

Trigonometric Finger Learning Media to Improve Mathematics Learning Outcomes of High School Students

Sayyidah Bilqis¹, Muhammad Hajarul Aswad A^{1*}, Irma T.¹

¹Institut Agama Islam Negeri (IAIN) Palopo, Jl. Agatis Kel. Balandai, Kota Palopo, Sulawesi Selatan, Indonesia

*Correspondent Email: muh_hajarul_aswad@iainpalopo.ac.id

ABSTRACT

Learning media in mathematics education is one of the determining factors for students' learning outcomes in mathematics. This study developed the Trigonometric Finger Learning Media (Jargonometry) to improve the mathematics learning outcomes of high school students. The research design an R&D approach using the ADDIE model. The study was conducted at a high school in East Luwu Regency, with Class X.8 from the 2023/2024 academic year as the research subjects. Data were collected through observation, interviews, product validation, response questionnaires, and learning outcome tests. The findings indicate that the Jargonometry learning media is valid, practical, and effective in improving high school students' mathematics learning outcomes.

Keyword: ADDIE, Jargonometry, Learning Media in Mathematics.

Article History:

Received, 12-11-2024; Revised, 5-12-2024; Accepted, 13-12-2024.

1. Introduction

Learning media can be defined as any medium that has been specifically designed with the intention of achieving learning objectives. However, it can also be argued that the very existence of such media can be used to clarify or facilitate student understanding of certain materials or messages (Abi Hamid et al., 2020). As previously indicated in Surah An-Najm, verses 39-41,

وَأَنْ لَّيْسَ لِلْإِنْسَانِ إِلَّا مَا سَعَىٰ ۚ ۝ ٣٩ وَأَنَّ سَعْيَهُ سَوْفَ يُرَىٰ ۚ ۝ ٤٠ ثُمَّ يُجْزَاهُ الْجَزَاءَ الْأَوْفَىٰ ۚ ۝ ٤١

The translation:

And that a man shall have nothing but what he has laboured for, and that his labour shall be revealed to him, and he shall be rewarded with the most perfect reward. (Kementerian Agama RI, 2011)

The utilisation of learning media has been demonstrated to be an effective strategy for enhancing mathematical learning outcomes. These include the use of YouTube videos (Kusmaryono & Basir, 2024), audio-visual learning media (Sappaile et al., 2024), the use of comics (Firmansyah et al., 2024), digital books (Nugroho et al., 2024), number card media (Jannah et al., 2024), and flash card media (Indriyani, 2024). This illustrates the necessity for diversity in mathematical learning through exploration and utilisation of learning media.

The preliminary observations conducted at one of the senior high schools in East Luwu Regency revealed that a number of students continue to exhibit difficulties in accurately determining the value of trigonometric comparisons for special angles. From a mathematical perspective, this is evidenced by the average daily test score of 60.25, with Learning

Objective Achievement Criteria (KTTP) of 76. Furthermore, the observation results indicate that learning activities remain deficient in terms of exploration of learning media. In this context, the utilisation of printed books as the sole learning medium within the classroom persists. Indeed, the flexibility of learning activities that utilise learning media is a learning need that is particularly suited to the characteristics of today's students (Taslibeyaz et al., 2024).

Jargonometry (Trigonometric Fingers) is a visual tool employed to illustrate trigonometric concepts pertaining to the comparative value of specific angles. The jargonometry board represents a further development of one of the techniques used in the introduction of special angles using real fingers, known as the 'rule of five trigonometric fingers'. This involves the value of \sin , \csc , and \tan from the direction of the thumb to the little finger, while for \cos , \sec , and \cot , the opposite direction is taken (Gunadi, 2016).

This research develops learning media for the Jargonometry Auxiliary Board with the objective of improving students' mathematics learning outcomes in Trigonometry material for class X students in one of the Senior High Schools in East Luwu Regency. This is in accordance with the need for adequate learning resources for the material. It is hoped that, as a result of this development, students will be better able to understand Trigonometry material, thus improving their mathematics learning outcomes.

2. Method

This research is a development project that employs the Analyze, Design, Development, Implementation, Evaluation (ADDIE) model for the creation of educational materials. The research was conducted at one of the high schools in East Luwu Regency, South Sulawesi, during the second semester of the 2023/2024 academic year. The study population comprised all students enrolled in class X.8. The data were collected through the use of observation techniques, interviews, product validation, response questionnaires, and learning outcome tests. The indicators of each technique are presented in the following tables: Table 1, Table 2, Table 3, Table 4, and Table 5.

