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Development of Teaching-Based Modules *Brain Based Learning* by Using Games in Mathematics Learning at Yapis Ranting 2 Middle School Timika

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Abstract
The aim of this research is to determine the feasibility of developing a brain-based learning mathematics module using a crossword puzzle game as seen from the level of validity, practicality and effectiveness. The method used is research and development with the ADDIE research design. This research was conducted at Yapis Ranting 2 Middle School with test subjects of 27 class VIII students. The validity results show that media validation reached a percentage of 83.33% and material validation was 89.98% in the "very valid" category. The module developed is also practical to use with a percentage of teacher response questionnaires of 70.90 with "practical" criteria and student response questionnaires of 81.61% with "very practical" criteria. Furthermore, the effectiveness seen from the results of the posttest with 21 students completing and 6 students not completing received a percentage of 80.76% for the "very effective" criteria. Based on these results, it was concluded that the module developed was suitable for use in learning.

Keywords: *Learning Modules, Brain Based Learning, Games*

INTRODUCTION

The partner for this PMP activity is Yapis Ranting 2 Timika Middle School with the target of the activity being students. Yapis Ranting 2 Timika Middle School is a private school in Mimika district where Yapis Ranting 2 Timika Middle School has 129 students in the 2023/2024 academic year and the number of educators is 11 teachers and 5 education staff. Yapis Ranting 2 Timika Middle School and 18 teachers. As for the initial conditions of the Yapis Ranting 2 Timika Middle School.

Figure 1. Condition of Yapis Branch 2 Timika Middle School

Based on the results of teaching several students to partners, it is known that many students have low levels of motivation and understanding in the learning process. Students admitted that they did not pay enough attention

to the teacher in delivering learning material and did not do enough activities in class. As for the initial description, researchers conducted teaching to see conditions directly to students at Yapis Ranting 2 Middle School, Timika.

Figure 2. Teaching Process at Yapis Ranting 2 Middle School Timika

Figure 2 shows researchers in the teaching process using modules *Brain based learning* (BBL) in mathematics learning. Based on classroom observations, it is known that many students experience motivation and understanding in receiving the material provided by the teacher. Based on the findings related to field conditions, it can be concluded that learning is still centered on teacher explanations using the lecture method, namely by speaking verbally, after which students are asked to complete

practice questions, so that while in the field researchers observe a phenomenon where in learning mathematics many students become bored, tend to lazy thinking and lack of interaction between teachers and students.

Therefore, researchers offer a solution to this problem by developing teaching-based materials and brain-*based learning*. It is hoped that with the development of teaching materials based on *brain-based learning* This will create a more enjoyable learning atmosphere so that it can increase student motivation in learning, increase students' ability to understand the material, help encourage students' brain abilities to integrate a number of materials that lead students to think critically and foster student activity and participation in learning. Students will be trained independently so they can solve or solve problems in learning.

Teaching modules are teaching tools or teaching designs that are based on a curriculum that is applied with the aim of achieving predetermined competency standards [1]. Teaching modules have a main role in supporting teachers in designing teaching. In preparing teaching tools, the teacher plays an important role. Teachers hone their thinking skills to be able to innovate in teaching modules. Therefore, creating teaching modules is a teacher's pedagogical competency that needs to be developed, this is so that the teacher's teaching techniques in the classroom are more effective, efficient, and the discussion does not leave the discussion of achievement indicators [2].

Ideally, teachers need to develop teaching modules optimally, but in reality, many teachers do not really understand the techniques for compiling and developing teaching modules, especially in the independent learning curriculum. Teaching processes that do not plan teaching modules well can ensure that the delivery of content to students is not systematic, so that teaching occurs unbalanced between teachers and students. It can be ascertained that only teachers are active or vice versa and the teaching carried out seems less interesting because the teacher did not prepare the teaching module well.

"Mathematics taught at school is a pure science that relies on numbers, symbols and emblems." In general, so far mathematics teaching has focused more on the algorithmic aspects of computing. It is not surprising that various studies show that students in general can carry out various mathematical calculations, but do not show encouraging results regarding their application in everyday life. One of the important problems in teaching mathematics today is the importance of developing students' mathematical communication skills. Communication development is also one of the goals of teaching mathematics and is one of the competency standards for graduates in the field of mathematics. Through mathematics teaching, students are expected to be able to communicate ideas using symbols, tables, diagrams, or other media to clarify situations or problems [3].

