Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram
https://e-journal.undikma.ac.id/index.php/prismasains/index
e-mail: prismasains.pkpsm@gmail.com

July 2022. Vol. 10, No. 3
p-ISSN: 2338-4530
e-ISSN: 2540-7899
pp. 609-617

Development of Mathematics Learning Tools Based on Ethnomathematics on Rectangular and Triangles in Junior High School

Winda Gusfitri, Abdurrahman, *Dedek Andrian, Sri Rezeki, Nofriyandi
Mathematics Education Study Program, Faculty of Teacher Training and Education, Universitas Islam Riau, Jalan Kaharuddin Nasution, No. 113 Pekanbaru, Riau
*Corresponding Author e-mail: dedekandrian@edu.uir.ac.id

Received: June 2022; Revised: July 2022; Published: July 2022

Abstract

Ethnomathematics is mathematics that appears in a particular culture and is considered a learning approach that aims to enable students to solve mathematical problems related to their daily activities which include grouping, counting, measuring, designing buildings or tools, playing, and determining location. This study aims to produce ethnomathematics-based mathematics learning tools on quadrilaterals and triangles that have been tested for feasibility. Learning tools are in the form of learning implementation plans (LIP) and student worksheets (SAS). This study uses the R&D method with the following steps: potential and problems, data collection, product design, design validity, design revision, and final product. In the R&D method, researchers did not use the pilot stage because school learning was carried out online. The data collection technique used is validation data and validator response data from two Mathematics Education Lecturers and one Mathematics Teacher. The data analysis technique used is validation data analysis and validator response data analysis to mathematics learning tools. From the research results obtained LIP validation results 89.72% with very valid criteria and 92.25% SAS validation results with very valid criteria. While the results of the validator's response to LIP were 80% with good criteria and the results of the validator's response to SAS were 79.86% with good criteria. Based on these results, it can be concluded that the development of ethnomathematics-based mathematics learning tools on quadrilateral and triangle material is feasible to be used and tested in junior high schools.

Keywords: Math Learning Tool, Ethnomathematics, Research and Development

How to Cite: Gusfitri, W., Abdurrahman, A., Andrian, D., Nofriyandi, N., & Rezeki, S. (2022). Development of Mathematics Learning Tools Based on Ethnomathematics on Rectangular and Triangles in Junior High School. *Prisma Sains : Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, *10*(3), 609-617. doi:https://doi.org/10.33394/j-ps.v10i3.5310

https://doi.org/10.33394/j-ps.v10i3.5310

INTRODUCTION

Education is an investment of a nation, education is a provision for human life in the present and in the future. In addition, education also plays an important role to improve and develop the quality of human resources, ranging from basic education to higher education. Regarding the importance of education, Islam as a religion of Rahmatan Lil 'Alamin, requires all its followers to acquire knowledge.

Narrated from Anas bin Malik RA, Rasulullah SAW said:

مُسْلِمٍ كُلِّ عَلَى فَرِيْضَةٌ الْعِلْمِ طَلَبُ

Translate: " Seeking knowledge is an obligation for every Muslim".

From the content of the hadith above, it can be understood that Allah SWT requires all his people to seek knowledge. With knowledge, humans will know something good and bad, right and wrong, bringing benefits and harm to themselves.

Rasulullah SAW said:

الْجَنَّةِ إِلَى طَرِيقًا بِهِ لَهُ اللَّهُ سَهَّلَ عِلْمًا فِيهِ يَلْتَمِسُ طَرِيقًا سَلَكَ وَمَنْ

Translate: “Whoever takes a path in search of knowledge, Allah will make easy for him the path to heaven.” (HR. Muslim)

From the above hadith, it can be seen that Allah SWT will make it easy for a person's path to heaven for those who take the path to seek knowledge. One way that can be done to gain knowledge is to receive formal education at school. Education certainly has clear goals to be achieved, these goals are systematically arranged in a curriculum. Kurniaman & Noviana, (2017) argues briefly that the curriculum functions as a guide in the implementation of educational activities in schools for the teachers and the students themselves. The curriculum is designed according to the needs of education in Indonesia.

Education in Indonesia currently uses the 2013 curriculum. Ikhsan & Hadi (2018) said briefly that the 2013 curriculum is a follow-up step from the 2006 Education Unit Level Curriculum (KTSP) development which includes integrated attitudes, knowledge, and skills competencies.. Andrian et al., (2018) explained that the curriculum needs to pay attention to local culture so that it can contribute to cultural development through education. Therefore, regions have their own authority and obligations to develop education according to the cultural characteristics of the local area.

