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Culturally Contextualized E-Module Based on Papua: Why Teachers and Students Need It for Teaching Linear Programming Material?

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Abstract
The use of e-modules in mathematics learning significantly aids both teachers and students in the teaching and learning process. However, the design of e-modules has not been extensively linked to the cultural context in which students live. Therefore, this study aims to explore and analyze the needs of teachers and students in developing culturally integrated e-modules, particularly those reflecting the culture of Papua, for high school students. The research design employed is phenomenological. Participants included Mathematics teachers for grades X, XI, and XII in Nduga Regency, Papua Highlands, and 64 high school students (42 male and 22 female). Data collected from observations and interviews were qualitatively analyzed using Miles-Huberman Interactive Analysis. Findings revealed that the high schools still use the 2013 curriculum, relying on standard textbooks as teaching materials. These textbooks pose problems for students as they are often uninteresting, use formal language, are difficult to understand due to abstract content, and are not contextualized to students' daily lives. Additionally, the reduction in face-to-face learning hours, due to the school's location in a conflict area, hampers effective teaching and learning processes. Another interesting finding is that high schools in Nduga Regency have not yet utilized technology in learning, despite having internet access. These findings imply the need for teaching materials integrated with technology and local culture to help students understand mathematics concepts and assist teachers in teaching both inside and outside the school.

Keywords: Papua Culture, E-Module, Teacher and Student Needs, Linear Programming

1. Introduction

With the advancement of technology, teaching methods must adapt to the latest technologies like the internet, which allows distance learning without the time and place constraints (Jubhari et al., 2022). Internet technology facilitates flexible learning, accessible anytime and anywhere, and overcomes face-to-face learning limitations. Therefore, mathematics teaching materials need to be integrated with technology to improve the quality of learning. Technology enables more interactive and engaging presentations of mathematical content, facilitating the understanding of abstract concepts through visualization, simulation, and animation (Sunzuma, 2023; Sudirman., et al.,

2022). Additionally, mathematics learning should be integrated with local culture to maintain the relevance of cultural heritage in education. Presenting materials rooted in local culture offers significant academic benefits to students (Meaney et al., 2020). Local culture in learning reflects students' identity and enriches their learning experiences. Using a local cultural approach deepens students' understanding of mathematical concepts by relating them to daily life, thus enhancing students' motivation and comprehension (Maqsood et al., 2024).

The integration of technology in education allows the development of various engaging learning tools for classroom use or independent study (Hartley et al., 2023; Sudirman et al., 2021). One such innovation is the development of electronic modules (e-modules), which can convey information through images, videos, and animations to enhance students' understanding (Herlina et al., 2024). E-modules have many advantages over conventional or printed modules, being more practical, cheaper to produce, durable, and capable of including audio, animation, and video in their presentations (Prabu et al., 2023). Gamage et al. (2022) also emphasize that electronic modules are highly effective learning media, facilitating student understanding and serving as teaching aids in the classroom and self-study tools at home.

Surveys in the field show many complaints from students and teachers about the teaching materials used by teachers in Nduga Regency, where high schools still use the 2013 curriculum. As a result, teaching materials still rely on textbooks from this curriculum, which tend to be too abstract and filled with word problems that use formal language and lack relevance to students' daily lives, making it difficult for students to solve mathematical problems, especially in linear programming material. The broad scope of the material and its lack of context with students' everyday realities are also major concerns. Verschaffel et al. (2020) highlight the difficulties students face in handling word problems that have direct relevance to real-world situations. Students' ability to solve word problems is crucial in developing critical thinking skills, applying mathematical concepts in real-world contexts, and essential analytical skills for solving everyday problems, as noted by Sutama et al. (2022).