Teaching mathematics requires teaching that is interesting and not boring so that teaching becomes more fun. Fun teaching cannot be separated from the brain's thinking ability becoming more balanced [4]. Teaching that is in harmony with how the brain works is needed to be able to provide a pleasant learning atmosphere so that it has a positive impact on learning outcomes. Therefore, to make the teaching process enjoyable, a brain-based learning model is used which is necessary to be able to provide a pleasant learning atmosphere so that it has a positive impact on interest in learning [5].

Brain based learning (BBL) is a teaching that sharpens the brain's thinking abilities by balancing the brain's abilities [6]. The brain-based learning model helps students optimize their brains to think and discover knowledge through an active learning process, so that students can learn more meaningfully. The brain-based learning model can create meaningful learning for students because it is able to change the physiology of students' brains when students collaborate in teaching and interact with each other. Therefore, researchers chose brain-based learning as the basis for developing teaching tools in mathematics teaching modules because it can help students optimize the brain's ability to construct and discover knowledge in solving problems [7].

Games are one of the media used to convey a message to the general public in the form of games that can be entertaining so that

someone wins and someone loses, usually in a non-serious context or with the aim of refreshing. A learning method used to analyze interactions between a number of players and individuals that demonstrate rational strategies. Apart from being a medium of entertainment, games can also improve a person's brain development [8].

METHOD

The research method used in this research is Research and Development with the research design used is the ADDIE (Analysis, Design, Development, Implementation and Evaluating) development model. The research and development design in this research is described as follows:

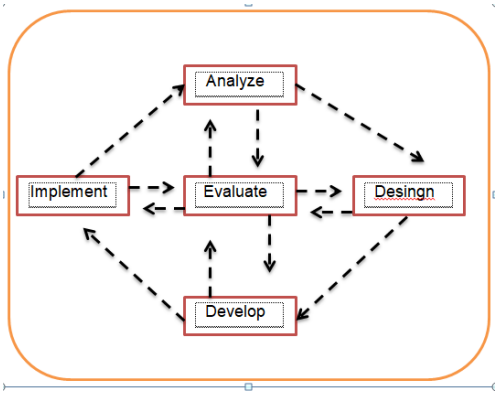

Figure 1. ADDIE Development Design

The subjects in this research were divided into two, namely, development subjects, namely experts or validators and product trial subjects. The division of subjects in the research was students at Yapis Ranting 2 Middle School in class VIII with a total of 26 students consisting of 12 male students and 14 female students. This school was chosen because when the mathematics subject teacher was interviewed, he said that the school already had teaching materials in the form of modules. The researcher was thinking about creating additional modules with new developments using the model. *brain-based learning*. The instruments used in this research were: expert validation sheets, questionnaires and tests. Using data analysis techniques, namely to test the validity, practicality and effectiveness of the modules being developed. Therefore, this research will encourage students and teachers to be able to use learning modules that will help students understand learning, which will help students understand learning easily and pleasantly, and can help teachers.

In carrying out this service activity, the team created steps for implementing service in the form of activities which were divided into eight stages as below:

1. **Level of Preparation**

   The preparation stage consists of planning and designing various conceptual and administrative matters. Conceptual service planning for novice communities (PMP) consists of situation and problem analysis, service objectives, previous service research, and literature study. Apart from that, this service also designs service designs, service methods, as well as the flow and structure of service activities. In administrative terms, service planning includes designing service proposals, requesting letters of assignment, as well as administrative coordination with prospective service participants through the owner school.

   The preparation stage consists of planning and designing various conceptual and administrative matters.

   1) Correspondence and permits.
   2) The briefing committee consists of 2 students who serve as note takers and documentation.
   3) Preparation of related documents, such as how to use the module, complete schedule, daily schedule, rules and regulations.
   4) Invitation letter

2. **Level of analysis (analyze)**

   a. Needs analysis is to determine the abilities or competencies that students need to learn to improve learning outcomes.
   b. Analysis of student character is to find out and clarify whether the problems faced require a solution in the form of creating learning tools.