Pekanbaru City is one of the regions in Indonesia, which has a very identical Malay cultural diversity. Over time, the existence of this culture is slowly swallowed up and forgotten by the community due to the immigrant culture that shifts the existence of the local culture. In the education sector, the existence of culture can be developed by involving it in subjects at school, one of the subjects that is suitable to be applied is mathematics

Wahyuni (2018) said that mathematics as one of the subjects taught in schools was considered to have played an important role in shaping students to become qualified. Until now, there has been no Junior High School that has introduced culture into mathematics learning. This can be seen in mathematics handbooks that do not link the existing culture to the problems or questions given. The book only contains materials that are monotonous without any questions that make students develop their ideas and creativity.

One of the right ways to introduce cultural diversity to students is to involve the culture in examples of questions or exercises that can make students learn real and meaningful so that they can increase their understanding of the concepts of the material being studied. The success of learning mathematics for students cannot be separated from the quality of teaching carried out by the teacher, the better the quality of teaching, the better the learning outcomes obtained. For that, we need an approach to learning mathematics that can connect mathematics and culture.

Wahyuni et al., (2013) explained that ethnomathematics can bridge mathematics with culture in an area. Rahmawati & Muchlian (2019) said briefly that ethnomathematics is mathematics that appears in a particular culture which is considered a lens for viewing and understanding mathematics as a cultural product. Culture refers to people, places, traditions, and ways of organizing, interpreting, conceptualizing, and giving meaning to the physical and social world..

Based on the results of the researcher's interview with the mathematics study teacher at Al-Manar Pekanbaru on 7 July 2020 on mathematics learning tools, some information was obtained as follows; 1) there is a discrepancy between learning objectives and indicators of competency achievement, 2) the LIP used by the teacher has not presented detailed time allocations for each learning activity, 3) the learning steps in the LIP still describe the teacher-centered learning process, 3) the LIP is used by the teacher has not included an answer key for knowledge assessment questions 4) The LIP used by the teacher has not included an assessment rubric for skills assessment questions, 5) The teacher has never provided lesson plans using a learner-centered learning model; 6) Teachers often use SAS available from book publishers, so that learning mathematics in class seems monotonous and does not vary; 7) The SAS presented by the teacher only contains a summary of the material and practice questions, so that it is difficult for students to understand the lesson; 8) In SAS

there is no empty space for students to write answers; 9) Does not contain pictures/illustrations that interest students to work on SAS; 10) The SAS presented by the teacher in terms of design and color is not attractive, so that students are not motivated in learning mathematics; 11) The teacher has never provided Ethnomathematics-based math SAS. Amir et al., (2021) & Risnawati et al., (2019) stated that it is difficult for teachers to manage time because of the high teaching load, so it is difficult to develop SAS that can assist teachers in teaching.

For the above information to be resolved, it is necessary to develop ethnomathematics-based learning tools in the form of LIP and SAS using a learner-centered learning model. The purpose of this research is to produce ethnomathematics-based mathematics learning tools on valid and practical quadrilaterals and triangles. Mathematics learning that is integrated with culture can produce a maximum educational product in maintaining a regional culture (Prastiwi, 2013; Rezeki et al., 2021). The integration will produce the best educational product and help teachers to give the best experience in classroom.

METHOD

The type of research to be carried out is research and development or Research and Development (R&D). According to Borg & Gall, (1983) Research and Development (R&D) is a research method used to produce a particular product and then test the effectiveness and validity of the product.. Sugiyono (2013) Sugiyono said briefly that R&D emphasizes useful and useful products as extensions, additions, and innovations of existing forms. This development research refers to the Research and Development (R&D) development model, but the researchers modified and only used 6 development steps because researchers were unable to conduct product trials and use trials due to the Covid-19 condition which resulted in researchers unable to go to the field for product trials involving students. For more details, the research steps can be seen in the following picture:

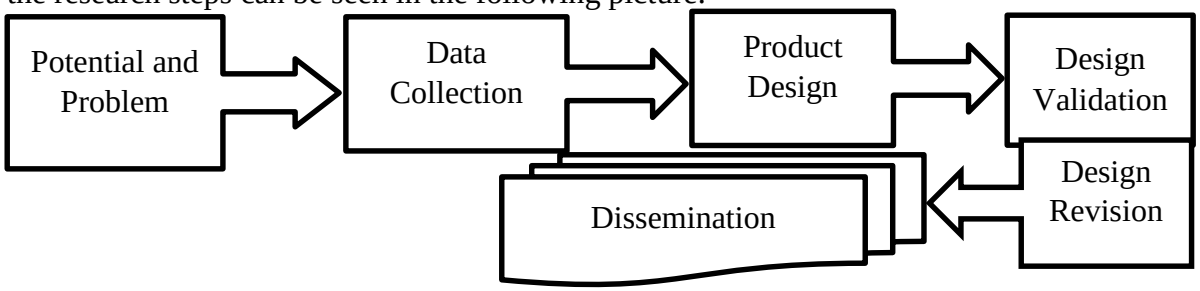

Figure 1. Modified Steps of Research and Development

The data in this study were collected using a questionnaire technique, while the data collection instruments were validation questionnaire sheets and validator response questionnaire sheets made by researchers and given to validators consisting of 2 mathematics education lecturers and 1 practitioner, namely the mathematics teacher at SMPIT Al-Manar Pekanbaru.

The data analysis technique used in this research is a descriptive qualitative analysis that describes the validity of the learning tools developed by the researcher using the Guttman scale and Likert scale. The purpose of filling out this validation questionnaire is to test the feasibility of the developed mathematics learning device. The scores and categories that researchers use are as follows:

Table 1. *Guttman Scale Scoring*

No.	Assessment Score	Category
1.	1	exist
2.	0	None

Table 2. *Likert Scale Scoring*

No.	Assessment Score	Category
1.	4	Very Good
2.	3	Good
3.	2	Less Good
4.	1	Not Good

After knowing the results of the questionnaire given, it is necessary to do a scoring test to find out what the average validation assessment of the developed mathematics learning tool is.. According to Akbar (2013) validation data analysis techniques can use the following formula:

$$Va_1 = \frac{TS_e}{TS_h} \times 100\%$$

$$Va_2 = \frac{TS_e}{TS_h} \times 100\%$$

$$Va_3 = \frac{TS_e}{TS_h} \times 100\%$$

After the validity value of each validator is known, the researcher can calculate the combined results of the analysis into the following formula::

$$V = \frac{Va_1 + Va_2 + Va_3}{3} = \ldots\ldots\%$$

Information:
V = Combined Validity
Va_1 = Validity of Expert 1 (Lecturer)
Va_2 = Validity of Expert 2 (Lecturer)
Va_3 = Validity of Expert 3 (Teachers)
TS_e = Total Empirical Score (Validation Results from Validator)
TS_h = Total Expected Maximum Score

After the results of the validity of each validator and the results of the combined validation analysis are known, the percentage level can be matched with the criteria for the level of validity as follows:

Tabel 3. Validity Level Criteria of LIP dan SAS

No.	validity criteria	Validity Level
1.	85, 01 % - 100, 00 %	Very valid, or can be used without revision
2.	70, 01 % - 85, 00 %	valid, or can be used but needs minor revision
3.	50, 01 % - 70, 00 %	Not valid, it is recommended not to use it because it needs a major revision
4.	01, 00 % - 50, 00 %	Tidak valid, atau tidak boleh dipergunakan

Source: *Akbar (2013: 155)*

The LIP and SAS assessment instruments are considered valid if the average validation assessment is categorized as valid or very valid.

Validator response data analysis was obtained from the validator response questionnaire to LIP and SAS which was developed by researchers using a Likert scale. The Likert scale used is 1-4 with the following categories.