Teachers also face challenges in teaching mathematics due to the lack of contextual teaching materials related to the culture of students in Nduga Regency, Papua Highlands Province. Additionally, high schools in Nduga Regency, Papua Highlands Province, have not yet integrated technology into the learning process, even though internet infrastructure is available. The internet plays an essential role in education by providing broad access to learning resources (Van Wart et al., 2020), enhancing interaction and collaboration in learning, and facilitating effective communication between teachers and students (Han et al., 2021). Furthermore, external barriers faced by students and teachers, such as an unconducive learning environment due to conflict areas, lack of learning resources because of remote locations, and inappropriate teaching methods, also exist. Therefore, learning innovations are needed to address these complexities, such as utilizing the internet to enable distance learning, which benefits students in remote areas or those with limited access due to regional security (Sato et al., 2024).

Developing a culturally contextualized electronic module for Papua is an appropriate solution to address mathematics learning issues based on the analysis of teachers' and students' learning needs in Nduga Regency, Papua Highlands Province. This e-module is effective in improving academic achievement and student interest in the subject matter, as recognized by various studies, including those by Sriyanti et al. (2022) and Rahayu et al. (2023). International research, such as by Tamrongkunanan et al. (2020) and Secadron et al. (2023), also shows that e-modules enhance students' knowledge, skills, and critical thinking abilities. Additionally, learning approaches emphasizing students' cultural context, as found by Seo et al (2021), can increase students' motivation and learning outcomes. Therefore, combining e-modules with mathematics content based on Papua culture is expected to contribute significantly to inclusive and competitive mathematics education. Especially regarding linear program material for students in class XI high school, high school students in Nduga Regency consider the program material difficult because it contains many story problems. In line with the research results of Setiabudi et al (2022) which states that Linear Program material is often considered complicated by students, so appropriate packaging of learning materials is needed and e-module teaching materials can have a positive impact on Linear Program learning

The connection between culture and mathematics is essential, as both elements play an integral role in daily life. The existence of Papua culture can be harmoniously linked with mathematical concepts, which is expected to help students understand not only mathematical concepts but also cultural values that can shape their character positively. Thus, practical teaching materials like e-modules that can integrate cultural values are necessary, enabling students to process this information easily and independently. The availability of appropriate teaching materials is crucial for providing students with proper guidance in understanding mathematical concepts correctly and integrating culture into the mathematics learning process. The aim of this study is to identify the needs of teachers and students in the field before developing a culturally contextualized e-module for linear programming material for high school students in Nduga Regency, Papua Highlands Province.

2. Methods

This research uses a qualitative method with a phenomenological design. Qualitative methods are research approaches used to understand social phenomena or human behavior in their natural context. The main goal of qualitative methods is to gain an in-depth understanding of an individual's or group's experiences, perspectives, and meaning given to a particular phenomenon (Tomaszewski et al., 2020). Phenomenological design aims to understand and explore individuals' subjective experiences and the meaning given to certain phenomena (Emiliussen et al., 2021). This design focuses on exploring students' learning experiences in depth to produce rich and meaningful understanding, contributing to improving the quality of education and teaching practices.

Phenomenological design data collection techniques are in-depth interviews and personal documentation of research subjects (Frechette et al., 2020).

This research was conducted over approximately one month, from February 16 to March 30, 2024, with the aim of identifying the characteristics of high school teachers and students in Nduga Regency, Papua Highlands. The selection of research subjects focused on analyzing issues related to teaching and learning, leading to the choice of two mathematics teachers who teach linear programming material and five eleventh-grade students as the main informants. Criteria for selecting teachers included: 1) a minimum of two years of teaching experience, 2) adequate professional qualifications, i.e., at least a bachelor's degree and for civil servants a minimum rank of IIIa, 3) competence in the subject matter taught, 4) physical and mental health, and 5) technological literacy. Students were randomly selected from several high schools in Nduga Regency in the eleventh grade. The data sources for this study consisted of primary and secondary sources. Primary data were obtained from informants, i.e., mathematics teachers teaching linear programming and eleventh-grade students, while secondary data were obtained from the documentation of the teaching materials used.