3. **Planning level (design)**

   After finding the problem from the analysis stage, the next step is the design stage. This level of planning aims to design teaching materials for modules that can be

used in learning mathematics. This level of planning includes:

a. Creating a brain-based learning mathematics learning module design using a crossword puzzle game
b. Instrument preparation

4. Development Stage (development)

The steps that will be taken in developing this module are:

a. Creation of module drafts
b. Expert validation
c. Module revision

5. Implementation stage (implementation)

The next step is to try out brain-based learning-based teaching modules using games in mathematics learning at school with students. Field trials at schools that are used as research subjects to test the quality of the module. The implementation stage was carried out to obtain data on the practicality of the learning modules being developed. This implementation stage is carried out after obtaining feasibility status from a competent validator.

6. Evaluation stage (evaluation)

The evaluation stage is a stage to measure the practicality of brain-based learning based learning modules using games or games developed. The validity of the module has been measured from the assessment of competent validators at the development stage. The evaluation relates to points of deficiencies in this service both in technical and administrative terms, points for improvement, as well as points that need to be improved in the next service. Apart from that, participants filled out a questionnaire aimed at evaluating and
improvement of subsequent activities.

7. Partner Participation in Program Implementation

Partner participation during the implementation of this service program is very necessary.

The following describes partner participation during program implementation:

a) Actively participate in every program implementation, starting from the preparation stage to the program implementation stage
b) Assist the Team to prepare the location for program implementation

8. Final Reporting

The final pioneer in this beginner community service (PMP) is:

1. Preparation of final report
2. Preparation of Draft Scientific Publications

RESULTS AND DISCUSSION

This PMP activity will take place from June-November 2024. The stages of activities that have been implemented include:

1. Management of permits and administration of PMP activities

The team has processed activity permits for Yapis Ranting 2 Timika Middle School. The processing of permits for PMP activities at SMP Yapis Ranting 2 Timika was carried out on June 20 2024 with permit number 173/SMP-YP/VI/2024. This activity has also received permission on July 4 2024 from SMP Yapis Ranting 2 Timika to be carried out with permit number 029/PDIM-SMP/VI/2024.

2. Level of Analysis *(analyze)*

The analysis stage is the initial stage in developing this module. At this stage, several activities are carried out, namely needs analysis and student character analysis.

a) Needs analysis

Needs analysis is carried out to determine basic problems in developing learning modules. In this step the team observed the problems that emerged in mathematics learning at Yapis Ranting 2 Middle School Timika Class VII. In general, at this step there are at least two things that must be answered, namely (1). What kind of learning tools are implemented in the classroom to improve students' learning abilities, (2). Have teachers and students ever used learning modules in learning?

Based on observations at SMP Yapis Ranting 2 Timika, teachers and students only use textbooks provided by the school

in the mathematics learning process in class even though there are learning modules at school. Some teachers also rarely use learning modules in the classroom learning process because when they are used in the learning process, students feel bored, disinterested and less active in classroom learning.

Based on the problems above, researchers chose to develop a mathematics-based learning module *brain-based learning* using crossword puzzle games to help students think critically and improve mathematical problem-solving abilities. With an approach to brain-*based learning* Using crossword puzzle games, students are expected to be more active and creative in solving mathematical problems and providing knowledge to students. So, it is necessary to develop this module as an alternative new learning model that is adapted to the curriculum used in schools, namely the 2013 curriculum.

b) Analysis of student character

At this stage, an analysis of the students' character is carried out to find out how the students are and to find out the students' initial knowledge. This is done by asking class teachers who have experience teaching these students about the character of class VII students, as well as the mathematics scores of students in that class in order to obtain data on students' mathematics scores.

Based on information from mathematics subject teachers, students at Yapis Ranting 2 Timika Middle School are declared complete if they get a score ≥ 78. The prerequisite material that students must study before studying sequence and series material is function material, which has been studied and can be understood well by students at Yapis Ranting 2 Timika Middle School class VII.

