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E-Module Ethnomathematics on Mathematical Representation Ability of Class XI High School Students

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***Abstract*—The research was conducted to produce E-module ethnomathematics on the mathematical representation ability of students at SMAN 1 Buay Madang with valid, practical, and effective criteria. The research conducted is in the form of research and development. The model used in this study is the ADDIE model (Analysis, Design, Develop, Implement and Evaluate). Research data is taken in the form of descriptive qualitative data. The instruments used are validation questionnaires, practicality questionnaires, and pre-test and post-test questions to determine the effectiveness of the e-modules that have been used. The research results that have been carried out have obtained valid, practical, and effective e-modules.**

Keywords—E-Modul, Ethnomathematics, Representasi Mathematics

I. INTRODUCTION

The world of education has now entered the 21st century, which sharpens several skills according to the global conditions of the 21st century [1]. The education that is expected is to be able to have the capital in preparing to become a person who develops and cares about the community environment. The impact of the current COVID-19 pandemic has hampered the learning process in some parts of the world. The utilization of learning media makes one alternative for conducting learning that aims to make time more effective in achieving learning objectives [2]. PISSA (Program for International Student Assessment) also stated the low mathematical ability, resulting in a 2018 survey that Indonesia was ranked 72 out of 78 [3]. This means that Indonesia is ranked sixth lowest in mathematical ability.

One of the factors of low mathematical ability is the lack of ability to represent a problem. Identification from NCTM that mathematical representation is an essential skill in solving mathematical problems [4]. Mathematical representation ability is the basis for understanding and applying problem-solving ideas [5]. The importance of mathematical representation skills in learning mathematics makes it a mental activity that requires students to learn optimally in understanding a concept in the form of pictures, symbols, and written words [6]. The category of representation ability is divided into three forms, namely verbal representation, pictorial representation (visual), and symbolic representation [7].

Learning media is needed to support mathematical representation skills, one of which is the electronic module. The electronic module (E-module) displays information in a book format presented electronically [8]. E-module can be a learning medium that can make it more exciting and interactive [9]. Learning using e-modules can change a student's view of being more interactive in reading and making it more comforTable [10]. Furthermore, using electronic media makes learning more interesting anytime and anywhere [11]. The e-module is developed with a flipbook application that can be accessed online.

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Kvisoft Flipbook is software for developing electronic-based learning modules [12]. Flipbook is used to make a display like any other book into a digital electronic book in a flip [13]. Flipbook development converts PDF files to digital book pages [14]. The development of e-modules through the flipbook application was chosen because it has many supporting features that provide more interactive media [15]. The flipbook feature provides an opportunity for students to be able to feel physically reading a book due to the animation effect of moving pages. With complete template design features, background features, navigation bars, sounds, and other features that can be used optimally [16]

The e-module was chosen because it is an independent learning tool containing systematically designed materials, methods, facilities, and feedback [17]. The modules are arranged systematically and attractively with the scope of material, methods, and evaluation of learning to be used independently by students [18]. The module components include the introduction, general learning objectives, and the learning activities section. The learning activities section describes the learning content, summaries, tests, answer keys, and feedback [19]. The module components developed to consist of learning instructions (teachers and students), instructional objectives, student worksheets, comprehension sheets, and student performance sheets [20]. Modules can be used as a tool to achieve competencies and sub-competencies [21]. The development of e-modules requires innovation so that the developed e-modules have their uniqueness.

The innovation developed in this e-module uses an ethnomathematics approach by taking one of the objects associated with culture. Ethnomathematics is an important part of mathematics; therefore, a teacher should be more creative and innovative in capturing mathematical ideas contained in the local culture [22]. Ethnomathematics plays a role as a facility for students to build mathematical concepts [23]. This explains the relationship between the results of learning mathematics motivated by culture. [24]

Ethnomathematics can be developed through various practical experience activities, and mathematics is a product of culture [25]. Ethnomathematics is an approach by linking culture to mathematics [26]. Giving an ethnomathematics approach can create a class atmosphere with respect for culture [27]. Taking the ethnomathematics approach in the development of the e-module made, namely taking a learning approach associated with a cultural context, namely batik and Songket motifs from Palembang.