The procedure and focus of this study are to analyze the learning needs of high school teachers and students in Nduga Regency, Papua Highlands Province. The research design used is based on the stages of phenomenology, which include several essential steps. First, define the scope of the phenomenon to be studied, namely high schools in Nduga Regency. Second, prepare a list of questions for interviews with informants to deeply explore students' learning needs. Third, collect data from five eleventh-grade students and two teachers teaching linear programming material to comprehensively understand their experiences and challenges in the learning process. Fourth, analyze the collected data to identify the main themes and essence of students'

3. Result and Discussion

Analysis of the learning needs of teachers and students in high schools in Nduga Regency, Papua Mountain Province, aims to understand the importance of contextual Papuan culture e-modules as learning materials. This analysis was carried out through direct observation during the learning process and interviews with mathematics teachers and class XI students studying linear programming. For data collection, researchers prepared structured questions before interviews with informants. Here are the results of the researchers' interviews with teachers and students.

1) Students

The results of interviews were obtained with five high school students who were randomly selected from several high schools in Nduga Regency, Papua Mountain Province, which were conducted online. The pictures of interview activities with students are presented in Figure 1.

Figure 1. Interview with student

Direct quotes from interviews with several high school students in Nduga district, Papua Mountain Province are presented in table 1.

Table 1 excerpts from interviews with students

Question	Student Answers	The number of students
What material do you consider the most difficult in mathematics? What makes it difficult?	linear program material, probability, systems of equations and linear inequalities because there are lots of story problems	Students A, B, and D
	Almost all of them are misses, because I don't like calculations	Students C dan E
Are there any special obstacles you face when studying mathematics?	Printed books are only used at school and there are no handbooks for completing assignments at home, and only notes are relied on	Students A, B dan C
	I don't have books to study at home, especially if I'm on holiday during a war situation	Students D dan E
Is the material in the textbook relevant to your daily life?	The material in the 2013 Curriculum book is less relevant	Students A, C, D, dan E
	The material is relevant	Students B
Do you need additional teaching materials? Why?	I need to study at home if I have assignments from the teacher, during holidays due to war zone conditions, and I don't need to buy printed books anymore	Students A, B, D dan E
	This is necessary because the current textbook is difficult for me to understand	Students C

Student A

Based on the interview with Student A, it was found that the student did not find mathematics very difficult, especially on the topic of numbers, but considered linear programming and probability challenging due to the story problems involved. Student A prefers auditory learning, enjoying listening to the teacher's explanations rather than watching videos or reading books, and prefers to study alone to avoid distractions from friends. The student faces difficulties due to limited printed

books, which makes completing assignments without the teacher's help challenging. Additionally, the textbooks used in school are hard to understand due to many formulas and lack relevance to everyday life, making the student reluctant to study them. Therefore, the student needs additional learning materials to study independently at home. Despite considering the teacher's teaching methods good, the student finds them boring and suggests integrating Papua's culture into mathematics material to increase engagement and relevance to daily life. The student also has never used digital devices to learn mathematics.
Given the need for additional learning materials, it is necessary to design contextually cultural e-modules that integrate Papua's culture. These e-modules should include audio explanations to support the student's auditory learning style and incorporate story problems relevant to daily life and Papua's culture to enhance engagement and understanding. Additionally, the e-modules should provide supplementary materials accessible independently at home, offering greater learning flexibility. The use of digital devices in the e-modules will also provide a more interactive and engaging learning experience for the student.

Student B

Based on the interview with Student B, it was found that the student considers mathematics quite difficult due to many calculations, especially in the topics of linear equations and inequalities and linear programming, which are hard to understand. The student struggles with story problems requiring modeling before solving. Student B's learning style is a combination of auditory and visual, preferring to watch videos and listen to the teacher's explanations. The student likes to study alone for peace and with friends for discussion when not understanding something. The main obstacle faced is the lack of books, hindering problem-solving and the textbooks being uninteresting and hard to understand, necessitating additional learning materials. Although the textbook content is considered relevant to daily life, the teaching methods are perceived as monotonous, and the textbooks need improvement. The student suggests integrating Papua's culture into mathematics materials to enhance understanding of local culture, The student has used digital devices to learn mathematics and prefers electronic books because they are more interesting and easier to understand with videos, pictures, and animations.

The needs analysis of Student B indicates the necessity for additional engaging and easily understood learning materials, supporting auditory and visual learning styles, and integrating local culture into the learning materials to increase engagement and relevance.