The characteristics of students at Yapis Ranting 2 Timika Middle School are indeed different, but the school has taken a policy of not separating students according to their character and academic abilities. Based on interviews conducted by researchers with one of the mathematics teachers, namely Mrs. Hasnita Mustaring, S.Pd., students at school tend to find it difficult to solve non-routine questions. They are used to questions that are only given examples by the teacher and students will experience difficulties if the way the questions are solved is changed. According to the teacher, this is because students are only used to memorizing formulas without knowing how to get the formula.

3. Planning stage *(design)*

The next stage after the analysis stage is carried out *(analyze)* namely the design stage *(design).* At this stage, the design and systematics of mathematics-based learning modules are carried out *brain-based learning* using a crossword puzzle game that includes:

1) Cover: contains the title of the module, namely a sequence and series module based on brain-based learning using crossword puzzles.
2) Foreword
3) List of contents
4) Introduction
   a. Module description
   b. Instructions for using the module
   c. Competencies and indicators
   d. Mathematical figures
   e. Pre-exposure: contains a concept map
5) Preparation: contains information about rows and series material to create curiosity and interest.
6) Initiation and acquisition: contains a description of sequence and series material.
7) Elaboration: contains practice questions about sequences and series.
8) Incubation and memory entry: contains a summary of sequence and series material.
9) Verification and confidence checking: contains a competency test in the form of a crossword puzzle game.
10) Glossary
11) Answer key
12) bibliography

The next step is to develop an instrument used to assess the validity and practicality of the module being developed. The instruments prepared are:

1) Creation of module draft

Preparation of products from the results of previous designs produces results *prototype* I which includes:

a. Initial View of the Module Cover

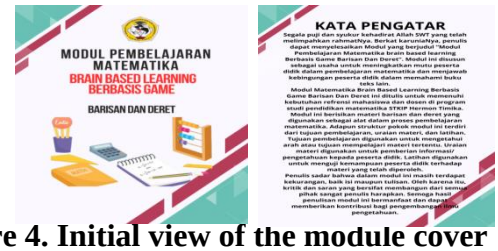

Figure 4. Initial view of the module cover

b. Pre-Exposure: Concept Map and Preparation: Information about Sequences and Series Material

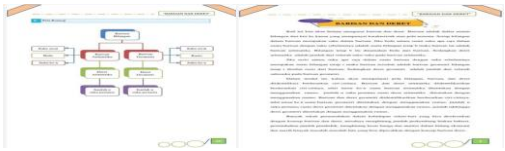

Figure 5: Concept Map and Preparation: Information about Sequences and Series Material

c. Initiation and Acquisition: Material Description and Elaboration: Practice Questions

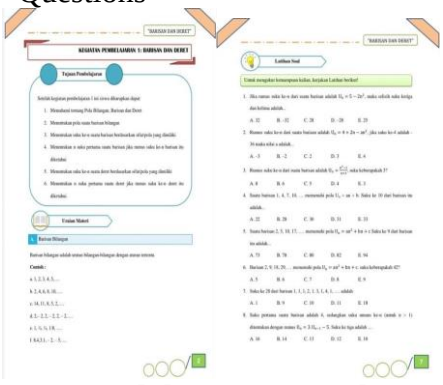

Figure 6.: Material description and practice questions

d. Incubation and Memory Entry: Summary of Material and Verification and Confidence Checking: Competency Test in the Form of a Crossword Game

Figure 7. Summary of Material and Verification and Checking

Confidence: Competency Test in the Form of a Crossword Game

2) Expert validation

This page contains checking whether students really understand the sequence and series material, namely by using a crossword puzzle game. After completing the development of the learning module, the module will be validated by the validator. The purpose of product validation is to determine the level of feasibility of the product before it is given during product trials. The results of the assessment from the experts are then interpreted and suggestions from the experts are used as a reference for making improvements. The following are the results of the validation assessment:

Table 1. Member Evaluation Results

Instrument Study	Validator 1	Validator 2	Rate-rate	Criteria
Material	97,71 %	84,26%	89,98%	Very Valid
Media	91,66 %	85%	88,33%	Very Valid
Question	100%	92%	96%	Very Valid

The material validation results contained 28 questions, the media validation results contained 12 statements and the question validation results contained 5 statements. From table 1, the assessment results from the two material experts are obtained with an average percentage of 89.98% with very valid criteria, the results from the two media experts with an average percentage of 88.33% with very valid criteria, and the results from both question expert with an average percentage of 96% with very valid criteria. Even though the validation results of the material, media and questions are categorized as very valid, there are still several revisions provided by the validator. Based on the input and suggestions given, researchers improve what the validator suggests.