II. METHODS

The type of research used is development research (R&D). The research was conducted using the ADDIE model with analysis, design, development, implementation, and evaluation stages. This research was conducted at SMAN1 Buay Madang with the trial subject of class XI IPA 1 TA. 2019/2020 semester 2 with a total of 34 students. The research data was used in descriptive qualitative research to obtain thorough and detailed research. The e-module is developed with a flipbook application that can be accessed online. With the advantages of flipbooks, e-modules will have a unique attraction for students to access, ease of carrying e-modules, and a more attractive appearance [28].

Data analysis of this research consists of the analysis of validation, practicality, and effectiveness. Validation analysis has used the form of material validation questionnaires and media validation, practicality analysis in student response questionnaires, and teacher responses. The effectiveness analysis is in the form of pre-test and post-test questions. Validation and practicality analysis uses the following reference assessment criteria:

Table 1. Validation and Practicality Assessment Guidelines

Score	Score Range	Criteria
A	$3{,}4 < \bar{X} \leq 4$	Very good
B	$2{,}8 < \bar{X} \leq 3{,}4$	Good
C	$2{,}2 < \bar{X} \leq 2{,}8$	Fairly Good
D	$1{,}6 < \bar{X} \leq 2{,}2$	Not Good
E	$1 < \bar{X} \leq 1{,}6$	Very Bad

The use of the E-module can be said to be valid if the average score is in the good enough category. The practicality of a module is considered practical if the average score is in a fairly good category. Meanwhile, to determine the effectiveness of the e-module using the N-gain statistical test using the equations and categories in Table 2 :

Table 2. Category of N-Gain

Score (<g>)	Criteria
$(< g >) > 0{,}7$	High
$0{,}7 \geq (< g >) > 0{,}3$	Medium
$(< g >) \leq 0{,}3$	Low

The e-module is declared effective if it obtains a minimum n-gain category in the moderate category, according to Table 2 [29].

III. Result And Discussion

The results of product development from the resulting e-module are following Table 3:

