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DEVELOPMENT OF ETHNOMATHEMATICS-BASED E-MODULE FROM DUKUTAN TRADITION OF KARANGANYAR COMMUNITY TO IMPROVE STUDENTS' MATHEMATICS LEARNING OUTCOMES ON LINEAR EQUATIONS AND INEQUALITIES

Nisa Nuraini[1], **Henny Ekana Chrisnawati**[1]* , **Ira Kurniawati**[1]
[1)]Departement of Mathematics Education, Faculty of Teacher Training and Education, Universitas Sebelas Maret, Surakarta

* Correspondence purposes: hennyekana@stafft.uns.ac.id

Abstrak: Penelitian ini dilatar belakangi masih minimnya sumber belajar matematika yang lengkap. Suatu waktu guru membuka video pembelajaran, lalu membuka buku, membuka alamat di intenet, hal tersebut tentunya membuat siswa terlalu banyak melihat sumber belajar yang terpencar-pencar. Untuk itu, penelitian ini bertujuan untuk mengembangkan sebuah e-modul matematika berbasis *realistic mathematic education* (RME) yang terintegrasi etnomatematika Tradisi Dukutan , yaitu sebuah tradisi yang ada di Kabupaten Karanganyar , Jawa tengah , yang bisa diimplementasikan pada materi Sistem Persamaan dan Pertidaksamaan Linear untuk SMK Wikarya Karanganyar, untuk mengetahui tingkat validitas *e*-modul matematika yang dikembangkan dan untuk mengetahui respon pengguna terhadap *e*-modul yang dkembangkan, serta mengukur efektivitas *e*-modul ditinjau dari hasil belajar siswa. Model pengembangan yang digunakan pada penelitian ini adalah model ADDIE dengan tahapan *Analysis*, *Design*, *Development*, *Implementation*, dan *Evaluation.* Subjek penelitian ini adalah siswa kelas X MPLB SMK Wikarya Karanganyar yang bejumlah 26 siswa Tahun Pelajaran 2023/2024. Pengambilan data diperoleh dengan tes, observasi, angket, dan dokumentasi. Hasil penelitian adalah (1) didapatkan skor rata-rata dari validasi ahli materi, media, dan budaya adalah 0,895 yang termasuk dalam kategori validitas tinggi (2) skor rata-rata respon guru dengan persentase sebesar 89,5% yang termasuk dalam kategori sangat praktis (3) skor rata-rata respon siswa dengan persentase sebesar 92,75% yang termasuk dalam kategori sangat praktis (4) rerata *N-Gain* sebesar 0,73 atau dalam bentuk persentase 73% yang termasuk dalam kategori peningkatan tinggi dengan tingkat keefektifan pada kategori cukup efektif. Berdasarkan hasil penelitian dapat disimpulkan bahwa *e*-modul matematika yang dikembangkan peneliti termasuk dalam *e*-modul matematika yang valid, praktis, dan efektif untuk meningkatkan hasil belajar siswa sehingga layak digunakan untuk menambah pemahaman konsep materi Sistem Persamaan dan Pertidaksamaan Linear bagi siswa kelas X.
Kata kunci : **Kata kunci** : *E-Modul, Realistic Mathematic Education (RME), Etnomatematika Tradisi Dukutan, Sistem Persamaan Dan Pertidaksamaan Linear, Hasil Belajar Siswa*

Abstract: This study is motivated by the lack of comprehensive mathematics learning resources. At times, teachers open instructional videos, then books, and browse websites, which inevitably leads students to rely on scattered learning sources. So, this research aims to develop a realistic mathematics education (RME)-based mathematics e- module integrated with the ethnomathematics of the Dukutan Tradition, which is a tradition in Karanganyar Regency on the

