

Research Article

Project-Based Learning Tool Model that empowers the Metacognitive Skills of MAN Model Manado Students

Mariana Rengkuan^{1*}, Marleny Leasa², Aprilia Mokoagow³, and Fernando Watung¹

¹Biology Department, Faculty of Natural Sciences and Mathematics, State University of Manado, Indonesia

²Elementary School Teacher Education, Faculty of Teacher Training and Education, Pattimura University, Ambon, Indonesia

³Madrasah Aliyah Negeri Model 1 Manado, Indonesia

ORCID

Mariana Rengkuan: <https://orcid.org/0000-0002-0632-8045>

Marleny Leasa: <https://orcid.org/0000-0003-0718-3447>

Abstract.

Problems in learning that do not empower students' thinking abilities, especially metacognitive skills, are of high concern in the 21st century. The demands of life require humans to have some required skills and must be empowered to learn through appropriate learning tools. This research aims to develop project-style learning tools that enable students' metacognitive skills in biology subjects. The research method used is Borg & Gall model development research with the following steps: 1) needs analysis to obtain the required information, 2) literature study, 3) development of learning tools using a project model, and 4) expert validation, then continued with limited group testing on users. The results of the development in the form of ATP and the Phase E Biology Teaching Module, show that the learning tools that have been developed are suitable according to material experts and learning experts with very high assessment categories, namely 94% and 90.66%, 100% of teacher assessment results, so that the learning tools are suitable for use. This is also reinforced by data from the results of applying learning tools to students by measuring students' metacognitive skills reaching a score of 76 or the good category.

Keywords: learning tools, PjBL, metacognitive skills

Corresponding Author: Mariana Rengkuan; email: marianabio05@unima.ac.id

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1. Introduction

The demands of facing the challenges of 21st century life require changes in all aspects of life, including education. The change that must be made is the quality of education which must be able to equip people with a number of skills in the 21st century. This can be prepared and obtained through innovative learning and characterized by 21st century skills, including: learning tools capable of empowering 4C abilities (critical thinking, creativity, collaboration, and communication). Apart from 4C capabilities, learning tools must have collaborative elements between teachers and students as well as between



students, ICT-TPACK based learning, developing literacy and Pancasila character, apart from that metacognitive skills are also needed [1].

States that metacognitive skills have an important meaning in the learning process. Metacognitive skills are skills in a person about thinking how to think [2]. Metacognition allows people to take responsibility for their own learning. This involves awareness of how they learn, as well as an evaluation of their learning needs [3]. Students often show self-confidence when they have trained their metacognitive skills. This self-confidence can increase motivation so that it has an impact on success in learning, even Rengkuan [4] report that metaconative skills also influence problem-solving skills. In line with the report by Rengkuan et al [5] that metacognitive skills can improve critical thinking and also have an impact on reading ability, the same thing is also seen by Jin, M., & Ji, C. [6, 7] on critical thinking abilities. Strengthened by Smith, Annie K., Black, Sheila., & Hooper, Lisa M. [8] who stated that metacognitive skills can improve academic achievement.

Basically, every student has metacognitive skills. However, during development, this skill needs to be trained. One way that educators can use to train students' metacognitive skills is by implementing a learning model. Hacker [2] stated that in general, to train metacognitive skills, a strategy is needed. State that like other skills, metacognition will be successfully empowered with practice [9]. One model that can empower metacognitive skills is Project Base Learning (PjBL). Rengkuan, et al [4], Sumampouw et al, [10] reported that the PjBL model can empower critical thinking abilities and metacognitive skills through genetic learning where through PjBL steps, especially in project monitoring and evaluation, students consciously carry out metacognitive skills. Similar research was also reported by Rengkuan, et al [4] that the PjBL model can influence the thinking abilities and metacognitive skills of students at Unima. Likewise, the research results of Rengkuan, et al., [5, 12, 13] on the Teacher Professional Education Program show that Problem-based Learning Tools can empower metacognitive skills.