Table 1. Observation Sheet for the Availability of Learning Media and Teaching Materials

Aspect	Indicators
Teaching media	Availability of learning media at school
	Availability of learning media on trigonometry material
	Availability of teaching aids on trigonometry material (comparison of special angle values)
	Frequency of use of teaching aids at school
Student Participation	Teaching medias provided by the school or made by the teacher
	Students' response to teaching aids used at school.

Table 2. Interview Guidelines

Aspect	Indicators
Availability of learning media	Availability of teaching aids for learning mathematics Frequency of use of teaching aids
Learning difficulty factors	Student ingenuity Students' attitude towards the learning process Student interest in the learning process Student behaviour while learning State of the environment Teacher-student relationship School and classroom atmosphere
Learning material	Material delivery Students' interest in learning materials Student barriers in learning mathematics
Scientific approach	Teacher's ability to teach Learning facilities and infrastructure
Teacher's role in learning	Mastery of learning materials

Table 3. Product Validation Guidelines

Aspect	Indicators
Interface	Initial view of the props Content display Image assignment Colour matches of text and images with the background / background
Usage	Clarity of guidance/instructions Can be used anywhere and anytime
Learning	Suitability of teaching aids with material Presentation of interesting material
Language	Use of language clearly
Question	Evaluation quality is appropriate
Usability	Clarify trigonometry material Increase independence

Table 4. Student Response Sheet Guidelines

Aspect	Indicators
Use of learning media	Freedom of use of jargonometry that can be used anywhere and anytime Image and visual appeal Easy to use teaching aids The power of jargonometry to encourage learning independence and creativity Easy to understand language
Ease of understanding	Teaching aids make it easier for students to learn Presentation of material and instructions for use are easy to understand
Interest in learning	Enthusiasm for learning Increases interest Increase motivation

Table 5. Pre-Test and Post-Test Guidelines

Basic Competence	Indicators of Competence Achievement	Question Indicator	Number
4.7. Solve contextual problems related to the trigonometric ratio of special angles	1.7.1 Determine the trigonometric ratio of special angles	Determine the values of <i>sin</i> , <i>cos</i> , <i>tan</i> , <i>sec</i> , <i>cosec</i> , and <i>cot</i> .	1, 2, and 3.
	1.7.2 Determine the magnitude of special angles whose ratio values are known	Determine the magnitude of the angle <i>sin</i> , <i>cos</i> , <i>tan</i> , <i>sec</i> , <i>cosec</i> , or <i>cot</i> that fulfils the comparison value of special angles.	4 and 5

The analysis stage is concerned with the gathering of information pertaining to the requirements of learning media. This is achieved through the examination of the curriculum in use, the evaluation of the suitability of the material being taught, and the identification of the needs of the students who are the subjects of the research. At the design stage, the preliminary design of the learning media is developed in accordance with the findings of the analysis conducted at the analyse stage. The design stage comprises the selection of materials and the formulation of the preliminary design for the Jargonometry Auxiliary Board learning media. At the development stage, a validation test of the learning media that has been designed is conducted. It is anticipated that the learning media in question will prove to be

valid, practical, and capable of enhancing students' mathematical learning outcomes. The validation test is conducted by expert evaluators. Subsequently, the learning media is implemented in the classroom. The final stage is evaluation, which is conducted to assess the efficacy of the learning media that has been developed. Two evaluations are conducted: a formative evaluation at each stage of media development and a summative evaluation of learning outcomes to ascertain the efficacy of the learning media. The evaluation employs the N-Gain methodology, utilising a score distribution as delineated in Table 6 and a category classification as outlined in Table 7.

Table 6. *N-Gain* Score Division (%)

The Scale	The criteria
$G < 0,3$	Low
$0,3 \leq G \leq 0,7$	Medium
$G > 0,7$	High

Table 7. Effectiveness Category based on *N-Gain* Score (%)

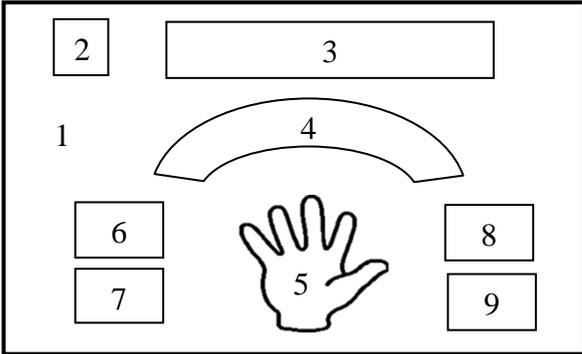
The Scale	The criteria
< 40	Not Effective
40 – 55	Less Effective
56 – 75	Moderately Effective
≥ 76	Effective