Table 4. ***Likert Scale Scoring***

No.	Assessment Score	Category
1.	4	Very agree
2.	3	Agree
3.	2	Less Agree
4.	1	Disagree

Analisis respon validator ini dapat dilakukan berdasarkan rumus modifikasi dari Akbar (2013: 158) sebagai berikut:

$$Ra_1 = \frac{TS_e}{TS_h} \times 100\%$$

$$Ra_2 = \frac{TS_e}{TS_h} \times 100\%$$

$$Ra_3 = \frac{TS_e}{TS_h} \times 100\%$$

After the response value of each validator is known, the researcher can calculate the combined results of the analysis into the following formula::

$$R = \frac{Ra_1 + Ra_2 + Ra_3}{3} = \ldots\ldots\%$$

Information:
R = Combined Response
Ra_1 = Response of expert 1 (Lecturer)
Ra_2 = Response of expert 2 (Lecturer)
Ra_3 = Response of expert 3 (Teacher)
TS_e = Total Empirical Score (Practical Results from Experts)
TS_h = Total Expected Maximum Score

After the results of each expert's response and the results of the combined response analysis are known, the percentage level can be matched with the following response rate criteria:

Table 5. Criteria for Validator Response Level to LIP and SAS

No.	Response Criteria	Response Level
1.	85, 01 % - 100, 00 %	Sangat baik, atau dapat digunakan tanpa revisi
2.	70, 01 % - 85, 00 %	Good, or can be used but needs minor revision
3.	50, 01 % - 70, 00 %	Not good, it is recommended not to use it because it needs a major revision
4.	01, 00 % - 50, 00 %	Not good, or should not be used

Source: *Modified of Akbar (2013: 155)*

LIP and SAS assessment instruments are considered good if the average assessment of the validator's responses is categorized as good or very good.

RESULT AND DISCUSSION

Result

The results of the research that have been validated by the three validators can be seen as follows:

Table 6. LIP Validity Result

LIP	Validity Percentage (%)			Average (%)	Validity level
	V1	V2	V3		
LIP-1	88,04%	88,58%	92,39%	89,67%	Very valid
LIP-2	88,04%	88,58%	92,39%	89,67%	Very valid
LIP-3	88,04%	88,58%	92,39%	89,67%	Very valid
LIP-4	88,58%	88,58%	92,39%	89,85%	Very valid
Total Average				**89,72%**	**Very valid**

Source: Researcher analysis

Based on the assessment of the three validators, the LIP Learning Implementation Plan for the first meeting to the fourth meeting has a "Very Valid" validity level with a total average of 89.72%. Based on these results, it was determined that the LIP which was developed based on ethnomathematics was feasible to use.

Tabel 7. SAS Validity Result

SAS	Validity Percentage (%)			Average (%)	Validity level
	V1	V2	V3		
SAS-1	91%	90%	95,5%	92,17%	Very valid
SAS-2	91,5%	90%	95,5%	92,33%	Very valid
SAS-3	91%	90%	95,5%	92,17%	Very valid
SAS-4	91,5%	90%	95,5%	92,33%	Very valid
Total Average				**92,25%**	**Sangat Valid**

Source: Researcher analysis

Based on the assessment of the three validators, the SAS for the first meeting to the fourth meeting has a "Very Valid" validity level with a total average of 92.25%. Based on these results, it was determined that the SAS which was developed based on ethnomathematics was feasible to use.

Table 8. Validator Response Results of LIP

LIP	Validity Percentage (%)			Average (%)	Response level
	V1	V2	V3		
LIP-1	77,5%	72,5%	90%	80%	Good
LIP-2	77,5%	72,5%	90%	80%	Good
LIP-3	77,5%	72,5%	90%	80%	Good
LIP-4	77,5%	72,5%	90%	80%	Good
Total Average				**80%**	**Good**

Source: Researcher analysis

Based on the assessment of the three validators, the LIP for the first meeting to the fourth meeting had a "Good" practicality level with a total average of 80%. Based on these results, it was determined that the LIP which was developed based on ethnomathematics was good to use.

Table 9. Validator Response Results of SAS

SAS	Validity Percentage (%)			Average (%)	Response level
	V1	V2	V3		
SAS-1	79,17%	72,92%	87,5%	79,86%	Good
SAS-2	79,17%	72,92%	87,5%	79,86%	Good
SAS-3	79,17%	72,92%	87,5%	79,86%	Good
SAS-4	79,17%	72,92%	87,5%	79,86%	Good
Total Average				**79,86%**	Good

Source: Researcher analysis

Based on the assessment of the three validators, the SAS for the first meeting until the fourth meeting has a "Good" practicality level with a total average of 79.86%. Based on these results, it was determined that the SAS which was developed based on ethnomathematics was practical to use.