2. Method

The research used is development research using a development research model with a modification of the Borg & Gall Model [4] which is a simpler learning design model so it is easy to understand and use, this is what also underlies the selection of this model. As with other development models, this model has limitations in terms of: there is no expert validation stage available, so for this reason the Borg & Gall model was modified into four stages, which include: 1) analysis of the need to obtain information, which including classroom observations, interviews which aim to explore as much information

as possible from teachers and students who are research subjects, 2) Literature study, by reviewing literature studies related to the research carried out 3) development of learning tools and materials which include: skill identification, goals; special knowledge about the objectives to be achieved by the researcher, estimates of time, costs and energy required, 4) Expert validation. Expert validation is limited to content experts and learning experts.

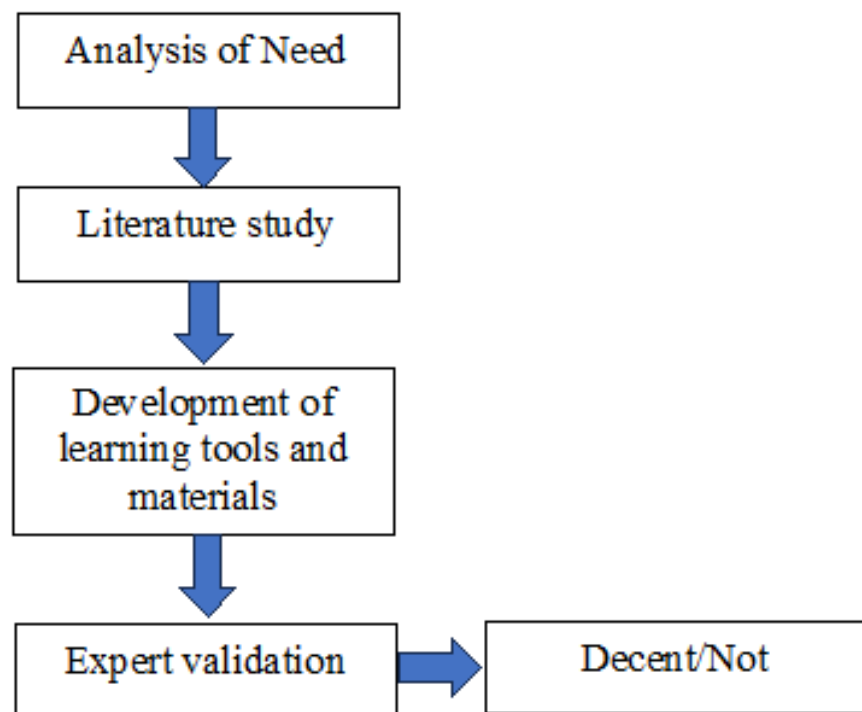


Figure 1: Borg & Gall Model Development Flow.

At the expert validation stage, quantitative data was obtained from the collected questionnaire and then the percentage of each question item in the questionnaire.

Giving meaning and making decisions about the quality of this learning device product will use a conversion level of achievement on a scale of 5 as in table 1 below:

3. Results and Discussion

The development product is a Phase E learning device which consists of: Learning Outcomes and Electronic-based Teaching Modules (Figure 1) equipped with barcodes so that they are easily accessed anytime and anywhere by students and teachers via smartphones, cellphones, laptops and tabs. The content of the material is biotechnology which is applied through the project model “processing organic waste into organic fertilizer through the fermentation process of local microorganisms”. The choice of

TABLE 1: Conversion of Achievement Levels and Qualifications.