3. Result and Discussion

The development of learning media in the form of a Jargonometry Auxiliary Board commences with the analysis stage. The curriculum analysis revealed that the curriculum employed at the research location was the Merdeka Curriculum, with learning outcomes encompassing the understanding and identification of fundamental trigonometric functions (sine, cosine, tangent) and other trigonometric functions (secan, cosecan, cotangen). Additionally, students are expected to demonstrate proficiency in describing, utilising, and applying trigonometric functions. The material analysis revealed that the basic trigonometric functions (sine, cosine, tangent) and other trigonometric functions (secan, cosecan, cotangen) are fundamental concepts that students still find challenging to grasp. It is therefore necessary to provide students with additional tools to facilitate their understanding. This is also based on the results of a needs analysis, which revealed that printed books are the only learning media currently in use. This has not been sufficient to enhance student engagement and comprehension of fundamental trigonometric concepts, despite the instructor's proficiency in the subject matter.

In accordance with the findings of the analysis stage, the learning media in question was developed in the form of a Jargonometry Auxiliary Board. The media is constructed from plywood, coated with zinc plate, rainbow board, and finger design images that are magnetised and coated with paper. Additionally, several other ornaments are included. The dimensions of the background are tailored to the size of the media. The objective of the

learning media design, incorporating designs and tools of this nature, is to facilitate the portability and repeated utilisation of props, thereby enabling students to engage in independent and creative learning, and gain new experiences. Student learning independence is reflected in creative attitudes, freedom of action and responsibility, characterised by learning initiatives and the desire to gain new experiences (Gusnita et al., 2021). The preliminary design is illustrated in Figure 1.

Visual	Description
	<ol style="list-style-type: none"> 1. Background 2. Logo of IAIN Palopo 3. The title 4. Rainbow Board 5. Fingerboard 6. <i>Tangen</i> Formula 7. <i>Secan</i> Formula 8. <i>Cosecan</i> Formula 9. <i>Cotangen</i> Formula

Gambar 1. Storyboard of Jargonometry

The Jargonometry Auxiliary Board that has been designed is then validated by a team of validators. The validation results stated that the Jargonometry Auxiliary Board was valid for use with a validity value of 82.07%. Some additional minor suggestions were the addition of the α° symbol to each formula as well as the IAIN Palopo logo in the left corner of the media. The revised Jargonometry Auxiliary Board and will be trialled to the research subjects as shown in Figure 2.



Gambar 2. The Jargonometry

In the implementation phase, the learning media for the jargonometry props, as shown in Figure 2, are used in the learning activities. In order to see its effectiveness, a practicality questionnaire and test were given first. The score of the teacher's practicality test results was 93.18% with a very practical category. The score of the students' practicality test results was 88.91% with a very practical category. Based on this, the Jargonometry Props learning media is very practical in its use. The effectiveness test is based on the pre- and post-test results as shown in Table 8.

Table 8. *Pretest and Posttest Score*

Statistic	Pre-test Score	Post-test Score
Number of Sample	33	33
Mean	33.45	82.28
Standard Deviation	17	12.91
Variance	288.13	166.71
Maximum score	65	100
Minimum score	10	55
<i>N-Gain</i>		0.77

The final stage in the development of learning media for jargonometry props is evaluation. The results of the formative evaluation obtained from the use of learning media for jargonometry props are in accordance with the curriculum analysis, material and student needs for learning media. The design of learning media for Jargonometry props uses simple materials and tools that are easily available in the environment. This is to provide motivation for classroom teachers related to the use of learning media can be done by using items around for other materials (Pujawan et al., 2024; Syahida et al., 2024). While the summative evaluation results are based on the N-Gain Score test results of 0.77 (see Table 8) with the High category. The percentage of N-Gain Score test results is 77% with the Effective category. Based on this, the learning media of jargonometry props are effectively used to improve the mathematics learning outcomes of high school students.

4. Conclusion

This research has successfully demonstrated the development of learning media for trigonometry props that are valid based on validation tests by a team of validators, practical based on teacher and student practicality tests, and effective based on *pre-test* and *post-test N-gain* scores. The media are designed to help students learn the basic concepts of trigonometry independently. The trigonometry learning media props are designed using simple objects, making it easier for teachers to explore learning media for other mathematics materials.

