

Enhancing Linear Programming Education Through Comprehensive and Maritime Relevant Teaching Materials

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Abstract. This research aims to identify the needs of students for teaching materials in the Linear Programming course at Raja Ali Haji Maritime University, emphasizing the completeness of the material and its relevance to maritime contexts. The findings indicate that most students struggle to find textbooks that cover all the necessary topics in Linear Programming. They reported that the existing learning resources do not adequately address all of the subjects being taught. Furthermore, the teaching materials currently in use have not been integrated with maritime contexts, despite their significance for students living in the maritime-based region of the Riau Islands. This research recommends developing teaching materials that are more comprehensive, easily accessible, and aligned with maritime contexts to enhance learning effectiveness and increase the material's relevance to students' everyday lives. Ultimately, creating teaching resources that incorporate the local context can support the vision of maritime-based education in the Riau Islands and strengthen students' competencies as they prepare to face challenges in a job market that increasingly demands skills connected to real-world applications.

1 Introduction

Based on Law No. 25 of 2002, the Riau Islands were designated as the 32nd province in Indonesia and inaugurated on July 1, 2004. This province includes Tanjungpinang City, Batam City, Bintan Regency, Karimun Regency, Natuna Regency, and Lingga Regency [1]. With its strategic geographical location located between the South China Sea, the Malacca Strait, and the Karimata Strait and supported by abundant natural resource potential, the Riau Islands Province has a great opportunity to become one of the main economic growth centers in Indonesia in the future.

Apart from that, from a historical perspective, the Riau Islands also have an important role in the history of the Indonesian nation. Indonesian, which was adopted from Malay, a regional language belonging to the Riau Islands, has been a link between islands in the archipelago for a long time. As a lingua franca used by sailors and traders, Malay is one of the pillars of cultural and maritime economic integration in this region [2]. Riau Islands Province, with its geographical characteristics consisting of thousands of islands, is one of the maritime-based provinces that has great potential to support the maritime axis policy launched by the central government. As a region that relies on marine resources, cultivating maritime culture is an important element that needs to be started early, including through formal education [3].

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Maritime culture is a vital aspect of regions that depend on marine resources, and it is essential to instill this understanding from an early age, particularly through education. One initiative aimed at enhancing this educational focus is the application of mathematics, specifically through courses like Linear Programming. This course is a mandatory part of the Mathematics Education Study Program at the Faculty of Teacher Training and Education at Raja Ali Haji Maritime University [4]. The Linear Programming course provides students with a solid foundation in operations research, including transportation model analysis, assignment problems, and production analysis. It also equips them with skills to tackle real-world issues, such as optimizing profits and improving resource efficiency in various contexts, particularly in maritime settings. However, a significant challenge in learning Linear Programming is the lack of comprehensive teaching materials. Students often need to gather information from multiple sources, such as textbooks, journal articles, or online content, to grasp the entire curriculum. This can hinder the effectiveness of the learning process. Therefore, it is crucial to develop integrated, relevant, and appropriate teaching materials that meet the needs of students [5].

Teaching materials that integrate the maritime context have great potential to introduce students to relevant local issues, such as maritime transport route management, fisheries resource allocation, or port logistics analysis. This approach not only broadens students' insight but can also increase their learning motivation [6]. Thus, it is hoped that the development of teaching materials of this kind will be able to foster a love of maritime culture as well as prepare students to face the challenges of the world of work which is closely related to the maritime sector.

2 Research Methods

This research is a qualitative descriptive study which aims to explore in-depth information regarding the need for teaching materials in the Linear Programming course at Raja Ali Haji Maritime University. The respondents in this research were 57 students from the Mathematics Education Study Program, Faculty of Teacher Training and Education, Raja Ali Haji Maritime University, who had taken Linear Programming courses in Semesters 4 and 5. This research was carried out in the period January to October 2024 on the campus of the Mathematics Education Study Program, Faculty of Teacher Training and Education, Raja Ali Haji Tanjungpinang Maritime University. To collect data, researchers used various techniques, namely interviews, observations, and questionnaires. The main instrument used was a needs questionnaire distributed via a Google form link. This questionnaire is designed to obtain information regarding the learning resources used by students so far and to explore their needs for teaching materials that are more relevant and integrated with their environmental context. Apart from that, observation sheets are also used to observe the learning process in Linear Programming courses, to gain a deeper understanding of class dynamics and the challenges faced by students. With this approach, it is hoped that this research can provide a comprehensive picture of the need for teaching materials that can support a more effective learning process and are appropriate to the maritime context.

