is learning in schools (Bobrovska, 2020). Based on the results of data analysis, the use of video learning media can affect the learning outcomes of elementary school students, the average score before the pre-test is 61.84, while the average score after the post-test is 77.31.

The profile of Pancasila learners is in accordance with the Vision and Mission of the Ministry of Education and Culture as stated in the Regulation of the Minister of Education and Culture Number 22 of 2020 concerning the Strategic Plan of the Ministry of Education and Culture for 2020-2024 (Yumna *et al.*, 2024). Pancasila learners are the realization of Indonesian students as lifelong learners who have global competence and behave in accordance with the values of Pancasila, with six main characteristics: faith, devotion to God

Almighty, and noble character, global diversity, mutual cooperation, independence, critical reasoning, and creativity. The six main characteristics of the Pancasila Student Profile do not have to be applied in every meeting, but can be selected according to the relevant theme or topic. In this meeting, the assessment given is faith, piety towards God, and noble character. Indonesian students who have faith, piety towards God, and noble character are students who behave in relation to God (Pamungkas & Koeswanti, 2022). He/she understands the teachings of his/her religion and beliefs and applies this understanding in his/her daily life. There are five key elements: morals of diversity, personal morals, morals towards nature and morals of the state. Critically reasoning, a critically reasoning learner is able to objectively process both qualitative and quantitative information, establish links between various information, analyze information, evaluate and conclude. Elements are obtaining and processing information and ideas, analyzing and evaluating reasoning, reflecting on thoughts and thought processes, and making decisions. Bergotong royong, Indonesian students have the ability to work together, namely the ability to carry out activities together voluntarily so that the activities carried out can run smoothly, easily and lightly. Elements are collaboration, caring and sharing. The results of research on the application of the Pancasila learner profile, teachers do with habituation activities, problem-based learning, group-based learning, being a role model for students, using Indonesian well in all learning activities, as well as giving assignments independently and integrating values in IPAS subjects (Setiawan *et al.*, 2024).

Teachers need to prepare themselves well through learning contracts, dividing students into small groups and preparing learning tools and materials. In accordance with the role of the teacher, Ki Hajar Dewantara taught "ing ngarso sung tulodho, ing madya mbangun karso, tut wuri andayani". As well as paying attention to social cognitive learning theory with a meta-cognitive approach to early childhood learning, a teacher has a very important role considering that every learning process for children will begin with the perception of seeing, hearing, touching, feeling, and smelling, so the teacher must be able to become a role model for children. How the teacher walks, how the teacher talks, how the teacher behaves will be an example and imitated by

the child. Learning theory that emphasizes the role of educators as role models is the cognitive social learning theory developed by Albert Bandura that learning essentially takes place through the process of imitation (modeling), where children learn and gain knowledge through the process of observing and imitating someone's behavior. In some cases, the teacher's words are even more trusted than the parents' words. Bandura said that "Observational learning is a cognitive process that involves a number of attributes such as language, morality, thinking and self-regulation of one's behavior, so that if someone does an action, then it is the result of a process that involves some of these attributes, not just imitating the behavior of others". Self-regulated learning can increase student engagement in online schooling. Self regulated learning is defined as the degree to which students actively engage metacognition, motivation, and behavior in the learning process (Zimmerman & Sch. Self regulation is the ability to control oneself. Self-regulation is the use of a process that activates continuous thinking, behavior, and feelings in an effort to achieve predetermined goals. Individuals perform regulation by observing, considering, giving, punishing themselves. This self-regulation system is in the form of standards for one's behavior and observing one's own abilities, assessing oneself, and responding to oneself. Self regulation theory with a metacognitive approach optimal child learning outcomes will be achieved because children can manage or control themselves in learning (Frazier *et al*., 2021).

The development of the teaching module has gone through expert evaluation, with the concept of assessing the quality of the student activity observation sheet of the digital-based holistic-integrative STEAM learning model through a metacognitive approach by considering the following matters: module size, module skin design (cover), and module content design.