Discussion

This research on the development of mathematics learning tools was developed based on ethnomathematics on the material of rectangles and triangles which the steps of Research and Development (R&D) were modified according to research needs. The steps used are the potential and problem stage, the data collection stage, the product design stage, the validation stage, the design revision stage, and the final product stage. The product resulting from this research is a learning device in the form of LIP and SAS based on Ethnomathematics on the material of rectangles and triangles in junior high school. The development of learning tools has been carried out to the maximum with the right procedures so that the experts state that the learning tools can be used according to the purpose. The development of learning devices that are carried out optimally can provide maximum contribution to learning (Amir et al., 2021; Maclinton & Andrian, 2022; Risnawati et al., 2019). Paying attention to the right procedures in the development of learning tools is an important requirement to produce quality products (Rezeki et al., 2021; Wahyuni et al., 2020). Quality educational products will not be possible to get without following the right development steps following what has been suggested by experts in their field (Awofala, 2017; Imhangbe et al., 2020). Educational products that are assessed accurately by experts will make a huge contribution to the development of student competencies in the classroom (Andrian et al., 2018; Andrian & Wahyuni, 2020; Hadi et al., 2019).

The results of the LIP validation analysis of 89.72% are included in the very valid category, while the results of the LIP validation analysis of 92.25% are included in the very valid category. The results of the analysis of the validator's response to the LIP of 80% are included in the good category, while the results of the analysis of the validator's response to the SAS of 79.86% are included in the good category. Although all of the developed mathematics learning tools in the form of LIP and SAS have met the criteria for validity and validator responses, several components need minor revisions to improve the LIP and SAS. Validity and practicality in the development of educational products in the form of media, learning tools, and textbooks are important things to note because valid and practical can affect the usefulness of these products for users (Hadi et al., 2022; Maclinton & Andrian, 2022). The development of educational products is an effort to increase competence in learning through the convenience and interest of students in learning (Kari et al., 2022; Nora & Lutfi, 2022). Interest or motivation is the basis for developing learning media because it can improve student learning outcomes (Lauermann & Berger, 2020). Learning media or learning tools were an important part of education that needed for thinking and development for education sustainability.

CONCLUSION

Based on the results of research data analysis and discussion, it was concluded that mathematics learning tools in the form of LIP and SAS based on ethnomathematics in the rectangular and triangles material of junior high school were tested for validity and validator responses were in a good category. With the details of the results of data analysis validation LIP 89.72% with a very valid category and SAS 92.25% with a very valid category. While the results of the data analysis of the validator's response to the LIP were 80% in the good category and against the SAS 79.86% in the good category. So it is obtained as a whole that the RPP and SAS developed have been tested for feasibility.

RECOMMENDATION

Integration of education and culture was the best strategy to maintain the sustainability of culture at a particular regency so the next research can find or develop the new material or strategy to care for the Indonesia culture through the integration of culture and education. Integration of culture with education can be done with every subject and not limited only to the mathematics subject or material, but also to other subjects. The next research can explore new methods, strategies, models and learning approaches to integrate with the particular culture of the whole regency of Indonesia.

REFERENCES

Akbar, S. (2013). *Instrumen Perangkat Pembelajaran*. Rosdakarya.

Amir, Z., Risnawati, Nurdin, E., Azmi, M., & Andrian, D. (2021). The Increasing of Math Adversity Quotient in Mathematics Cooperative Learning Through Metacognitive. *International Journal of Instruction*, *14*(4), 841–856.

Andrian, D., Kartowagiran, B., & Hadi, S. (2018). The Instrument Development to Evaluate Local Curriculum in Indonesia. *International Journal of Instruction*, *11*(4), 922–934. https://doi.org/10.12973/iji.2016.9115a

Andrian, D., & Wahyuni, A. (2020). Student Readiness Model Facing the Industrial Revolution 4.0. *Second International Conference on Social, Economy, Education AndHumanity(ICoSEEH 2019) - Sustainable Development in Developing Country ForFacing Industria*, *ICoSEEH 2019*, 302–306. https://doi.org/10.5220/0009128703020306

Awofala, A. O. A. (2017). Assessing senior secondary school students' mathematical proficiency as related to gender and performance in mathematics in Nigeria. *International Journal of Research in Education and Science*, *3*(2), 488–502. https://doi.org/10.21890/ijres.327908

Borg, W R & Gall, M. D. (1983). *Educational Research Forth Edition*. Longman.