Table 3. Results of E-Module Development

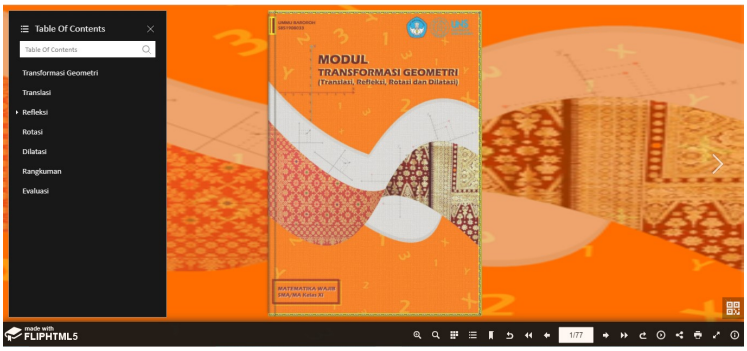
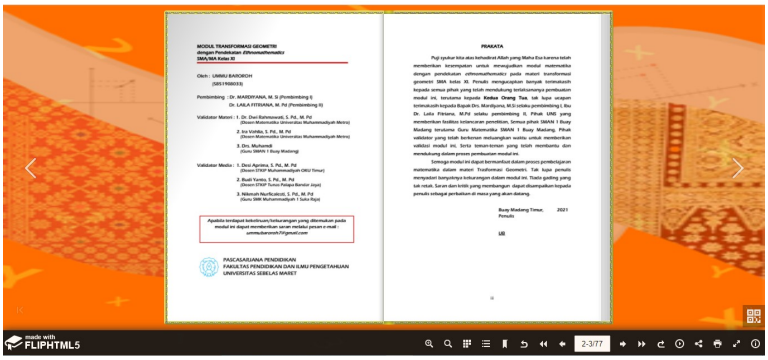
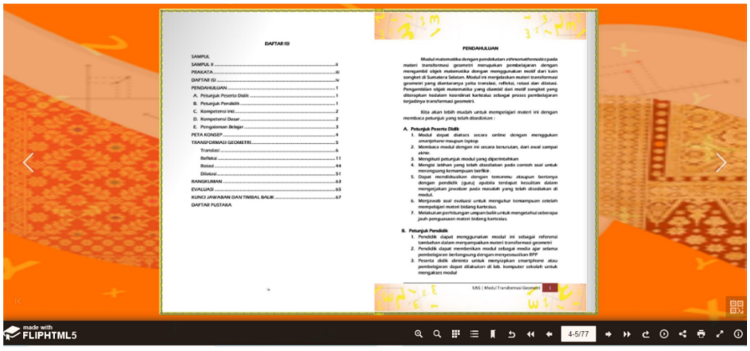
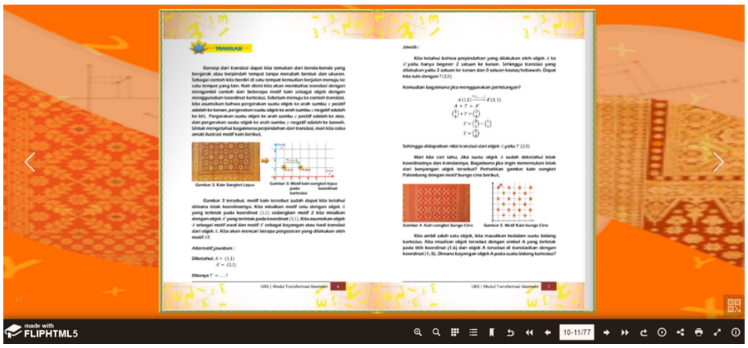
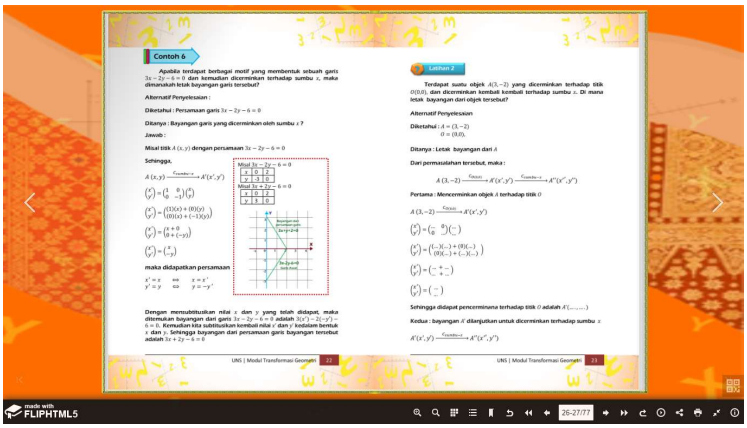
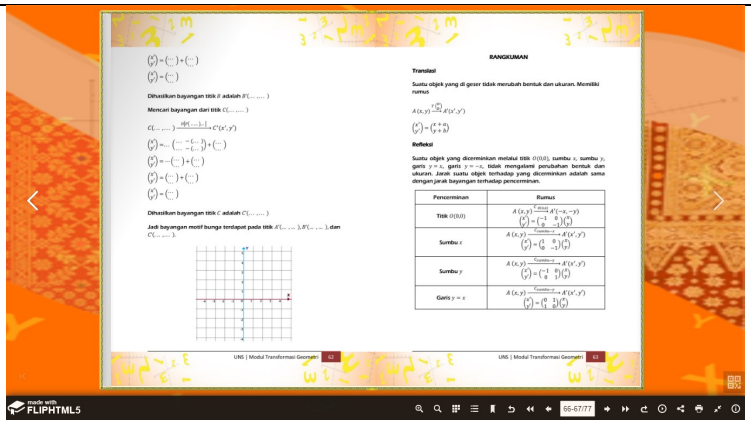
Illustration of E-Module	Description
Show cover via PC/laptop 	The cover contains the name of the module's author and the title. The cover design uses the South Sumatran Songket design, and this design is given as a characteristic of the e-module, which was developed using an ethnomathematics approach in the form of a south Sumatran Songket cloth.
Cover II and Preface 	Cover II contains the identity of the e-module containing the title, the compiler of the e-module, the name of the supervisor during product development, the name of the media and material validator, and the name of the campus identity. The preface contains thanks, apologies, and suggestions from readers.