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material of the Linear Equation and Inequality System for Wikarya Karanganyar Vocational High School, to determine the level of validity of the developed mathematics e-module and to find out the user's response to the developed e-module, and measure the effectiveness of the e-module in terms of student learning outcomes. The development model used in this research is the ADDIE model with the stages of Analysis, Design, Development, Implementation, and Evaluation. The subjects of this study were class X Office Management and Business Services students of Wikarya Karanganyar Vocational High School, totaling 26 students in the 2023/2024 academic year. Data were collected using tests, observations, questionnaires, and documentation. The results of the study are (1) the average score obtained from the validation of material, media, and cultural experts is 0,895 which is included in the high validity category (2) the average score of teacher responses with a percentage of 89,5% which is included in the very practical category (3) the average score of student responses with a percentage of 92,75% which is included in the very practical category (4) the N-Gain average is 0,73 or in the form of a percentage of 73% which is included in the high improvement category with the level of effectiveness in the moderately effective category. Based on the results of the study, it can be concluded that the mathematics e-module developed by the researcher is included in the valid, practical, and effective mathematics e-module to improve student learning outcomes so that it is suitable for use to increase understanding of the concept of Linear Equation and Inequality System material for grade X students.
Keywords: *E-Modules, Realistic Mathematic Education (RME), Dukutan Tradition Ethnomathematics, Linear Equation And Inequality System, Student Learning Outcomes*

INTRODUCTION

The achievement of national education goals depends on the success of learning activities. Meanwhile, the success of learning activities depends on the learning support components used and developed. Currently, the independent curriculum is implemented in order to restore learning with characteristics, namely the emphasis on essentialism content so that students can explore concepts and strengthen competencies through differentiated learning in order to realise the Pancasila learner profile (Rahmadayanti & Hartoyo, 2022). Suryati & Dwi Krisna (2021) stated that one of the lessons that fulfils the characteristics of the independent curriculum is learning mathematics. The characteristic of mathematics is its abstract nature which causes students to have difficulty in learning mathematics. Learning mathematics that has not been meaningful results in students' weak understanding of mathematical concepts. Building meaningful mathematics concepts for students is the main goal in mathematics learning activities.

Realistic Mathematics Education or commonly abbreviated as RME is a mathematics learning approach that focuses on a problem that students imagine as a problem in real life (Yuniati & Sari, 2018). Learning in school is certainly very different from problems in real life. Therefore, it is necessary to bridge mathematics with real life, one of which is the application of mathematics to culture (Abi, 2016). Suranti & Wulantina (2023) suggested that culture plays an important role in the learning process of mathematics because culture is always closely related to human real life. Integrating cultural values in

mathematics learning can improve students' understanding in the learning process. Ethnomathematics can improve students' ability to understand mathematical concepts, which is known that the literacy skills of students in Indonesia are almost always at a low level (Nisrina et al., 2021 in Suranti & Wulantina, 2023). Several research studies in ethnomathematics as learning resources have been conducted by Fouze, A. Q., & Amit, M. (2018), Faiziyah et al. (2021), Putri and Junaedi (2022), Kurnia et al. (2022), and Setiawan et al. (2021). However, the distinctive feature of this module development research is its interactive nature, incorporating various learning resources such as audiovisual materials, interactive test formats, and worksheets that engage interactively while incorporating readings set in the cultural context of Karanganyar District (Dukutan Tradition).

According to Khotimah (2019), many students complain that mathematics lessons are difficult, there are many formulas and various complicated problems. In the learning process, students need a tool to support the learning process so that the learning process is interesting so that learning mathematics feels fun for students (Nugroho et al., 2017). Teaching materials or commonly known as modules have a very close relationship with learning resources because it is one of the learning resources used to support the learning process, namely the process of delivering material and also helping students in the process of understanding the material (Rokhmawati et al., 2019). So far, the mathematics learning module is only in the form of formulas, the suitability of examples with practice problems, and the lack of examples of contextual problems in the application of the material being studied and the appearance of the material presented does not attract students' attention.