Student C

Based on the interview with Student C, it was found that the student finds mathematics very difficult due to all topics involving disliked calculations, considering almost all mathematical topics challenging, especially story problems. Student C prefers to study by watching videos, choosing to study alone but facing difficulties due to the lack of printed books, often falling behind

in lessons. The current textbooks are considered too difficult and not meeting the student's needs, lacking relevance to everyday life. The student finds the teaching methods monotonous (lectures, discussions, note-taking) and unappealing for all students, suggesting integrating Papua's culture into mathematics materials to make them more relevant to daily life, like the prices of goods. The student has never used digital devices to learn mathematics as it has not been taught by the teacher and electronic books are unavailable.

From this analysis, the learning needs include more engaging and relevant learning materials, particularly those related to Papua's culture; more varied and interactive teaching methods, such as using videos and other visual aids; additional learning materials that are easier to understand and meet students' needs; integrating digital devices and electronic books in learning to make it more engaging and interactive; and resources allowing independent study, given the student's preference for self-study. Therefore, developing contextually cultural electronic learning modules becomes an appropriate solution because e-modules are easily accessible, more engaging, and interactive.

Student D

Based on the interview with Student D, it was found that the student also considers mathematics very difficult and uninteresting due to the focus on confusing calculations, especially in solving story problems in topics like linear programming and probability. The student prefers learning mathematics by watching videos and studying with friends to facilitate discussions when there is difficulty in understanding. The student faces obstacles, including limited printed books, often falling behind in lessons. Although the teacher's teaching methods are considered good, the student still struggles to understand the material presented, particularly because the textbooks are uninteresting and lack relevance to everyday life. The student feels the need for additional learning materials that are easier to understand for independent study at home, as textbooks are only available in class and must be purchased independently. Additionally, the student suggests integrating Papua's culture into mathematics materials to make them more relevant and interesting. The student has used digital devices to watch YouTube videos but has not experienced using electronic books.

From this analysis, the identified learning needs include improving learning materials to be more engaging and relevant, applying more varied and interactive teaching methods, providing additional easily understood learning materials, integrating digital technology in learning, and supporting group learning to enhance student interaction and understanding. Therefore, the appropriate solution to meet Student D's needs is developing contextually cultural e-modules because e-modules are more engaging than printed books and can be used for both group and independent study.

Student E

Based on the interview with Student E, it was found that the student considers mathematics difficult due to the complexity of calculations, highlighting the need for a more focused approach on basic concepts before introducing complex material. The student also expressed an inability to mention interesting material in mathematics, indicating the need for a more engaging and relevant teaching approach. The difficulty in solving story problems also reflects the need for learning strategies to better tackle this type of problem. Additionally, the student's preference for learning through videos shows the potential use of multimedia to increase interest and understanding. Obstacles such as the unavailability of textbooks at home emphasize the need for easier access to learning materials. The student's desire for variety in teaching methods underscores the importance of developing more interactive and engaging teaching methods.

Considering the interview results with Student E, it can be concluded that there is a need to develop more engaging, relevant, easily accessible learning approaches that integrate technology and content more aligned with students' daily lives, including connections to Papua's culture to increase their engagement and understanding of the material.

The conclusion from the interviews with various students shows that their main needs in learning mathematics include providing materials relevant to daily life in Nduga Regency, Papua Mountains Province. Students face difficulties, particularly in topics involving story problems like linear programming and probability, which they find hard to understand. The dominant learning styles include auditory and a combination of auditory-visual, indicating the importance of using diverse approaches in teaching. Obstacles related to the availability of printed books and textbooks that do not meet students' needs emphasize the need for additional learning materials that are easily accessible at home. The development of contextually cultural e-modules that integrate Papua's culture and support students' learning styles, with audio explanations and relevant story problems, is expected to increase their engagement and understanding in learning mathematics. The integration of digital technology in e-modules is also considered to make learning more engaging and interactive for these students. Therefore, this approach is expected to meet the diverse learning needs and support a better understanding of mathematics. The coding of students' learning needs is summarized in one thinking framework image, which is presented in Figure 2.