Achievement Level	Qualification	Information
90% - 100%	Very high	Very decent, no need for revision
75% - 89%	High	Decent, no need for revision
65% - 74%	Fairly high	Not feasible, needs to be revised
55% - 64%	Not high	Not suitable, needs to be revised
0% - 54%	Very low	Very inadequate, needs to be revised

the Project model as the learning strategy used aims to encourage students to produce innovative projects and this product also supports 21st century learning, namely cultivating abilities known as 4C (Communication, Collaboration, Critical Thinking and Creativity and Innovation). Attached below are the results of the Content Expert and Learning Design Expert Assessment of the learning resources developed.

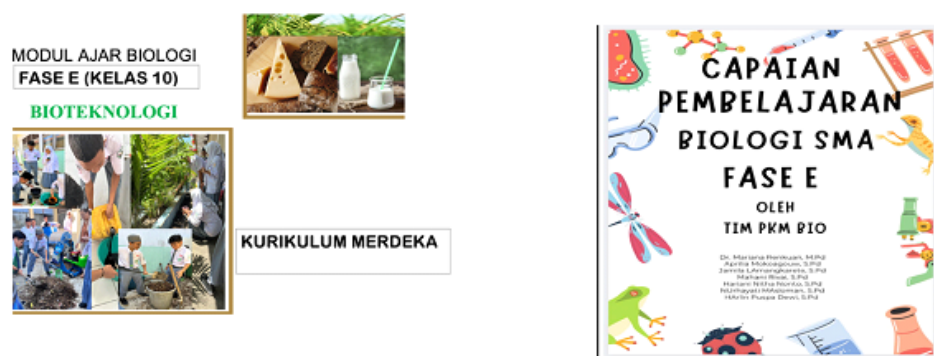


Figure 2: Cover of Teaching Module.

3.1. Response Results / Content Expert Assessment

Response results evaluation can be seen in Table 2.

Based on the table above, the total average product value is 5 = very high for the product. From the accumulated data from the assessment of learning tools, the percentage level of product achievement was 84%.

The percentage data obtained from material experts regarding learning device products with very high assessment results is suitable for use by students and teachers as well as suggestions and input given by material experts recorded by researchers, namely the idea for making an E-Book is very good and the E-Book created will also

TABLE 2: Results of Learning Content Expert Assessment of learning resources via Questionnaire.

No	Item Questions	Score
1	Completeness of material content	4
2	Spaciousness material	4
3	Presentation text and images in accordance	5
4	Develop metacognitive abilities	5
5	Cultivate students' curiosity	5
6	Includes material in the Merdeka Curriculum	5
7	Increasing students' desire to read based on the latest design	5
8	Accuracy of concepts and definitions	4
9	Image accuracy	4
10	Accuracy of data and facts	4
11	Attractiveness of interesting facts	5
12	Accuracy of material	5
13	Selection of projects according to biotechnology concepts	5
14	Inviting students to be active in learning	5
15	Presentation of biotechnology images is easy to understand	5
16	Developed information in accordance with current development	5
17	Use of language that is easy to understand	4
18	Using example as well as case in everyday life	5
19	Encourage curiosity	5
20	The choice of words and use of sentences is appropriate to the abilities of SMA/SMK level students	5
Total		94

Note: The choice of learning model/strategy is appropriate because it is in accordance with the merdeka curriculum

used as an overview of Biotechnology material. Overall the E-Book developed is very good.

3.2. Analysis of Data from the Learning Media Expert Assessment Results

Analysis of data from the learning media expert assessment results can be seen in Table 3.

Based on the table above, the total average product value is 5 = very high, no need for product revision. From the accumulated data from the E-Book media assessment results, the percentage level of product achievement was 90.66%.

TABLE 3: Results of Learning Media Expert Assessment.