Based on the results of pre-research observations made by researchers during Introduction to the School Environment Teaching Assistance activities at Wikarya Karanganyar Vocational High School. Odd Semester of the 2023/2024 Academic Year, the low student learning outcomes were seen when a daily test assessment was carried out on the material Rows and Rows. Based on the results of the assessment of students' daily tests on this material in class X Office Management and Business Services, students who get scores above 65 are only 4 students out of 27 students or only 14,81%. The data shows that students' mathematics learning outcomes are still relatively low. In addition, based on observations, the daily teaching materials used as learning resources for students in mathematics lessons are still monotonous and conventional. Teachers have not compiled teaching materials independently to support learning. The learning resources used only come from the student worksheet module which if analysed the student worksheet module does not meet the demands of the latest Indonesian curriculum used, namely the independent curriculum. Due to the limitations of learning resources and learning media that support the learning process, teachers have not been able to create student-centred learning. Because of these limitations, the learning that is created still focuses on the teacher delivering the material and

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students listening to the teacher's explanation. This certainly has not provided a learning experience and also has not encouraged students' thinking skills so that students have not been able to learn a material to be more meaningful. Culture-based mathematics learning has also not been applied at the school so that mathematics and culture seem to have no connection. In addition, the use of technology has not been done optimally, teachers have not utilised electronic media to support learning in the classroom. Researchers have not found interactive e-modules that can be used to support differentiated mathematics learning processes in accordance with the latest curriculum implemented.

Based on this description, a new innovation is needed in learning mathematics in the current era. In the current era, students have a tendency to use smartphones. Especially at the Senior High School or Vocational High School level, students are allowed to carry and access smartphones in the school environment, including Wikarya Karanganyar Vocational High School. The rapid development of technology can encourage the replacement of printed technology with electronic technology in learning activities. In the implementation of the independent curriculum, students are required to be active because learning is student-centred. Such learning is very possible to utilise the help of electronic learning media or in the module category it can be replaced by text media that is integrated with technology, namely in the form of an electronic module (e-module) (Haj & Yerizon, 2022).

Lestari & Aziz (2022) stated that one of the topics of Senior High School or Vocational High School mathematics subjects for class X even semester which is presented with contextual problems is the material of the Linear Equation and Inequality System. In the material of the Linear Equation and Inequality System, students are faced with contextual problems and then students use the information in the contextual problems to develop a mathematical model and solve the problem. Based on the description above, a meaningful mathematics learning is needed so that students can construct concepts based on real-life problems.

Haj & Yerizon (2022) conducted a study entitled "Development of E-Module Based on Realistic Mathematics Education Approach (PMR) for Class VII Students of SMP / MTs" aims to develop e-modules based on the Realistic Mathematics Education (PMR) approach for VII grade students of Nurul Islam Islamic Boarding School Tsanawiyah Madrasah that meet the criteria of valid and practical. The developed e-module was declared valid with an average percentage of 86,79%. E-modules are also said to be practical with a percentage of 92,94% from students and 90% from teachers. Meanwhile, Utami et al. (2018) conducted a study entitled "Development of Ethnomathematics-Based E-Modules to Improve Problem Solving Ability". The research conducted aims to develop e-modules based on culture both in terms of material content and presentation. The e-module developed was declared valid with an average

score of 90% from media expert validation, an average score of 93% from material expert validation and an average score of 88% from cultural validators.

Based on the problems encountered by researchers and also references to previous research, researchers are interested in conducting development of RME (Realistic Mathematic Education) Based Mathematics E-Modules Integrated with Ethnomathematics on the Material of Linear Equation and Inequality Systems to Improve Learning Outcomes of Class X Students of SMK Wikarya Karanganyar. The focus of this research is to develop a realistic mathematics education (RME)-based mathematics e-module that integrates ethnomathematics of a local culture in Karanganyar Regency, namely the Dukutan Tradition and optimises learning outcomes and learning objectives on the material of the System of Linear Equations and Inequalities. With a realistic mathematics education approach, mathematics learning will focus on a problem that students imagine as a problem in real life. Integration of cultural values can also improve the ability to understand the mathematical concepts of students, which is known that the literacy skills of students in Indonesia are almost always at a low level.

The novelty in the product developed by the researcher is the integration with ethnomathematics of local culture, in contrast to modules in general that only use contextual problems in everyday life. The use of Canva and Heyzine, which offer numerous advantages, allows designs from both applications to present concepts/materials interactively. Canva's intuitive interface enables users to create designs quickly without needing deep design skills. Heyzine provides various customization options for layout, colors, fonts, and other visual styles, along with its ability to simulate the experience of a physical book, allowing users to create e-modules tailored to students' needs and preferences. The integration of Dukutan Tradition ethnomathematics in the developed e-module is in the form of using the historical context, background, cultural practices, and terminology of the Dukutan Tradition. The content presented and all images and illustrations used in the e-module are accurate representations of the Dukutan Tradition. This can be useful in introducing local culture to students and also as part of the characteristics of the independent curriculum, namely the Pancasila Student Profile Strengthening Project activities which provide opportunities for students to learn from the surrounding environment, one of which is local cultural wisdom.