Table of Contents and Introduction 	A Table of contents is provided to make it easier for readers to find the desired page. In contrast, the introduction contains a brief description of the e-module, instructions for using the e-module, core competencies, basic competencies, and experience to be gained.
Material section 	We are taking the material object as a motif from a typical South Sumatran cloth as a representation of students in geometry transformation material.
Sample questions and practice questions 	In the example questions, detailed steps for solving are given. Finally, practice questions are given as a deepening of the material that has been studied.
Material Summary	The material summary contains the essence of the geometry transformation material in the developed e-module

<table>
<tr>
<td> 
</td>
<td></td>
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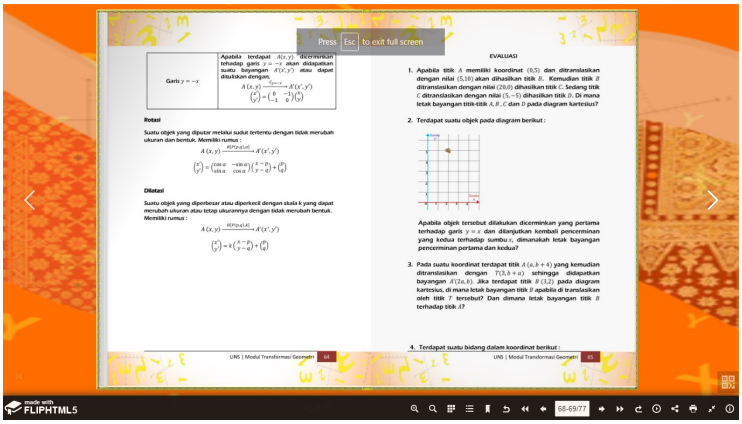
<tr>
<td>Evaluation questions
 
</td>
<td>Evaluation questions are given after students study the e-module as a whole.</td>
</tr>
<tr>
<td>References and Author Biography
 
</td>
<td>Bibliography contains e-module development references. At the same time, the author's biography contains the identity and education of the author.</td>
</tr>
</table>

After the development is done, the next step is e-module validation. The following results of the validation carried out with three material expert validators and three media expert validators are shown in the following Table.4:

Table 4. Results of e-module material validation

Aspect	Average	Category
Content eligibility	3.20	Good
Mathematical Representation Ability	3.00	Good
Ethnomathematics	3.67	Verry Good
Eligibility of presenting material	3.25	Good
Language Eligibility	3.25	Good

The results of material validation in Table 4 have an average value of 3.28 with a good category. Therefore, the results of material validation with good categories are already indicators of validity. The e-module validation activity gave the experts suggestions for improvement to improve the module. Suggestions for improvement refer to typing errors or writing words that are not quite right. While the results of media validation are shown in Table 5 :

Table 5. Results of e-module media validation

Aspect	Average	Category
Type of module	3.33	Good
Cover design	3.89	Very Good
Content Design	3.38	Good
Flipbook Feature Animation	3.50	Very Good

The results of media validation in Table 5 obtained an average value of 3.53 with a very good category. The results of media validation have met the validity indicators. The media validation activities in the e-module obtained suggestions for improvement, which were then consulted with the validator.

After improvements have been made to the module, the next step is to look for experimental data by distributing response questionnaires to students and educators.

Table 6. The results of the practicality of student responses

Aspect	Average	Category	Total Average
Appearance	3.54	Very good	3.47
Material Presentation	3.27	Good	
Benefit	3.64	Very good	
Media Flipbook	3.41	Very good	

The results of the student practicality questionnaire are considered practical if the average score is obtained with a fairly good assessment category. The questionnaire results on the practicality of student responses in Table 6 obtained a total mean value of 3.47 with a very good category. Therefore, the results of the practicality questionnaire from student responses have met the practicality indicators.

Table 7. The results of filling out the teacher practicality questionnaire

Aspect	Average	Category	Total Average
Content Compatibility	3.22	Good	
Presentation	3.67	Very good	3.49
Application	3.6	Very good	

The teacher's practicality questionnaire results are considered practical if the average score is obtained in a fairly good assessment category. The questionnaire results on the practicality of the teacher's responses in Table 7 obtained a total average value of 3.47 with a very good category. Therefore, the results of the practicality questionnaire from student responses have met the practicality indicators. Therefore, it is concluded that the developed e-module meets the practical category.