3 Result and Discussion

This section presents the results of observations and questionnaires distributed to students who have completed linear programming courses. The data is described in relation to identifying the need for teaching materials for these courses, with the aim of determining the requirements for effective textbooks. The following data begins with the results of the observations, followed by the questionnaire responses

Table 1. Results of Observations

No	results of observations
1	Students do not yet have textbooks as the main learning resource in linear programming courses.
2	The learning resources used by students so far come from the internet, a collection of several books, no one book can contain all the material in the linear programming course
3	The textbooks and learning resources used so far have not been integrated with the maritime context
4	Lecturers currently lack a main handbook for the learning process.
5	Students feel it is hard to understand maritime integrated linear programming material because there are no supporting learning resources

Based on the results of filling out the questionnaire obtained regarding student needs for teaching materials in the linear programming course, it is described as follows.

1. Ease of finding linear programming textbooks

Based on the responses to the question “saya merasa mudah dalam mencari buku ajar yang memuat semua materi pemrograman linear” the researchers found 24 respondents out of 57 answers who answered disagree and 6 respondents answered strongly disagree. This shows that more than 50% of respondents find it difficult to find textbooks that contain material in linear programming courses. This is reinforced by the observation that so far there have been no books/main learning resources in linear programming courses. This obstacle certainly has an impact on learning success. The scientific gains obtained by students between classes vary due to the lack of adequate guidelines. Students often only use references downloaded from blogs whose authenticity is not guaranteed [7].

2. Learning resources contain all Linear Programming material

Based on the responses to the question “Buku teks/sumber belajar yang ada saat ini mencakup seluruh materi pemrograman linear”. The response from respondents was that more than 44% stated that the books/learning.

3. Saya merasa mudah dalam mencari buku ajar yang didalamnya memuat semua materi pada pemrograman linear
57 jawaban

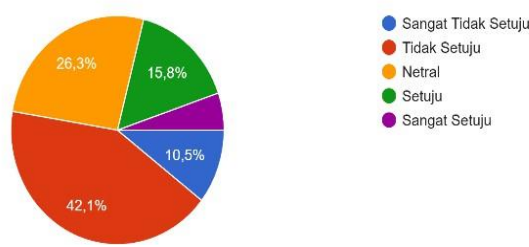


Fig. 1. The responses to the question

Resources currently used do not cover all the material in the linear programming course. This is also reinforced by the results of observations in the table above that so far students are still using a variety of learning resources or a collection of several books to

find all the material contained in linear programming courses and lecturers are still the main source for learning. Lecturers are the main learning source with all their abilities, scientific insights, and skills, but students also need other learning sources that can increase their knowledge and train their independence in learning [8]. The incompleteness of learning resources is one of the main challenges that needs to be overcome to improve the quality of learning.

6. Buku Teks/Sumber Belajar yang ada saat ini mencakup seluruh materi pemrograman linear.
57 jawaban

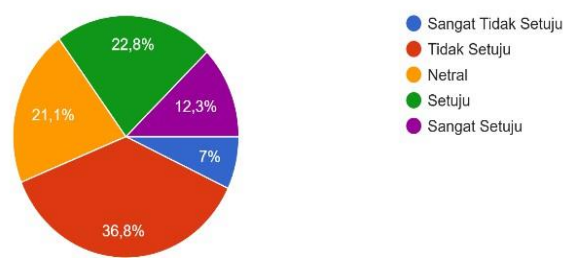


Fig. 2. The linear programming course

3. There are no textbooks/learning resources that are integrated with maritime affairs.
Based on the responses to the statement above, around 32 respondents stated that the books or learning resources currently used do not link learning material to maritime contexts or local wisdom. One motivation that can increase interest is through learning designs that familiarize learning with real-life or local wisdom. In other words, learning can be fostered through factual issues and conditions faced daily. For people in the Riau Islands, the maritime environment is the closest and most representative environment that they often encounter in their daily lives. Understanding learning from a perspective that is very close to their lives, will certainly make learning more meaningful and useful for them [9].

7. Buku Teks yang digunakan saat ini tidak terintegrasi kemaritiman atau kearifan lokal.
57 jawaban

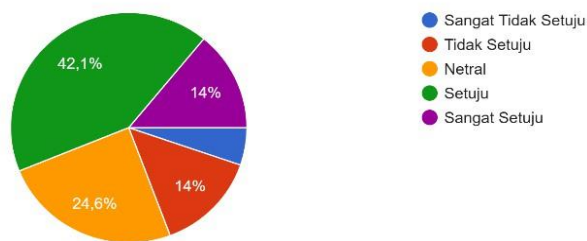


Fig. 3. The responses to the statement

The development of teaching materials can be a solution to students' needs as an alternative learning resource that provides convenience in practical, interesting learning and can be used for independent learning [10].