The e-module developed by researchers in the form of a flipbook gives an interesting impression because the packaging is like a book but is presented in an interactive electronic form that provides its own practical value. E-modules in the form of flipbooks can be made with a variety of software such as Canva and Heyzine. Canva and Heyzine applications are some of the supporting applications in the learning process. The features available in the application are not only fixated on adding text but there are features that can create a flip effect such as a book display that can be flipped pages, image or

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animation addition features, audio insertion can even insert videos or links for various activities to be added such as YouTube learning video reference links, quizzes, geogebra links and so on. E-modules can be published online through an online website HTML link and there is also a download feature to be accessed offline in pdf form. These features can make an interesting interactive teaching material so that learning is not monotonous and seems fun.

Mathematics e-modules based on realistic mathematic education integrated with ethnomathematics are one of the appropriate alternatives for use at Wikarya Karanganyar Vocational High School, this e-module is expected to meet the needs of learning resources and can support the learning process so that it can help students understand the concept of Linear Equation and Inequality System material.

Based on these problems, the researcher conducted a study with the following research objectives:

1. To describe the process and produce an RME (Realistic Mathematic Education) Based Mathematics E-Module product integrated with Ethnomathematics on the material of the Linear Equation and Inequality System.
2. To determine the validity of the development of RME (Realistic Mathematic Education) Based Mathematics E-Modules and Integrated Ethnomathematics on the material of the Linear Equation and Inequality System.
3. To determine the practicality of the development of RME (Realistic Mathematic Education) Based and Ethnomathematics Integrated Mathematics E-Modules on the material of Linear Equation and Inequality System.
4. To determine the effectiveness of the development of RME (Realistic Mathematic Education) Based Mathematics E-Modules Integrated with Ethnomathematics on the material of the Linear Equation and Inequality System to improve the learning outcomes of grade X students of Wikarya Karanganyar Vocational High School in the 2023/2024 academic year.

RESEARCH METHOD

This research was conducted in the even semester of the 2023/2024 academic year at Wikarya Karanganyar Vocational High School. The type of research used in this study is development research or Research and Development (R&D). Research activities are carried out to obtain information about user needs (needs assessment) while development activities are carried out to produce learning devices (Arifin, 2018). This research develops a teaching material in the form of an RME-based e-module or electronic module integrated with ethnomathematics as a means of supporting learning grade X Linear Equations and Inequalities System.

The research conducted refers to the ADDIE development research model which consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation.

Data collection techniques used to evaluate and validate the developed e-modules are using observation sheets, questionnaires, and learning outcomes test instruments. The data analysis techniquused to process the data of the development results is with qualitative description analysis techniques and quantitative data analysis techniques.

Analysis of the results of the e-module validity test was carried out through an e-module assessment questionnaire which was prepared with 5 alternative answers consisting of very good, good, good enough, less good, and very less good. From the scores obtained, then the validity value is calculated using the Aiken's Value validity formula as quoted from Tomoliyus & Sunardianta (2020) as follows:

$$V = \frac{\sum(r - I_0)}{[n(c-1)]}$$

Then interpret the data based on the following table:

Table 1. Interpretation of Validity Data of RME-Based Mathematics E-Modules Integrated with Ethnomathematics

Interval	Category
$0.00 \leq V < 0.20$	Very Low Validity
$0.20 \leq V < 0.40$	Low Validity
$0.40 \leq V < 0.60$	Medium Validity
$0.60 \leq V < 0.80$	High Validity
$0.80 \leq V < 1.00$	Very High Validity

(Source: Febrianti, 2022)

Analysis of the results of the e-module practicality test developed was carried out through a teacher and learner response questionnaire prepared with 5 alternative answers consisting of very good, good, good enough, less good, and very less good.