Table 8. Statistical test results for independent samples test

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil Belajar	Equal variances assumed	.753	.389	9.138	66	.000	14.05882	1.53855	10.98700	17.13065
	Equal variances not assumed			9.138	65.243	.000	14.05882	1.53855	10.98634	17.13131

The independent sample statistical test carried out as in Table 7 produces a Sig (2-tailed) of 0.000, which can be interpreted as rejected. So it can be concluded that the average mathematical representation ability of students using e-modules is better than the average without using e-modules. After it is stated that the representation ability using the e-module is better without the e-module, then the N-Gain test is then given to see the effectiveness of the developed e-module. Meanwhile, the results obtained after the class was given learning using e-modules on the N-gain test obtained a value of 0.4787 in the medium category. So it can be concluded that the developed e-module is said to be effective.

IV. CONCLUSION

Based on the research results obtained from the validation, practicality, and effectiveness results, it can be concluded that the application of e-module ethnomathematics to mathematical representation abilities is valid, practical, and effective. The validity score of the material validation obtained an average score of 3.28 with a good category, and media validation obtained an average score of 3.53 with a very good category. The practicality score of the average student response questionnaire obtained an average score of 3.47 in the very good category and the average teacher response questionnaire 3.47 in the very good category. The independent sample test statistical test obtained Sig (2-tailed) of 0.000, which means that the mathematical representation ability using the e-module is better than without using e-module. Likewise, the effectiveness of the e-module based on the results of the

N-Gain is said to be effective.

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REFERENCES

[1] United States Chamber of Commerce, "Bridging the soft skills gap: How the business and education sectors are partnering toprepare students for the 21st-century workforce". Washington DC: Center for Education and Workforce, U.S. Chamber of Commerce Foundation, 2017

[2] Farida (2020) Development of Interactive Mathematics E-Module Using Visual Studio. *Journal of Physics*. 1-11.

[3] OECD. (2019). PISA 2018 Results Combined Executive Summaries Volume I, II & III. PISA 2018 at a Glance, I, II, II. https://doi.org/10.1787/g222d18af-en

[4] NCTM. (2000). Principles and Standards for School Mathematics. Reston: Virginia.

[5] Rahmah, F., Subanji, dan Irawati, S. (2019). Mathematical representation analysis of students in solving mathematics problems. *Journal of Physics*. Conf. Series 1200 (2019) 012011 .1-9.

[6] Noto, M. S., Hartono, W., dan Sundawan, M. D. (2016). Analysis Of Students Mathematical Representation And Connection On Analytical Geometry Subject. *Journal of Mathematics Education*. 5 (2) 99-108.

[7] Villegas,J.L., Castro, E.,& Gutierrez, J. (2009). Representations in problem solving: A case study with optimization problems. *Elect. J of Research in Educational Psychology* 7(1) 279-308.

[8] Farida. (2015) Mengembangkan Kemampuan Pemahaman Konsep Peserta Didik Melalui Pembelajaran Berbasis VCD Farida, *Al-Jabar J. Pendidik. Mat*. 6 (1) 25–32.

[9] Sari, Y.P., Sunaryo, Serevina,V., dan Astra, I. M. (2019). Developing E-Module for fluids based on problem-based learning (PBL) for senior high school students. *Journal of Physics*. 1-7.

[10] Darmaji, A., dan Kurniawan, D. A. (2019). E-Module Based Problem Solving in Basic Physics Practicum for Science Process Skills. *International Journal of Online and Biomedical Engineering (iJOE).* 15 (15) 1-17.

[11] Perdana, F.A., Sarwanto, Sukarmin, dan Sujadi, I. (2017). Development of e-module combining science process skills and dynamics motion material to increasing critical thinking skills and improve student learning motivation senior high school. *Journal of Physics* . 1 (1) 45-54.

[12] Fahmi., Priwantoro, S. W., Cahdriyana, R. A., Hendroanto, A., Rohmah, S. N., dan Nisa, L. C., (2019). Interactive Learning Media Using Kvisoft Flipbook Maker for Mathematics Learning. *Journal of Physics : Conf. Ser. 1188 012075.* 1-6

[13] Priwantoro, S. W., Fahmi, S., dan Astuti, D. (2018). Pengembangan E-Modul Berbasis Kvisoft Flipbook Maker Dipadukan Dengan Geogebra Sebagai Alternatif Media Pembelajaran Mata Kuliah Program Linier. Seminar Nasional Pendidikan Matematika Ahmad Dahlan. ISSN: 2407-7496. 744-757