The results of validation by validators on products and materials obtained several improvements to the media and materials provided. The first input is given by the first validator, namely giving suggestions to replace the cover image with an image that includes the material used. The second validator provides suggestions for instructions on how to use the module, replaced with general module instructions so that it is easy to understand, the material information section does not need to be too clear, just use general information, the brain based learning stages are directly included so that it is easy to understand the parts of the stages, examples of questions are clarified, competency tests No. 12 was discarded because it was considered not included in the brain based learning model, the answer key was only for a few questions and only the answers.

After the learning module is declared valid, improvements are made to several of the validator's suggestions, then the product can be tested as a learning module to see its practicality and effectiveness. From the results of trials conducted on 26 students. The practicality of the module can be seen from the results of the teacher and student response questionnaire. The practicality assessment was completed by 26 students at Yapis Ranting 2 Middle School class VIII. The following are the results of the teacher response questionnaire and student response questionnaire to the module:

Table 2. Practicality of teacher & student response questionnaires

No	Aspect	Rating %	Criteria
1	Teacher Response	70,90%	Practical
2	Student Response	81,61%	Very Practical

From the table, it is obtained 70.90% for teacher responses, 81.61% for student responses. Based on the data from the teacher response questionnaire and student responses above, it is known that the mathematics learning module is based on *brain-based learning* using a crossword puzzle game on the subject of sequences and series, is very practical so it can be used as a learning instrument in the learning process, especially in the topic of sequences and series in class VIII at school. The teacher also hopes that the brain-based learning module can be applied to future students who will study the same material.

The effectiveness of the learning module can be seen from the results of the posttest carried out by class VIII students of SMP Yapis Ranting 2 in accordance

with the aspects of brain-*based learning*. The results of the posttest obtained 21 students who completed and 6 students who did not complete because the scores they obtained were below the KKM. So, the posttest results obtained by students in class VIII of SMP Yapis Ranting 2 received very effective criteria with a percentage of 80.76%. After conducting limited trials, the researcher carried out final revisions obtained based on the trial result data, resulting in a module. This product is limited to the development stage. However, this research can still be continued by other researchers to the next stage. After conducting research using modules, which were designed from the analysis stage to the implementation stage, the results were obtained according to the desired expectations. Modules can provide benefits to students. After going through various input and revisions by several validators, the module can be implemented and can also facilitate the teaching and learning process and minimize learning time.

The aim of the ADDIE development model is to see the validity, practicality and effectiveness of the module learning media. This is in accordance with what states that in research on developing learning models, quality criteria are needed, namely validity, practicality and effectiveness. This module's learning media must first pass validation so that it can be tested through validation results by a validator, then its practicality and effectiveness are determined based on the results of the response questionnaire and test results [9].

The validity of the module learning media is obtained from the validation results by the two validators. The module learning media was declared valid with an average validity index percentage of 88.33% with very valid criteria. The validation results are in the form of comments and suggestions for the learning media modules that want to be developed along with the instruments that will be used in the research. Before testing the module learning media first based on the validation results, next is product testing. The trial of this product to determine the practicality and effectiveness of the learning media modules developed said that practicality can be seen from the opinions of users, especially teachers and students who think that the product produced is easy to use and also describes the actual learning process. To find out the practicality, it was obtained from the average response of class VIII students at SMP Yapis Ranting 2 involving 26 students with an average student response of 81.61% with very practical criteria, while from the teacher's response the percentage was 70.90. % with practical criteria. To find out the effectiveness of the product, you can see it by giving a posttest. The average difference test was carried out by giving a posttest consisting of 5 descriptive questions. The posttest questions were given to 26 class VIII students at Yapis Ranting 2 Middle School. The results of the posttest obtained 21 students who completed and 6 students who did not complete because the scores obtained were below the KKM. So, the posttest results obtained by students at Yapis Ranting 2 Middle School obtained very effective criteria with a percentage of 80.76. The development stage aims to develop a revised product based on input from experts and field trials.