5. References

AbiHamid, M., Ramadhani, R., Masrul, M., Juliana, J., Safitri, M., Munsarif, M., Jamaludin, J., & Simarmata, J. (2020). *Media pembelajaran*. Yayasan kita menulis.

- Firmansyah, F., Irnandi, I., Siregar, N. N., & Simamora, E. W. (2024). Development of Comic Media to Improve Problem Solving Abilities and Interest in Learning Mathematics Subjects of Elementary School: English. *Jurnal Elementaria Edukasia*, 7(3), 3119–3133. <https://www.ejournal.unma.ac.id/index.php/jee/article/view/10081>
- Gunadi, F. (2016). Menentukan Sudut Istimewa Trigonometri Dengan Aturan Lima Jari. *Mathline: Jurnal Matematika Dan Pendidikan Matematika*, 1(1), Article 1. <https://doi.org/10.31943/mathline.v1i1.13>
- Gusnita, G., Melisa, M., & Delyana, H. (2021). Kemandirian Belajar Siswa Melalui Pembelajaran Kooperatif TPSq. *Jurnal Absis: Jurnal Pendidikan Matematika Dan Matematika*, 3, 286–296. <https://doi.org/10.30606/absis.v3i2.645>
- Indriyani, L. (2024). Penggunaan Media Flash Card untuk Meningkatkan Hasil Belajar dengan Pendekatan Teaching at the Right Level. *Edutama: Jurnal Ilmiah Penelitian Tindakan Kelas*, 1(1), 268–278.
- Jannah, A., Lubis, A. H., & Julia, N. M. (2024). Development of Number Card Media in Mathematics Learning for Elementary School Students. *Journal of Indonesian Primary School*, 1(3), 12–23. <https://journal.mgedukasia.or.id/index.php/jips/article/view/135>
- Kementerian Agama RI. (2011). *At-Thayyib Al-Qur'an Transliterasi Per Kata dan Terjemahan Per Kata*. PT Sinar Abadi.
- Kusmaryono, I., & Basir, M. A. (2024). Learning media projects with YouTube videos: A dynamic tool for improving mathematics achievement. *Int J Eval & Res Educ ISSN*, 2252(8822), 8822. <https://pdfs.semanticscholar.org/e748/76bea61fac24919a85bd45839fef77d1dad0.pdf>
- Nugroho, A. A., Dwijayanti, I., Prayito, M., Noordin, M. K., & Fenyvesi, K. (2024). Design of Algebra Digital Book on Mixed Reality-Based to Improve Learner's Numeracy Literacy. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*. <https://journals2.ums.ac.id/jramathedu/article/view/4745>
- Pujawan, I. G. N., Hartawan, I. G. N. Y., & Dewi, P. K. (2024). Pelatihan Pembuatan Media Pembelajaran Matematika Berbasis Lingkungan Sekitar Untuk Mengoptimalkan Pembelajaran Matematika di SD Negeri 1 Padangbulia. *Seminar Nasional Pengabdian Kepada Masyarakat*, 9(1), 1036–1041. <https://eproceeding.undiksha.ac.id/index.php/SENADIMAS/article/view/561>
- Sappaile, B. I., Yusuf, N. F. M., Mardiaty, M., Cahya Zoraida, M. N., & Sitepu, E. (2024). Effectiveness of Using Audio Visual Media in Improving Student Achievement in Mathematics Learning in Elementary Schools. *Journal Emerging Technologies in Education*, 2(1), 49–60. <https://journal.ypidathu.or.id/index.php/jete/article/view/742>
- Syahida, F., Rahmasari, I., Marbun, I. A. Y., Lubis, A. R., Dalimunthe, A. A., Simamora, E., Khoirunnisa, K., Azhari, A. S., Sari, I. R., & Matondang, L. (2024). Pemanfaatan Barang Bekas Dalam Pembuatan Alper Bangun Ruang Untuk Meningkatkan Kreativitas Anak. *Community Development Journal: Jurnal Pengabdian Masyarakat*, 5(6), 11004–11010.
- Taslibeyaz, E., Su, F., & Margaret. (2024, January 10). Genz – the New Generation of University Students and Implications for Academic Practice. *European Educational Research Association*. <https://blog.eera-ecer.de/genz-university-students/>