[14] Mulyaningsih, N. N. dan Saraswati, D. L. (2017). Penerapan Media Pembelajaran Digital Book Dengan Kvisoft Flipbook Maker. *Jurnal Pendidikan Fisika*. 5(1). 25-32

[15] Andani, D. K. dan Yulian, M. (2018). Pengembangan Bahan Ajar Electronic Book Menggunakan Software Kvisoft Flipbook Pada Materi Hukum Dasar Kimia di SMA Negeri 1 Panton Reu Aceh Barat. *(JIPI) Jurnal IPA dan Pembelajaran IPA*. 2(1). 1-6

[16] Divayana, D. G. H., Suyasa, P. W. A., dan Adiarta, A. (2018). Pelatihan Pembuatan Buku Digital Berbasis Kvisoft Flipbook Maker Bagi Para Guru di SMK TI Udayana. *Abdimas Dewantara*. 1(2). 31-44.

[17] Fauzi, H., Farida, I., Sukmawardani, Y., and Irwansyah, F.S. (2019). The making of e-module based in inquiry on chemical bonding concept with representation ability oriented. *Journal of Physics*. 1402 (5). 1-6.

[18] Tjiptiany, E.N. dkk. (2016). Pengembangan Modul Pembelajaran Matematika Dengan Pendekatan Inkuiri Untuk Membantu Siswa SMA Kelas X dalam Memahami Materi Peluang. *Jurnal Pendidikan.* Vol. 1 No. 10, Hal. 1938—1942.

[19] Parmin dan Peniati, E. (2012). Pengembangan Modul Mata Kuliah Strategi Belajar Mengajar IPA Berbasis Hasil Penelitian Pembelajaran. *Jurnal Pendidikan IPA Indonesia*. Vol.1 No.1, Hal 8-15.

[20] Pohan, J.E., Atmazaki dan Agustina. (2014). Pengembangan Modul Berbasis Pendekatan Kontekstual pada Menulis Resensi di Kelas VIII SMP 7 Padang Bolak. *Jurnal Bahasa, Sastra dan Pembelajaran.* Volume 2 Nomor 2, Hal 1-10.

[21] Widodo, C.S dan Jasmadi. (2008). *Panduan Menyusun Bahan Ajar Berbasis Kompetensi*. Jakarta: Alex Media Komputindo.

[22] Muhtadi, D., Sukirwan, Warsito, dan Prahmana, R.C.I. (2017). Sundanese Ethnomathematics: Mathematical Activities In Estimating, Measuring, And Making Patterns. *Journal on Mathematics Education*. 8 (2) 185-198.

[23] Fajriyah, E. (2018). Peran Etnomatematika Terkait Konsep Matematika dalam Mendukung Literasi. *PRISMA, Prosiding Seminar Nasional Matematika*. 1. 114-119.

[24] Zhang, W., dan Zhang, Q. (2010). Ethnomathematics and Its Integration within the Mathematics Curriculum. *Journal of Mathematics Educations*. 3(1) 151-157.

[25] Cimen, O. A. (2014). Discussing ethnomathematics: Is mathematics culturally dependent?. *Procedia - Social and Behavioral Sciences*. 152 . 523 – 528.

[26] Kusuma, D. A., Ruchjana, B.N., Dewanto,S.P., dan Abdullah, A. S. (2017). The role of ethnomathematics in West Java (a preliminary analysis of case study in Cipatujah). *Journal of Physics*. Conf. Ser. 893 012020. 1-8.

[27] Widada, W., Nugroho, K. U. Z., Sari, W. P., dan Pambudi, G. A. (2019). The ability of mathematical representation through realistic mathematics learning based on ethnomathematics. *Journal of Physics*. *Conf. Ser.* 1318 012073. 1-7.

[28] Maynastiti, D., Serevina, V., dan Sugihartono. (2020). The development of flip book contextual teaching and learning-based to enhance students' physics problem solving skill. *Journal of Physics* : Conf. Ser. 1481 012076. 1-8

[29] Aziz, H., Yulkifli and Yohandri. (2021). Effectiveness of E-Module Based on Integrated Project Based Learning Model Ethno-STEM Approach on Smartphones for Student Senior High School Grade XI. *International Journal of Progressive Sciences and Technologies (IJPSAT*). Vol. 30 No. 1 December 2021, pp.273-279.

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