3) Module revision

After expert validation of the module developed, the next process is module revision. Module revision activities aim to carry out comprehensive finalization or final improvements to the module. The revisions of the three validators are:

a) Added essay/description questions, answer columns and HOTS questions to practice questions

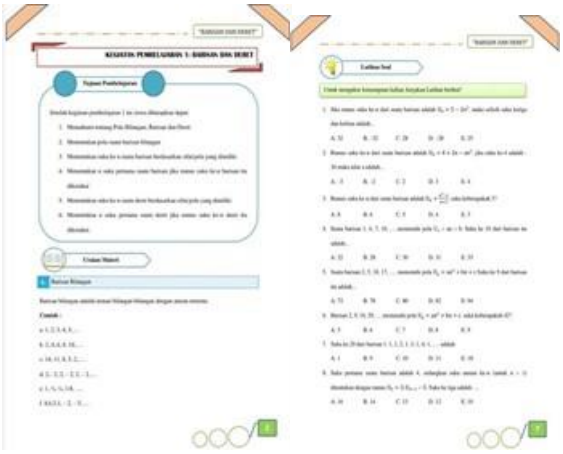

Figure 8. Display of Practice Questions Before Revision

In Figure 4.1 above, the researcher only wrote multiple choice questions, then the researcher revised them by adding description questions and HOTS questions. As in Figure 8. following:

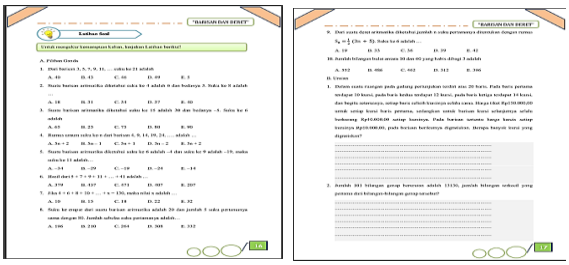

Figure 9. Display of Practice Questions After Revision

b) Added answer key for practice questions

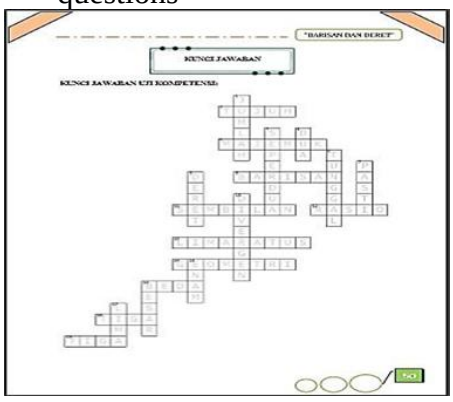

Figure 10. Answer Key View Before Revision

In Figure 10 above, the researcher only wrote down the answer key for the competency test, then the researcher revised it by adding the answer key for the practice questions contained in each learning activity. As in Figure 10 below:

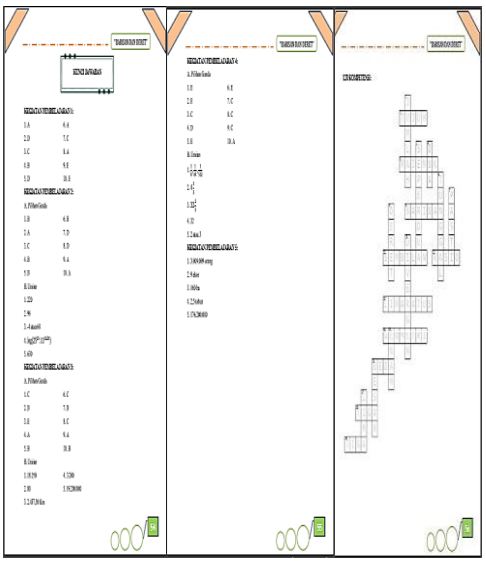

Figure 11 View of the Answer Key After Revision

4. Implementation stage *(implementation)*

After receiving valid status from the three validators, the next step is to try out a brain-based mathematics learning module using a crossword puzzle game on the subject of sequences and series to obtain data on the practicality of the module. The trial was carried out with a limited trial by class VII students at Yapis Ranting 2 Middle School, Timika, totaling 35 people, which was carried out offline by providing a module practicality questionnaire.