No	Item questions	Score
1	Accuracy in selecting the type of software as a media development tool	5
2	E-books are easy to carry anywhere/anytime	5
3	The potential of media in facilitating learning content in material	4
4	Operating system / Convenience barcode/link based E-Book access	5
5	E- Book Media easy to update anytime and anywhere	5
6	<i>Digital E-books</i> facilitate information technology-based learning	5
7	Suitability of media for learning material	5
8	Communicative (Easy to understand language)	4
9	Selecting the type and size of letters used	4
10	The e-book cover illustration depicts the content of the teaching material and reveals the character of the object	5
11	Use clear and well readable fonts	4
12	Space between text and illustrations is appropriate	4
13	The attractiveness of learning using media	5
14	Clear separation between paragraphs	4
15	E-Book Cover Design depicting material objects	4
Total		68

3.3. Data Analysis of Biology Subject Teacher Assessment Results

After the learning media product, namely the E-Book, is created, the next stage is to carry out a trial of the E-Book media to ask for responses from biology subject teachers at MAN Model Manado and validation from biology subject teachers regarding the media that has been created. Two data were obtained from the media test assessment data, namely qualitative descriptive data in the form of comments, suggestions and input and quantitative statistics in the form of processed numerical data. The following is data on the results of the assessment of the product being developed.

Based on the table above, the total average product value is 5 = very high for the product. From the accumulated data from the E-Book media assessment results, the percentage level of achievement of the Teaching Module product was 100%.

The percentage results data obtained from biology subject teachers regarding the Teaching Module product were found to be very highly rated as suitable for use by students and teachers and the suggestions and input provided by subject teachers

TABLE 4: Data Analysis of Subject Teacher Assessment Results.

No	Item questions	Score
1	Compatibility of indicator with ATP	5
2	Suitability of indicators and materials	5
3	Target users	5
4	Clear description of the material	5
5	Feasibility of teaching modules to be used in learning	5
6	Ease of accessing teaching modules in learning	5
7	Teaching modules are adaptive	5
8	Suitability of explanation of material	5
9	Interesting and motivating material for users	5
10	Correct use of language	5
11	The sentences used do not give rise to multiple interpretations	5
12	Placement of images and explanations is correct	5
13	Background color selection for teaching module	5
14	Attractive graphic design choices	5
15	Color suitability teaching module	5
Total		75

were recorded by researchers, namely media developed in accordance with current developments increasing students' willingness to reading even makes it easier for teachers to provide learning, the packaging of the E-Book is very attractive by using pictures of species and interesting facts that make readers enthusiastic about reading.

3.4. Analysis of Assessment Data by Students

After the E-Book media was validated and assessed by a team of experts, a trial was carried out to determine students' responses to the E-Book media being developed. Student response testing activities are carried out by giving metacognitive skills questionnaires to students.

The results of the research show that learning tools can empower metacognitive skills in the good category, namely a score of 76. This tool can develop self-directed, reflective, lifelong learners as seen in initial abilities when students determine several basic questions related to the problems raised by students in At this stage, students also practice cooperation because they help each other in groups to formulate critical questions. At this stage students can also experience self-directed learning where

TABLE 5: List of Topics of Test Items.

Items	Topics
1	History of Biotechnology and civilization
2	Relationship between Biotechnology and other sciences
3	Utilization of Biotechnology in everyday life
4	Biotechnology developments in producing new products genetically
5	Biotechnology developments in overcoming health problems
6	Biotechnology developments in overcoming food problems
7	Biotechnology developments in overcoming environmental problems
8	Utilization of Biodiversity and Biotechnology
9	Bioinformatics in biotechnology
10	Bioethics in Biotechnology

TABLE 6: The Categories of Metacognition Level.

Scores	categories
86-100	Very good
76-85	Good
60-75	Enough
55-59	Low
0-54	Very low

(Source: Corebima, 2011)

students are encouraged to be disciplined in designing and evaluating projects. Apart from that, self-regulated learning is also formed throughout the stages of the learning project.

4. Conclusion

The research results show that the learning tools that have been developed are suitable according to material experts and learning experts with very high assessment categories, namely 94% and 90.66%, 100% teacher assessment results, also reinforced by data from the results of applying learning tools to students by measuring skills The students' metacognitive score reached 76 or good category, so the learning device is suitable for use.

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