Based on the scores, the percentage of the number of respondents' answers will be calculated using the formula proposed by Sugiyono (2019) as follows

$$P = \frac{Total\ acquisition\ score}{Total\ maximum\ score} \times 100\%$$

The average validity score of all validators is obtained from the following formula:

$$\bar{X} = \frac{\sum_1^n P}{n}$$

After that, the average score will be converted by referring to the practicality assessment category proposed by Budiyono (2020, p. 141) as in the following table.

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Table 2. Interpretation of Practicality Test Data of RME-Based Mathematics E-Modules Integrated with Ethnomathematics

Interval (%)	Category
$0 \leq X < 20$	Not Practical
$20 \leq X < 40$	Less Practical
$40 \leq X < 60$	Practical Enough
$60 \leq X < 80$	Practical
$80 \leq X < 100$	Very Practical

(Source: Budiyono, 2020, p. 141)

Description:

$\bar{X}$ = average total practicality score

Analysis of the results of the effectiveness of e-modules in terms of student learning outcomes was carried out through pre-test and post-test on the material of the Linear Equation and Inequality System. The form of questions used in the test instrument is the type of description questions with the same indicators but with different levels of difficulty, namely a higher level of difficulty in the post-test of learning outcomes.

The normalised gain value formula is as follows:

$$\boldsymbol{N - Gain} = \frac{\boldsymbol{S_{post-test}} - \boldsymbol{S_{pre-test}}}{\boldsymbol{S_{maks}} - \boldsymbol{S_{pre-test}}}$$

The interpretation of the N-Gain value in this study refers to the interpretation of the N-Gain expressed by (Hake, 1999 in Wahab et al., 2021) as in the following table.

Table 3. N-Gain Interpretation

Interval	Category
$0.70 \leq N - Gain < 1.00$	High Improvement
$0.30 \leq N - Gain < 0.70$	Medium Improvement
$0.00 \leq N - Gain < 0.30$	Low Improvement

(Source: Hake, 1999 in Wahab et al., 2021)

In addition to knowing the category of improvement in N-Gain, the interpretation of the effectiveness of N-Gain in the form of percentage as in the following table.

Table 4. N-Gain Effectiveness Category (Percentage)

Percentage(%)	Category
> 75	Effective
$56 - 75$	Effective Enough
$40 - 55$	Less Effective
< 40	Ineffective

(Source: Hake, 1999 in Wahab et al., 2021)

RESULTS AND DISCUSSION

In the ADDIE development model, 5 stages of research are carried out as follows.

1. Analysis

At the analysis stage, students' needs were analysed, learners' characteristics were analysed, materials were analysed, and curriculum was analysed.

In the learning process, students need interactive teaching materials that can fulfil the characteristics of the independent curriculum, namely creating student-centred learning. Students need a tool to support the learning process so that the learning process is interesting so that learning mathematics feels fun for students (Nugroho et al., 2017). Teaching materials or commonly known as modules have a very close relationship with learning resources because it is one of the learning resources used to support the learning process, namely the process of delivering material and also helping students in the process of understanding the material (Rokhmawati et al., 2019). Vocational students need literacy-based teaching materials to improve students' reading and writing literacy skills. Reading and writing activities for vocational students who were born in the era of information technology (digital natives) are carried out in a different way from the generation before them. These skills must be accommodated in the classroom and in the Vocational High School environment so that they must be maximally utilised to improve cognitive, social, language, visual and spiritual skills (Lamada & Rahman, 2019). Students need teaching materials that can hone students' problem solving skills. The National Council of Teacher Mathematics (2000) in Christina & Adirakasiwi (2021) states five abilities that students must have in the 21st century, one of which is problem solving skills. Students must use mathematical problem solving skills to solve mathematical problems.

The module will be used by vocational students who are in the age range of 15-17 in the formal operation stage, namely at the age of 11-adult. At this stage, children are able to reason using abstract things. Meanwhile, Vgygotsky in social psychology theory states that learning occurs when students work or learn to handle tasks that have not been learned but the task is still within the range of abilities or within the zone of proximal development at the child's current level of development which is defined as the ability to solve problems under the guidance of adults or more capable peers (Maharani, 2014). Vygotsky's theory emphasises social interaction, namely cooperation, exchanging opinions between fellow students or between students and teachers in learning.