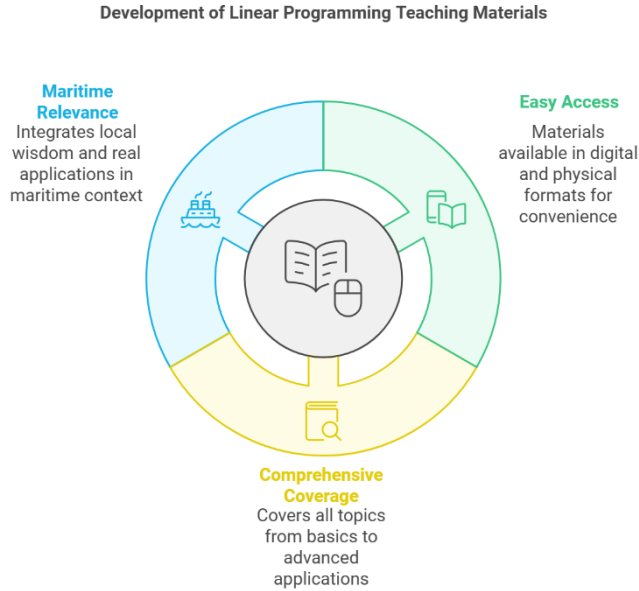


Fig. 4. The development of teaching

The findings of this study indicate an urgent need for the development of instructional materials for Linear Programming that cater to the learning needs of students, particularly in the context of mathematics education at higher education institutions. Based on interviews, questionnaires, and needs analysis, several key characteristics of the desired instructional materials were identified:

1. **Easily Accessible:** Students require instructional materials that are not only physically available but also provided in digital formats. Accessibility is crucial in this technological era, enabling students to utilize devices like laptops or smartphones for learning anytime and anywhere. Previous research, highlights the importance of digital instructional materials in supporting independent learning [11].
2. **Comprehensive:** The instructional materials should cover all topics taught in the Linear Programming course, ranging from basic concepts to advanced applications. This comprehensiveness ensures that students gain an in-depth and holistic understanding of the subject. Demonstrated that systematically structured and complete instructional materials significantly enhance students' conceptual understanding and analytical abilities [12].
3. **Relevant to the Maritime Context:** Integrating the maritime context is a primary need identified in this study. Students are expected to understand the application of Linear Programming in maritime fields, such as optimizing shipping routes, logistics distribution, or marine resource management. This approach not only provides local relevance but also fosters students' motivation through cultural wisdom and real-world applications. These findings align with who found that incorporating local wisdom into instructional materials increases student engagement in learning [13].

By developing instructional materials with these three characteristics, the Linear Programming learning process is expected to become more effective, relevant, and aligned with students' needs in maritime-oriented higher education institutions. This effort will not only improve students' competencies but also prepare them to apply their knowledge in real-

world contexts.

4 Conclusion

This study highlights significant challenges faced by students in accessing comprehensive and contextually relevant teaching materials for the Linear Programming course at Raja Ali Haji Maritime University. The findings indicate that the existing resources are fragmented and fail to cover all necessary topics, limiting students' ability to grasp the course content effectively. Additionally, the absence of maritime integration in these resources reduces their relevance to students' real-world environments in the maritime-based Riau Islands. To address these issues, the development of teaching materials that are comprehensive, accessible, and integrated with maritime contexts is essential. Such resources would not only enhance students' understanding of Linear Programming concepts but also increase their motivation and engagement by connecting learning to their everyday lives and future careers. Ultimately, integrating maritime elements into teaching materials aligns with the university's vision of fostering maritime-based education and prepares students for the challenges of a job market increasingly focused on real-world applications. These findings underscore the need for collaborative efforts in designing innovative teaching materials that support both academic success and regional development goals. Based on the research results, students face difficulties in accessing comprehensive learning resources for the Linear Programming course, with most finding it difficult to find textbooks that contain all the material. In addition, existing teaching materials do not yet integrate the maritime context, even though this is important to increase the relevance of learning and student motivation. Therefore, the development of teaching materials that are easily accessible, complete, and integrated with the maritime context is very necessary to support more effective learning and suit the needs of students at Raja Ali Haji Maritime University.

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