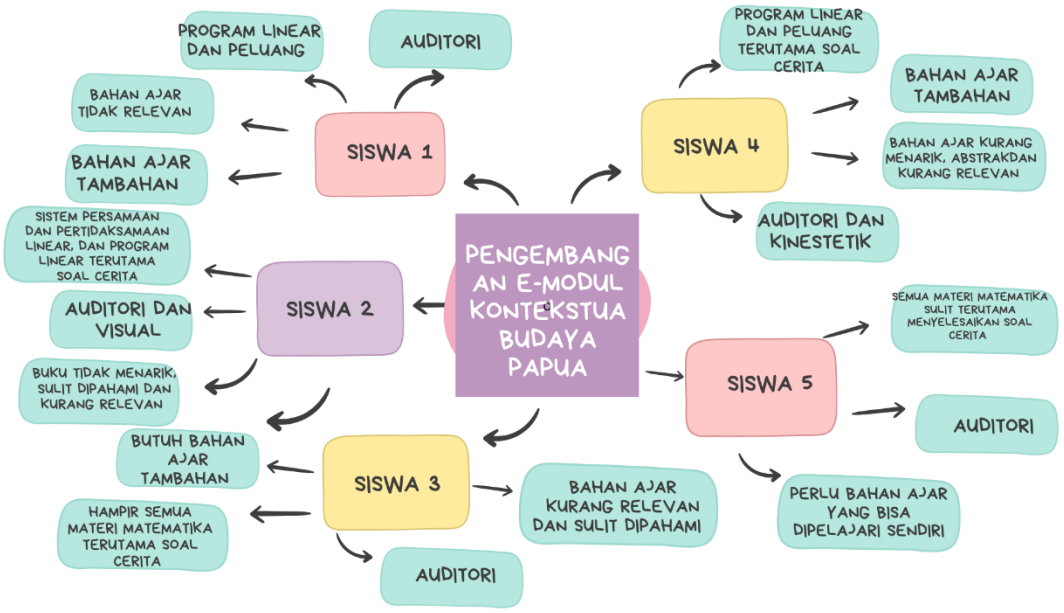

Figure 2. Coding of Student Learning Needs

2. Teachers

The results of interviews obtained with high school teachers in Nduga Regency, Papua Mountain Province are presented in the following sequence. Meanwhile, pictures of interview activities with mathematics teachers are presented in Figure 3.


Figure 3. Documentation of interviews with mathematics teachers

Direct quotes from interviews with high school mathematics teachers in Nduga Regency, Papua Mountain Province are presented in table 2.

Table 1 excerpt from interview with teacher

Question	Teachers Answers	The number of Teachers
Is it true that linear programming material is the most difficult material for most of your students to understand?	According to him, students have difficulty solving linear program material questions because they contain a lot of story problems.	First Teacher
	It's true, students often have difficulty solving problems in linear programming material because the word problems are difficult to understand	Second Teacher
Do you need additional materials such as electronic modules?	It is really needed because electronic modules are easy to access and more interesting for students to learn and can cover the learning styles of all students.	First Teacher
	It is really needed so that students can study independently at home when they are on holiday because regional conditions are not conducive	Second Teacher
What is the biggest challenge you face when teaching linear programming?	Find appropriate methods and teaching materials that are relevant to children's needs	First Teacher
	Find the right methods and teaching materials that are relevant to student needs	Second Teacher

First Teacher

Based on the interview with a mathematics teacher from SMA Negeri 1 Kenyam, it was found that teaching linear programming is the biggest challenge. This is due to the low scores of students on this material, influenced by their difficulty understanding story problems due to limited proficiency in standard Indonesian, as the teacher stated, "Yes, children have difficulty solving linear programming problems because they contain many story problems." Additionally, the teacher acknowledged difficulties in completing the syllabus, covering all materials, and facing obstacles such as the limited number of teachers, with only one mathematics teacher for all grade levels. The current textbooks are considered less useful and unengaging for students, who rarely bring them home due to the limited availability. "The books are very limited; students rarely bring textbooks home." To increase student engagement, integrating Papua's culture into the material can make mathematics learning more interesting. The teacher supports the development of contextually cultural e-modules to help improve students' understanding, especially in topics involving story problems like linear programming.