Lestari & Aziz (2022) stated that one of the topics of Senior High School or Vocational High School mathematics subjects for class X even semester which is presented with contextual problems is the material of the Linear Equation and Inequality System. In the material of the Linear Equation and

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Inequality System, students are faced with contextual problems and then students use the information in the contextual problem to develop a mathematical model and solve the problem.

Students need teaching materials that can meet the characteristics of the independent curriculum, namely student-centred learning and provide opportunities for students to learn from the surrounding environment, one of which is the local wisdom of local culture. According to Lestari et al. (2016) in Lamada & Rahman (2019) teacher-centred learning causes students to get bored with mathematics lessons.

2. Design

Furthermore, the design stage is the stage of designing a realistic mathematics education-based mathematics e-module integrated with Dukutan Tradition ethnomathematics. At the design stage, several stages are carried out, namely compiling the e-module framework, compiling learning materials in the e-module, selecting the e-module format, designing e-module prototypes in the form of designing e-module components, e-module writing systematics, preparing tools and materials for making e- modules and e-module development stages. At this stage, an e-module assessment instrument was also prepared which was used as a tool to measure the quality of the e-modules that had been developed. These are some displays of the e-modules that we have developed:

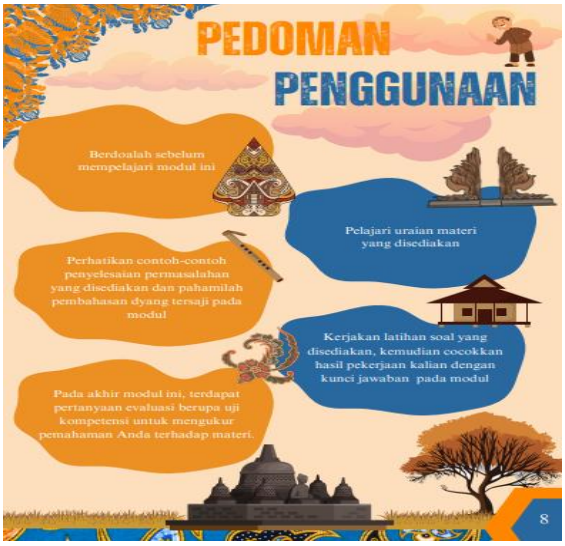

Figure 1: Guidelines for Using E Module

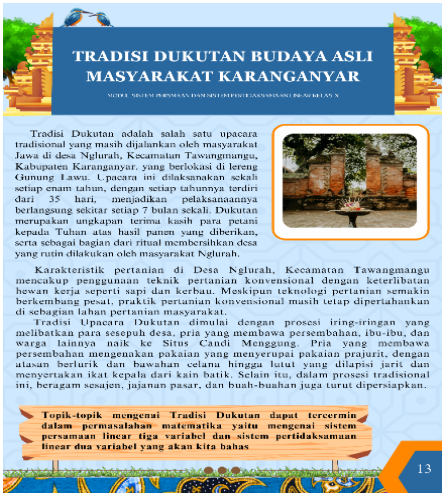

Figure 2. The Display of the Introduction Page of Ethnomathematics Dukutan Tradition in the E-Module

3. Development

After the development of the mathematics e-module was completed, the next stage was the validation stage by material expert validators, media experts, and cultural experts using questionnaires. The assessment questionnaire has been validated by instrument validators who come from lecturers.

Table 5. Results of Validity by Material Experts

Assessment Aspect	Average Validity Score	Validity Criteria
Presentation Aspect	0,828	Very High
Language Aspects	0,979	Very High
Presentation Appropriateness Aspect	0,938	Very High
Average Total Validity Score	0,915	Very High

Based on Table 5, it can be seen that the average total score of the overall validity of the assessment by the two material experts has a very high validity because it is in the range of 0,8 to 1. Suggestions and input from material experts are used as improvement materials to improve e-modules, namely improving learning objectives to be more specific, errors in writing the word rupiah, and improving writing material that can cause misconceptions.