Table 2

Expert Validation Instrument

No.	Statement	Expert 1	Expert 2	Expert 3	Ket.
	Module Size				
1	Module size in accordance with ISO standards	5	4	5	
2	Appropriateness of margin and paper size in the module	5	4	5	
	Module Skin Design (Vover)				
3	The skin illustration of the module describes the teaching content/material and reveals the character of the object.	5	3	5	
4	Not using too many typeface combinations	5	5	4	
5	Module title color contrasts with background color	5	4	4	
6	The proportion of the font size of the title, subtitles, and supporting text of the module is more dominant and professional than the size of the module and author's name.	5	5	4	
	Module content design				
7	Suitability material module with learning objectives	5	4	4	
8	Use of font variations is not excessive	5	4	4	
9	Image suitability with text message (material)	4	5	5	
10	Suitability of Formulas with material	4	4	4	
11	Spacing between lines in normal text	5	5	4	
12	Spacing between letters is normal	5	5	4	
13	Attractiveness of the appearance of the math module on fractions	5	4	4	

Description: 5 = very good; 4 = good; 3 = sufficient; 2 = deficient; 1 = very deficient

According to the three validators, the quality of the teaching module development can be described as follows: Validator 1 (PGSD Lecturer) stated that it was very good with a score of (63: 13 = 4.8) meaning that it was feasible to use with minor revisions. While suggestions for improvement, "Overall it is very good for the teaching modules made, only a few suggestions for adding character values: P5 characters can be added according to the material, for example: creativity and independence. For faith and piety, I think it can be included in all materials, only here it is more emphasized according to the material (can be seen in the script)". Validator 2 (PGSD Lecturer) stated that it was very good with a score of (56: 13 = 4.3) meaning that it was feasible to use with minor revisions (Hajiriah *et al.*, 2023). While suggestions for improvement, "1) The image section contained in the teaching module should use real images such as examples of unhealthy food foods, if the use of images in the module takes from the internet, then it would be nice in accordance with ethics in writing, given a reference from which the image is taken. 2) The cover of the

module is good, but a little does not contrast with the writing attached to the cover because the aesthetics of the writing becomes invisible or the readability becomes unclear. Validator 3 (SD / MI Teacher) stated that it was very good with a score of (56: 13 = 4.3), meaning that it was feasible to use with minor revisions. While suggestions for improvement "In my opinion, the teaching materials in this book are suitable for student learning, but the images presented would be nice to use colorful images, and images that elementary school children understand. For example in technology material, you can use robots, televisions and others.

5 CONCLUSION

The Holistic which means integrating various aspects of learning to provide a comprehensive understanding, and the metacognitive approach is what encourages learners to reflect on and organize their thinking processes, including an understanding of their own learning. so that the syntax of the digital-based holistic-integrative steam learning model through a metacognitive approach is obtained, namely model and show, reflective discussion, learning journals, metacognitive questions, provide constructive feedback, activities based on learning environment engineering, self-questioning, involvement in assessment, evaluating learning outcomes. The development of teaching modules in learner learning activities raises the characters of honesty, mutual cooperation and nationalism. The results of the validation of three validators of the teaching module stated that it was very good, worthy of being used with minor revisions.

ACKOWLEDGEMENT

This research was supported by the RIIM LPDP Grant and BRIN, grant number: 109/IV/KS/11/2023 and number: 019/SP/II.3.AU/LPPM/A/2023). We also thanks to the Universitas Muhammadiyah Surabaya and Pimpinan Daerah Muhammadiyah Surabaya.