Considering the interview results with the first teacher, it can be concluded that the main needs are providing more engaging and easily understood learning materials, especially in topics involving story problems. This can be achieved by integrating Papua's culture into the material to make it more relevant to students' daily lives and supporting the development of contextually cultural e-modules to improve students' understanding of mathematics.

Second Teacher

Based on the interview with a mathematics teacher from SMA Negeri 1 Mbua, it was found that students' difficulty in solving linear programming problems is mainly due to their limited proficiency in standard Indonesian, making it hard for them to understand story problems. "Students often struggle to solve linear programming problems because the story problems are hard to understand." The teacher also highlighted the limited availability of printed books, causing students to face difficulties in studying independently at home. "The availability of textbooks is very limited, making it hard for students to study independently at home." The teacher believes that integrating Papua's culture into the material can make mathematics learning more interesting and relevant to students' daily lives. Additionally, the teacher supports the development of contextually cultural e-modules to improve students' understanding, especially in topics involving story problems like linear programming.

Considering the interview results with the second teacher, it can be concluded that the main needs are providing more engaging and easily understood learning materials, especially in topics involving story problems. This can be achieved by integrating Papua's culture into the material to make it more relevant to students' daily lives and supporting the development of contextually cultural e-modules to improve students' understanding of mathematics.

The analysis of the needs of teachers and students in Nduga Regency, Papua Mountains Province, indicates that the primary needs in learning mathematics include providing engaging and easily understood learning materials relevant to students' daily lives. Students face difficulties, especially in topics involving story problems like linear programming and probability, which are hard to understand due to limited proficiency in standard Indonesian. The dominant learning styles among students include auditory and a combination of auditory-visual, indicating the importance of using diverse approaches in teaching. Obstacles related to the availability of printed books and textbooks that do not meet students' needs emphasize the need for additional learning materials that are easily accessible at home. The integration of Papua's culture into the material is considered necessary to make mathematics learning more interesting and relevant to students' daily lives. Therefore, developing contextually cultural e-modules that support students' learning styles and integrate Papua's culture is expected to increase their engagement and understanding in learning mathematics. The integration of digital technology in e-modules is also considered to make learning more engaging and interactive for students, supporting better understanding of mathematics.
The summary of the results of the interviews with the two mathematics teachers is presented in Figure 4