Table 6. Results of Validity by Media Experts

Assessment Aspect	Average Validity Score	Validity Criteria
Display Aspects Screen Design	0,896	Very High
Ease of Use Aspect	0,95	Very High
Consistency Aspect	0,958	Very High

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Assessment Aspect	Average Validity Score	Validity Criteria
Graphics Aspects	0,893	Very High
Aspects of usefulness	0,938	Very High
Average Total Validity Score	0,927	Very High

Based on Table 6, it can be seen that the average total score of the overall validity of the assessment by the two media experts has a very high validity because it is in the range of 0,8 to 1. Suggestions and input from media experts are used as material for improvement to perfect the e-module, namely on improving the colour of white writing fonts with orange background colours that are less contrasting, so that the writing is less easy to read. there is less spaced writing, module titles that are not colour blocked, the author's name has not been included on the cover, the addition of terms used in contextual problems in the glossary, and the umus font is more clarified.

Table 7. Hasil Validitas oleh Ahli Budaya

Assessment Aspect	Average Validity Score	Validity Criteria
Content Quality Aspects	0,9375	Very High
Presentation Aspect	0,75	High
Average Total Validity Score	0,84375	Very High

Based on Table 7, it can be seen that the average total score of the overall validity of the assessment by cultural experts has a very high validity because it is in the range of 0,8 to 1.

The following are the results of the overall assessment:

Table 8. Overall Validity Results

Assessment Aspect	Average Validity Score	Validity Criteria
Material Expert	0,915	Very High
Media Expert	0,927	Very High
Cultural Expert	0,844	Very High
Average Total Validity Score	0,895	Very High

Based on Table 8, it can be seen that the average total score of the overall validity of the experts' assessment has a very high validity because it is in the range of 0,8 to 1.

4. Implementation

After the developed mathematics e-modules were validated by validators, the developed mathematics e-modules were implemented. We can acces this module in https://heyzine.com/flip-book/5fb5598be2.html. The implementation was carried out in class X Office Management and Business Wikarya Karanganyar Vocational High School with 26 students. The results of the practicality test assessment were based on a response questionnaire given to teachers and students. The results of the practicality test assessment of the teacher response questionnaire are shown in Table 9.

Table 9. Practicality Test Results by Teachers

Assessment Aspect	Score (%)	Practicality Criteria
Aspects of Learning	95	Very Practical
Aspects of E-Module Quality	83	Very Practical
Aspects of E-Module Function	84	Very Practical
E-Module Display Aspect	96	Very Practical
Average Total Validity Score	89,5	Very Practical

Table 9 shows that the average score is 89,5%. The percentage shows that the e-module is included in the very practical criteria with all aspects of the assessment included in the very practical criteria.

Table 10. The Result Of Practicality Test

Assessment Aspect	Score (%)	Practicality Criteria
Aspects of Learning	94	Very Practical
Aspects of E-Module Quality	85	Very Practical
Aspects of E-Module Function	95	Very Practical
E-Module Display Aspect	97	Very Practical
Average Total Validity Score	92,75	Very Practical

Meanwhile, Table 10 shows that the average score is 92,75%. The percentage shows that the e- module is included in the very practical criteria with all aspects of the assessment included in the very practical criteria. Based on the results of the practicality test, it can be concluded that the mathematics e-module developed by the researcher is very practical to be used in learning.

Table 11**.** N-Gain Category Percentage

Category	Total number of students	Percentage
High Improvement	20	76,92%
Medium Improvement	6	23,08%
Low Improvement	0	0%

Based on the results of the pre-test and post-test of student learning outcomes, it is known that there are 20 students who are included in the high improvement category and 6 students are included in the moderate improvement category. Based on these results, it is obtained that 76,92% of students are included in the high improvement category and 23,08% are included in the moderate improvement category. There were no students who fell into the low improvement category and there were also no students who experienced a decrease or stability in their learning outcomes, so it can be concluded that the mathematics e-modules developed by researchers can improve student learning outcomes. It is known that the average pre-test score and post-test score also increased from 36,65 to 83,04. Meanwhile, the average N-Gain in percentage form shows 73,05%, which means that the

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product developed has an interpretation of effectiveness in the moderately effective category. Based on the results of the N-Gain test conducted, it can be concluded that the realistic mathematic education-based mathematics e-module integrated into the ethnomathematics of the Dukutan Tradition developed by the researcher is quite effective in improving student learning outcomes on grade X Linear Equation and Inequality System material.