REFERENCES

Ammar, M., Al-Thani, N. J., & Ahmad, Z. (2024). Role of pedagogical approaches in fostering innovation among K-12 students in STEM education. *Social Sciences & Humanities Open*, *9*, 100839. https://doi.org/10.1016/j.ssaho.2024.100839

Bakar, M. a. A., & Ismail, N. (2020). Exploring metacognitive regulation and students' interaction in mathematics learning: an analysis of needs to enhance students' mastery. *Humanities & Social Sciences Reviews*, *8*(2), 67–74. https://doi.org/10.18510/hssr.2020.82e07

Bedeker, M. (2023). COVID-19 Resulted in Classrooms Without Walls: What can Pedagogical and Content Knowledge (PCK) Offer? *The Journal of Educators Online*, *20*(2), 1–14. https://doi.org/10.9743/jeo.2023.20.2.2

Bisaillon, N. (2023). Development of number sense and numeration: a continuum hypothesis. *Journal of Research in Science Mathematics and Technology Education*, *6*(SI), 91–108. https://doi.org/10.31756/jrsmte.615si

Bobrovska, O. (2020). Management approaches in the implementation of digital technologies in public administration. *Public Administration Aspects*, *8*(1 SI), 12–14. https://doi.org/10.15421/152029

Chen, S., Sermeno, R., Hodge, K., Murphy, S., Agenbroad, A., Schweitzer, A., Tsao, L. L., & Roe, A. J. (2024). Young Children's Self-Regulated Learning Benefited from a Metacognition-Driven Science Education Intervention for Early Childhood Teachers. *Education Sciences*, *14*(6), 565. https://doi.org/10.3390/educsci14060565

De, L. L., & Suastra, I. W. (2024). Strengthening pancasila student profile in schools in perenialism view. *Indonesian Journal of Educational Development*, *5*(1), 101–113. https://doi.org/10.59672/ijed.v5i1.3380

Dewantara, A. W. (2017). "Gotong-Royong" (Mutual Assistance of Indonesia) according to Soekarno in Max Scheler's Axiology perspective. *International Journal of Humanities and Social Science*, *4*(5), 41–50. https://doi.org/10.14445/23942703/ijhss-v4i5p106

Dewi, R., Syukur, T. A., Abusiri, A., & Hendra, T. (2023). Metode pengajaran berbasis karakter untuk anak usia Dini (Telaah Pemikiran Ratna Megawangi). *Indonesian Journal of Counseling & Development*, *5*(1), 9–23. https://doi.org/10.32939/ijcd.v5i1.2713

Festiawan, R., Hooi, L. B., Widiawati, P., Yoda, I. K., S, A., Antoni, M. S., & Nugroho, A. I. (2021). The Problem-Based Learning: How the effect on student critical thinking ability and learning motivation in COVID-19 pandemic? *JOURNAL SPORT AREA*, *6*(2), 231–243. https://doi.org/10.25299/sportarea.2021.vol6(2).6393

Frazier, L. D., Schwartz, B. L., & Metcalfe, J. (2021). The MAPS model of self-regulation: Integrating metacognition, agency, and possible selves. *Metacognition and Learning*, *16*(2), 297–318. https://doi.org/10.1007/s11409-020-09255-3

Haddad, F. B., ASTabieh, A., Alsmadi, M., Mansour, O., & Al-Shalabi, E. (2022). Metacognitive awareness of STEAM education among primary stage teachers in Jordan. *Journal of Turkish Science Education*, *19*(4), 1171–1191. https://doi.org/10.36681/tused.2022.168

Hajiriah, T. L., Sudiatmika, A. R., Suma, I. K., & Suardana, I. N. (2023). Meta-Analisis : Studi pentingnya mengukur keterampilan metakognitif siswa. *Bioscientist Jurnal Ilmiah Biologi*, *11*(2), 1697. https://doi.org/10.33394/bioscientist.v11i2.9567

Huang, Y., Chiu, P., Liu, T., & Chen, T. (2011). The design and implementation of a meaningful learning-based evaluation method for ubiquitous learning. *Computers & Education*, *57*(4), 2291–2302. https://doi.org/10.1016/j.compedu.2011.05.023

Khoiron, M., Wahyuningtyas, N., & Miftakhuddin, N. (2020). Revitalization of Social Studies Education: A Developmental Study Based on Dick and Carey Instructional Design. *Advances in Social Science, Education and Humanities Research*, *404*(41), 1–6. https://doi.org/10.2991/assehr.k.200214.007