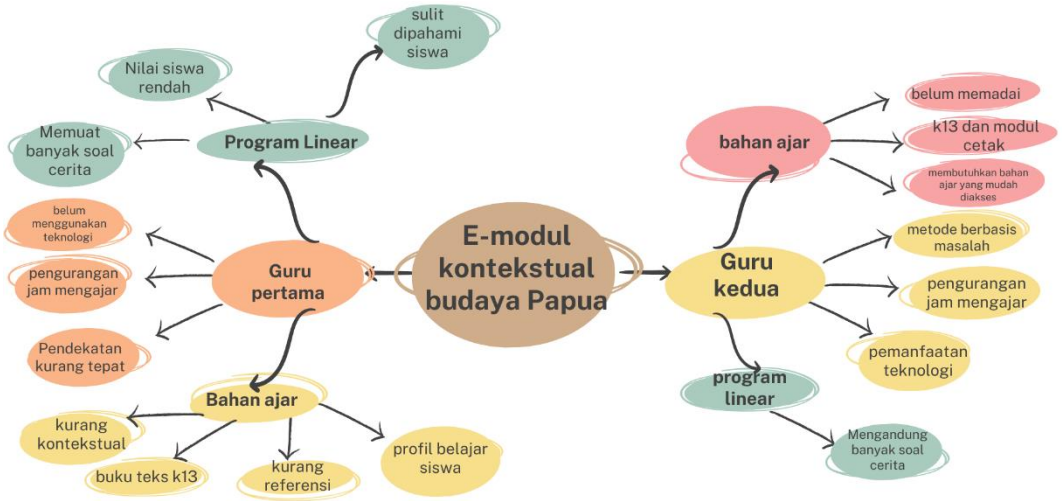

Figure 4. Coding of Teacher Needs Analysis

3. Direct Observation Results

The documentation of direct observation activities is presented in Figure 5, and was carried out to answer why teachers and students need contextual e-module teaching materials that focus on Papua's culture. This observation encompassed various crucial aspects, including unique student characteristics, the diverse challenges faced by teachers and students in the mathematics learning process, and the extent to which technology is utilized in the learning process. Additionally, the availability of facilities that support learning was also a focal point of the observation, with the hope of obtaining a comprehensive understanding of genuine needs in the context of education that is more meaningful and relevant to local culture.

Figure 5. Documentation of Direct Observation

Based on the survey results from the researcher's direct teaching experience at SMA Negeri 1 Kenyam, it was found that students at SMA Negeri 1 Kenyam struggle with solving mathematical problems, especially those presented in the form of story problems. Consequently, the topic of Linear Programming is particularly challenging for them due to its numerous story-based problems.

This aligns with Setiabudi et al.'s (2022) findings that Linear Programming material is often perceived as complex by students, necessitating educational material packaging that can address these difficulties. The difficulties faced by SMA Negeri 1 Kenyam students in solving mathematical problems related to story problems stem from the inadequacy of the learning materials used, which are perceived as uninteresting and irrelevant to their lives. Annizar et al. (2023) underline the importance of problem-solving skills in tackling these story problems.

The students' difficulties in solving mathematical problems at SMA Negeri 1 Kenyam are exacerbated by various learning obstacles, including internal factors such as low learning motivation due to uninteresting and difficult-to-understand teaching materials. Filgona et al. (2020) state that low learning motivation due to uninteresting teaching materials is a major barrier. Additionally, students' interest in mathematics is low because it is perceived as difficult and boring, with many formulas being hard to understand, as stated by Nisa et al. (2021). Furthermore, most SMA Negeri 1 Kenyam students are not proficient in using correct and formal Indonesian language. External obstacles are also significant, such as an unfavorable learning environment due to conflict areas, lack of learning resources, inappropriate teaching methods, and minimal parental support for education.

Teachers at SMA Negeri 1 Kenyam also face challenges in teaching Linear Programming material because the K13 printed books used are too abstract, using formal language and lacking contextual relevance to the daily lives of students at SMA Negeri 1 Kenyam, and teachers lack teaching reference materials. This opinion is supported by Sriyanti et al.'s (2022) research, which states that teachers struggle to explain story problems as found in Linear Programming in Grade XI at SMK Negeri 3 Sinjai. Challenges at SMA Negeri 1 Kenyam do not stop there; the policy of reducing face-to-face teaching hours due to conflict situations in the area further complicates the learning process. This condition requires an appropriate approach to effectively address these issues. Furthermore, learning at SMA Negeri 1 Kenyam has not yet integrated technology. The coding of the survey results is presented in Figure 6.

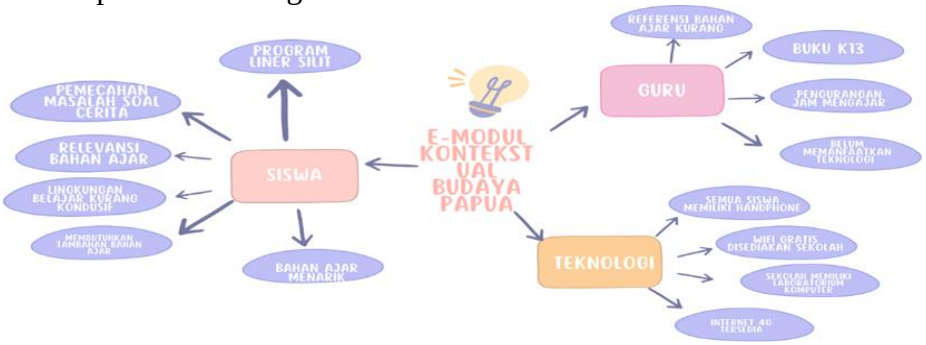

Figure 6. Coding of Direct Survey Results

SMA Negeri 1 Kenyam needs to promptly integrate technology into education to enhance its quality. The school has provided adequate facilities such as computer laboratories and free internet access for students and teachers. Additionally, almost all students have smartphones, providing a