5. Evaluation

The last stage is evaluation. At this stage, evaluation is carried out during the product development research process, researchers evaluate product deficiencies based on the results of student and teacher response questionnaires and the results of the e-module effectiveness test in improving student learning outcomes. The evaluation results will later be used as a reference and note for further research. In this study, researchers realised that the products developed still had weaknesses. The weaknesses in question include:

1. Some features can only be used with the help of an internet connection, for example learning video references from YouTube, quizizzes, and the geogebra platform.
2. In using this e-module, it needs some loading time in accessing it.
3. The material used in the product is still too basic and lacks depth so it is not appropriate for use in higher grades or levels.

CONCLUSIONS AND SUGGESTIONS

From the results of the research and discussion regarding the development of mathematics e-modules based on realistic mathematic education integrated with ethnomathematics to improve student learning outcomes on the material of the Linear Equation and Inequality System, the researcher can conclude the following:

1. The development of a realistic mathematics education-based mathematics e-module integrated with ethnomathematics on the material of the Linear Equation and Inequality System using the ADDIE development model. At the analysis stage, researchers made initial observations while analysing the needs for the basis of product development both in terms of models, methods, media, and teaching materials. In addition, researchers also analysed student characteristics, materials, and the applied curriculum. Furthermore, at the design stage, researchers compiled a product design in the form of an outline of the e-module content consisting of an e-module framework, e-module learning content, e-module selection, and e-module format selection At the development stage, the preparation of the product prototype began by making an initial e- module design in the form of e-module components and e-

module initial writing systematics. After that, proceed to prepare the tools and materials for making e-modules. The e-module development begins with compiling the entire e-module content that has been compiled in Microsoft word into the Canva application. After the e-module content is perfectly arranged, the e-module format is changed to a flipbook. The application used is Heyizne Flipbook Maker which has been integrated with Canva. On the other hand, researchers also prepared various instruments needed in testing the validity, practicality, and effectiveness of the product. After the e-module was developed, the e-module product was validated by material experts and media experts. After the product is declared valid and revised according to the validator's suggestions, the implementation stage is then carried out. The implementation stage is carried out to test the practicality and effectiveness of the product which is carried out by teachers and all students of Class X Office Management and Business Service Wikarya Karanganyar Vocational High School who have participated in learning activities using mathematics e-modules based on realistic mathematic education integrated with ethnomathematics of the Dukutan Tradition In the last stage, namely evaluation, it focuses on the final results of product development that has been implemented in class X Office Management and Business Service Wikarya Karanganyar Vocational High School, totalling 26 students. Evaluation comes from test results, teacher feedback, and student feedback on the use of e-modules as a reference to meet the needs of learning resources at school.

2. Based on the results of validation by material experts, media experts, and cultural experts, the average total validity score is 0,915 for material validation, the average total validity score is 0,927 for media validation, and the average total validity score is 0,844 for cultural validation. Based on these results, it can be concluded that the integrated realistic mathematic education- based mathematics e-module developed is valid for use in learning.
3. Based on the results of testing the practicality of the product by teachers and students, an average total score of 89,5% was obtained for testing by teachers and an average score of 92,75% for testing by students. Based on these results, it can be concluded that the developed ethnomathematics-integrated realistic mathematic education-based mathematics e-module is practical for learning Linear Equation and Inequality System material.
4. Based on the results of the N-Gain Test, the average N-Gain calculation result is 0,73 which is included in the high improvement category. While in the interpretation of the product effectiveness test, the average N-Gain with a percentage of 73% is included in the moderately effective category. Based on these results, it can be concluded that the developed

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ethnomathematics-integrated realistic mathematic education-based mathematics e-module is effective enough to improve student learning outcomes on the material of the Linear Equation and Inequality System.

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