Hadi, S., Andrian, D., & Kartowagiran, B. (2019). Evaluation model for evaluating vocational skills programs on local content curriculum in Indonesia: Impact of educational system in Indonesia. *Eurasian Journal of Educational Research*, *2019*(82), 45–62. https://doi.org/10.14689/ejer.2019.82.3

Hadi, S., Maisaroh, S., Hidayat, A., & Andrian, D. (2022). An Instrument Development to Evaluate Teachers ' Involvement in Planning the Schools ' Budgeting at Elementary Schools of Yogya karta Province. *International Journal of Instruction*, *15*(2), 1087–1100.

Ikhsan, K. N., & Hadi, S. (2018). Implementasi dan Pengembangan Kurikulum 2013. *Jurnal Ilmiah Edukasi*, *6*(1), 193–202.

Imhangbe, O. S., Oladele Victor, I., & Osarenren-Osaghae, R. I. (2020). Teachers' Classroom Job Performance: How Teachers' Tasks Impact Their Classroom Job Performance in Edo Central School District, Nigeria. *Journal of Education*, *200*(3), 164–174. https://doi.org/10.1177/0022057419881146

Kari, D. S., Ayub, S., Nyoman, N., & Putu, S. (2022). The Validity of the Discovery

Learning Model to Improve Students Creative Thinking Skills. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *10*(2), 183–191.

Kurniaman, O., & Noviana, E. (2017). Penerapan Kurikulum 2013 dalam Meningkatkan Keterampilan, Sikap, dan Pengetahuan. *Jurnal Primary Program Studi Pendidikan Guru Sekolah Dasar Fakultas Keguruan Dan Ilmu Pendidikan Universitas Riau*, *6*(2), 389–396.

Lauermann, F., & Berger, J. (2020). Linking teacher self-efficacy and responsibility with teachers ' self-reported and student-reported motivating styles and student engagement. *Learning and Instruction*, 101441. https://doi.org/10.1016/j.learninstruc.2020.101441

Maclinton, D., & Andrian, D. (2022). *Pengembangan Media Pembelajaran Prisma Berbasis Macromedia Flash Dengan Desain Pembelajaran Assure*. *4*(1), 83–97. https://doi.org/10.35438/inomatika.v4i1.323

Nora, N., & Lutfi, A. (2022). Development of Hy-Quiz Learning Media Based on Android to Improve Students ' Learning Motivation in Nomenclature of Hydrocarbon Derivative Compounds Sub Material. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *10*(2), 206–217.

Prastiwi, Y. (2013). Transmitting Local Cultural Knowledge through English as Foreign Language (EFL) Learning as a Means of Fostering "Unity in Diversity." *Academic Journal of Interdisciplinary Studies*, *2*(3), 507–514. https://doi.org/10.5901/ajis.2013.v2n3p507

Rahmawati, Y., & Muchlian, M. (2019). Eksplorasi Etnomatematika Rumah Gadang Minangkabau Sumatera Barat. *Jurnal Analisa*, *5*(2), 124–136.

Rezeki, S., Andrian, D., & Safitri, Y. (2021). Mathematics and cultures: A new concept in maintaining cultures through the development of learning devices. *International Journal of Instruction*, *14*(3), 375–392. https://doi.org/10.29333/iji.2021.14322a

Risnawati, Andrian, D., Azmi, M. P., Amir, Z., & Nurdin, E. (2019). Development of a definition maps-based plane geometry module to improve the student teachers' mathematical reasoning ability. *International Journal of Instruction*, *12*(3), 541–560. https://doi.org/10.29333/iji.2019.12333a

Sugiyono. (2013). *Metodelogi Penelitian Kuantitatif, Kualitatif Dan R&D*. ALFABETA.

Wahyuni, A. (2018). Pengaruh Pembelajaran Kooperatif Dengan Tipe Think Pair Share (Tps) Terhadap Kemandirian Belajar Matematika Mahasiswa. *MATH DIDACTIC: Jurnal Pendidikan Matematika*, *4*(32), 277–286.

Wahyuni, A., Aji, A., Tias, W., & Sani, B. (2013). Peran etnomatematika dalam membangun karakter bangsa. *Seminar Nasional Matematika Dan Pendidikan Matematika*, *November*, 114–117.

Wahyuni, A., Effendi, L., Angraini, L., & Andrian, D. (2020). Developing instrument to increase students' geometry ability based on Van Hiele Level integrated with Riau Malay culture. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *24*(2), 208–217.