Lukitasari, M., Susilo, H., Ibrohim, I., & Corebima, A. D. (2014). Lesson Study in Improving the Role of E-Portfolio on the Metacognitive skill and concept Comprehension: A Study on cell Biology subject in IKIP PGRI Madiun, Indonesia. *American Journal of Educational Research*, *2*(10), 919–924. https://doi.org/10.12691/education-2-10-11

Naufal, N., & Maksum, M. N. R. (2024). Management of Strengthening character education in Junior High school. *Munaddhomah Journal of Islamic Education Management*, *5*(2), 126–135. https://doi.org/10.31538/munaddhomah.v5i2.778

Neupane, D., Rai, J., Chaulagain, S., Jha, N., Sah, A., & Bhuju, D. R. (2020). Role of academic institutions during the COVID-19 pandemic. *International Journal of Infection Control*, *16*(4), 1–9. https://doi.org/10.3396/ijic.v16i4.024.20

Pahmi, S., Juandi, D., & Sugiarni, R. (2022). The Effect of STEAM in Mathematics Learning on 21st Century Skills: A Systematic Literature reviews. *PRISMA*, *11*(1), 93. https://doi.org/10.35194/jp.v11i1.2039

Pamungkas, W. a. D., & Koeswanti, H. D. (2022). Penggunaan media pembelajaran video terhadap hasil belajar siswa sekolah dasar. *Jurnal Ilmiah Pendidikan Profesi Guru*, *4*(3), 346–354. https://doi.org/10.23887/jippg.v4i3.41223

Rakesh, D., McLaughlin, K. A., Sheridan, M., Humphreys, K. L., & Rosen, M. L. (2024). Environmental contributions to cognitive development: The role of cognitive stimulation. *Developmental Review*, *73*, 101135. https://doi.org/10.1016/j.dr.2024.101135

Setiawan, B., Suherman, W. S., Wuryandani, W., & Dwiningrum, S. I. A. (2024). The school strategy from the teacher's perspective in building a profile of Pancasila students. *Global Journal of Guidance and Counseling in Schools Current Perspectives*, *14*(2), 87–95. https://doi.org/10.18844/gjgc.v14i2.9459

Teo, T., Unwin, S., Scherer, R., & Gardiner, V. (2021). Initial teacher training for twenty-first century skills in the Fourth Industrial Revolution (IR 4.0): A scoping review. *Computers & Education*, *170*, 104223. https://doi.org/10.1016/j.compedu.2021.104223

Wahba, F. A., Tabieh, A. a. S., & Banat, S. Y. (2022). The power of STEAM activities in enhancing the level of metacognitive awareness of mathematics among students at the primary stage. *Eurasia Journal of Mathematics Science and Technology Education*, *18*(11), em2185. https://doi.org/10.29333/ejmste/12562

Wahyuningsih, S., Nurjanah, N. E., Rasmani, U. E. E., Hafidah, R., Pudyaningtyas, A. R., & Syamsuddin, M. M. (2020). STEAM learning in Early Childhood Education: A Literature review. *IJPTE International Journal of Pedagogy and Teacher Education*, *4*(1), 33. https://doi.org/10.20961/ijpte.v4i1.39855

Yulianti, E., Suwono, H., Rahman, N. F. A., & Phang, F. A. (2024). State-of-the-Art of STEAM Education in Science Classrooms: A Systematic Literature Review. *Open Education Studies*, *6*(1), 1–17. https://doi.org/10.1515/edu-2024-0032

Yumna, Y., Jaili, H., Tupas, P. B., Azima, N. F., Minsih, M., Dahliana, D., & Fransiska, N. (2024). Transformative Learning Media for Generation Z: Integrating Moral Values through Interactive E-Books in Islamic Education. *Indonesian Journal on Learning and Advanced Education (IJOLAE)*, *6*(3), 403–422. https://doi.org/10.23917/ijolae.v6i3.23814

Zhao, Y., & Watterston, J. (2021). The changes we need: Education post COVID-19. *Journal of Educational Change*, *22*(1), 3–12. https://doi.org/10.1007/s10833-021-09417-3