5. Evaluation stage *(evaluation)*

The evaluation stage is the final stage in the ADDIE model. The evaluation stage was carried out to measure the practicality of the brain-based learning module using a crossword puzzle game on the topic of sequences and series being developed. There are two aspects assessed in the module practicality questionnaire, namely the material aspect and attractiveness. The validity of the module has been measured from the assessment of expert validators at

the development stage. Meanwhile, the practicality of the module is obtained from the module practicality questionnaire given to students and its validity has been tested.

SUGGESTION

With this Beginner Community Service (PMP) activity, it is hoped that this partner can provide insight for readers and further research, including: 1) Further research is needed to measure student development in self-learning embedded in this media. 2) Module learning media also needs to be developed in other materials. 3) Students can utilize learning media that have been developed to learn independently.

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BIBLIOGRAPHY

[[1]. Nurhalijah, N. (2021). Berbasis Brain Based Learning Menggunakan Permainan Teka-Teki Silang Pada Pokok Bahasan Barisan Dan Deret Di Sma Negeri. http://repository.iainpalopo.ac.id/id/eprint/4163/1.

[2]. Nurdyansyah, & Mutala'liah, N. (2015). Pengembangan Bahan Ajar Modul Ilmu Pengetahuan Alambagi Siswa Kelas IV Sekolah Dasar. Program Studi Pendidikan Guru Madrasa Ibtida'iyah Fakultas Agama Islam Universitas Muhammadiyah Sidoarjo, 41(20), 1–15.

[3]. Dini, F., Nesri, P., & Kristanto, Y. D. (2020). PENGEMBANGAN MODUL AJAR BERBANTUAN TEKNOLOGI UNTUK MENGEMBANGKAN KECAKAPAN ABAD 21 SISWA Pendidikan Matematika, Universitas Sanata Dharma Yogyakarta, Indonesia E-mail : Abstrak PENDAHULUAN Abad 21 memberikan banyak peluang bagi dunia pendidikan untuk be. AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 9(3), 480–492.

[4]. Muliawan, J. U. 2012. Menyulap Siswa Kaya Prestasi di Dalam dan Luar Sekolah. Yogyakarta: FlashBooks.

[5]. Solihat, A., Panjaitan, R. L., & Djuanda, D. (2017). Penerapan Model Pembelajaran Brain Based Learning. Jurnal Pena Ilmiah, 2(1), 451–460.

[6]. Zakaria, L. M. A., Purwoko, A. A., & Hadisaputra, S. (2020). Pengembangan Bahan Ajar Kimia Berbasis Masalah Dengan Pendekatan Brain Based Learning: Validitas dan Reliabilitas. Jurnal Pijar Mipa, 15(5), 554–557. https://doi.org/10.29303/jpm.v15i5.2258

[7]. Khafid, A. (2016). Pengembangan Perangkat Pembelajaran berbasis Brain-Based Learning untuk Meningkatkan Hasil Belajar Siswa. Prisma Sains : Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram, 4(2), 71. https://doi.org/10.33394/j-ps.v4i2.1150

[8]. Danisa, V. S., Suciati, & Sunarno, W. (2015). Pengembangan Modul Berbasis Brain Based Learning Disertai Vee Diagram Untuk Meningkatkan Hasil Belajar Ranah Kognitif. Prosiding Seminar Nasional Pendidikan Sains (SNPS), 141– 151.

[9]. Saputri, R., Deswita, P., Fauzi, A., & Wulan, R. (2020). Efektifitas pengembangan lembar kerja peserta didik (LKPD) fisika sma berbasis model pembelajaran generatif. Jurnal Penelitian Bidang IPA Dan Pendidikan IPA, 2(6), 126–134.