great opportunity for digital and interactive learning methods. Supported by 4G internet access in the area, students can easily access various online learning resources. This integration of technology not only facilitates the teaching and learning process but also prepares students to face the challenges of the digital age, producing more competent graduates ready to compete in the job market or pursue higher education (Rahmatullah et al., 2022).

Figure 7. Coding of Conclusions for Solutions

Based on direct interviews and surveys in high schools in Nduga District, it can be concluded as shown in Figure 7 above that the problems arise from inadequate and irrelevant teaching materials and teaching methods that do not meet the students' learning profiles. High schools in Nduga District still use textbooks published by the Ministry of Education and Culture. Several schools have begun using modules. These modules are created by teachers based on Lesson Plans (RPP). However, their usage is still limited. Module development should also be relevant to the curriculum in use. Currently, Indonesia still adopts the 2013 curriculum with a scientific and integrative thematic approach. According to Regulation of the Minister of National Education No. 63 Year 2009 concerning the Education Quality Assurance System (SPMP), the implementation of the 2013 curriculum is also based on the pattern of Education for Sustainable Development (ESD) to create a sustainable society. The application of the 2013 curriculum in high schools is marked by the integration of three pillars of development: cultural, economic, and social environments in the learning process.

In Indonesia, contextual learning application is not new. However, its implementation is still suboptimal (Jubhari et al., 2022). This is similar to what teachers expressed, that in their teaching, they embed the value of cultural sustainability in the examples they provide, but they do not have detailed knowledge about its application in Linear Programming material. In this study, the focused e-module is as a supplementary material. The e-module contains additional material from the content already explained in videos. Besides containing material, this e-module also includes problems and culturally contextualized Papua as the application and feedback from the material already studied by students.

Furthermore, based on the interviews conducted, information was obtained that the use of mathematics learning media is still lacking, and there are no teaching materials integrated with technology such as electronic learning media. While internet access in Nduga District already exists, even schools in Nduga District, especially SMA Negeri Kenyam, provide free Wi-Fi for teachers and students that can be accessed daily. Moreover, SMA Negeri Kenyam already has a computer laboratory that teachers can utilize in teaching. The use of ICT in education aims to improve the methods and approaches to teaching they want to achieve effective learning activities and to meet the challenges of 21st-century teaching skills (Msafiri et al., 2023). Other information obtained is that teaching materials such as electronic modules integrated with Papua's culture need to be developed because students do not always learn using generally available teaching materials that are less relevant to their lives. It is hoped that by using enjoyable teaching materials like culturally contextualized electronic modules of Papua, students can change their opinions and views that mathematics is a difficult but enjoyable subject and also understand more about the benefits of learning mathematics in their daily lives. Many studies also indicate that ICT brings positive significance to student learning achievements in subjects such as Mathematics.

4. Conclusion

Based on the research findings, it is concluded that the current teaching materials used in Grade XI of high schools in Nduga Regency, Papua Highlands Province, do not adequately meet the needs of the students. Therefore, there is a pressing need for additional teaching materials that are easily comprehensible for self-directed learning, such as culturally contextualized e-modules based on Papua's culture. This research specifically examines the necessity of these e-modules as supplementary teaching resources.

Further research is essential to develop culturally relevant Papua-based e-modules tailored for Grade XI high school students in Nduga Regency, Papua Province. This development should encompass visual aids, test questions, and instructional videos, aiming to enhance engagement and understanding among students, thereby addressing the current gaps in the curriculum effectively. By integrating these resources, educators can better support students in mastering complex subjects like mathematics, fostering a deeper connection to their cultural heritage while preparing them for future academic and professional challenges.

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