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Need Analysis of Student Worksheets Based on Case Method to Develop Problem-Solving Skills

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Abstract

Currently, the pharmaceutical mathematics class has implemented the case method. However, many students still experience difficulties in organizing problem-solving in solving problems offered in the form of case studies. 70% of students have not focused on the problems offered during learning activities due to the lack of guidelines for solving the problems discussed. Therefore, it is necessary to conduct a needs analysis of student worksheets based on the case method to develop problem-solving skills. This study employed a quantitative descriptive method, involving lecturers teaching the pharmaceutical mathematics course and 68 students of the pharmacy study program at Universitas PGRI Adi Buana Surabaya as the research samples. Data collection techniques used were interviews and questionnaires with percentage formulas. The results of the interviews indicate that lecturers need to create student worksheets based on the case method to direct the learning process. Moreover, the questionnaire results showed that students really need case method-based student worksheets as a guide in solving problems in case studies. This study is an initial study for the development of student worksheets based on the case-based pharmaceutical mathematics course to develop students' problem-solving skills.

Keywords: need analysis; student worksheets; case method; problem-solving skills.

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INTRODUCTION

Currently, mastery of the 6C skills – computational thinking, critical thinking, creativity, collaboration, communication, and compassion – is a competency that needs to be possessed by students and lecturers (Kembara et al., 2022; Munusamy & Gurusamy, 2023; Wang et al., 2021). Therefore, student-centered learning activities are expected to develop any necessary skills that students possess nowadays. The ideal learning activity (Nasution, 2022; Nur Fathonah et al., 2024; Samala et al., 2022) is a condition and situation where it does not only transfer knowledge from lecturers to students but can also provide space for students to build more applicable knowledge. Thus, the necessary skills to be developed by students, especially in solving problems faced by students (Leksono & Fitriatien, 2021; Sri Rahmawati Fitriatien, 2023) are higher-order thinking skills (Hamzah et al., 2022; Ichsan et al., 2019; Yerimadesi et al., 2023).

Active learning is created, trained (Rety et al., 2020), and honed through learning activities that involve peers in activities and discussions to train higher-

order thinking skills. Since students need higher-order thinking skills to analyze and solve existing problems, active learning might be the answer to forming students' higher-order thinking skills. Case method learning is an effective way to build problem-solving skills. Case method (Andayani et al., 2022; Bayona & Durán, 2024; Chumak et al., 2022; Puri, 2022; Servant-Miklos, 2019) is a participatory learning approach that uses discussion to address cases or problems. This method may help students enhance their critical thinking skills for problem solving (Mahdi et al., 2020; Siswati & Suratno, 2023), as well as their communication, collaboration, and creative abilities.

The case method provides an opportunity for students to show their self-actualization (Lara & Rivas, 2009), and develop their potential by innovating and finding solutions to cases discussed with peers. Students are challenged with real problems that require solutions to the cases being faced. Thus, students are expected to be able to develop their thinking skills to analyze problems, find solutions, and even create new solutions to problems being faced in everyday life (Bi et al., 2019; Gholami et al., 2021; Rezaee et al., 2022).

The case method focuses on learning experiences with realistic learning situations. The case method is a method that can be used to increase student participation (Asep, 2023; Puri, 2022; Salvador-García, 2021) in learning activities. This aligns with the 7th Higher Education Key Performance Indicators for collaborative and interactive classrooms. It is crucial for lecturers to develop learning experiences that encourage students to participate actively in their learning. Implementing the case approach in learning can boost learning innovation among students by enhancing their critical thinking skills and creating participatory or interactive learning based on discussions to solve situations (Fauzi et al., 2022; Mahdi et al., 2020; Popil, 2011; Purba et al., 2020; Ririen & Irawati, 2023). Furthermore, a similar study discovered that the use of the case method had a good influence on helping students to improve thinking skills in problem solving, intellectual skills, and autonomous learning (Widiastuti et al., 2022).

This study implemented case method-based learning in the pharmaceutical mathematics course for pharmacy students. As a prospective pharmacist, mathematics has a vital role (Fika, 2020; Hegener et al., 2013; Sharma & Yadav, 2023; Veronika & Cahya, 2015) in understanding and being able to apply mathematics in solving problems in the field of pharmacy. The implementation of learning in the pharmaceutical mathematics course currently has focused on problems presented in the form of mathematical models. However, students still experience obstacles in organizing the problems being discussed. The results of observations in lectures showed that 70% of students had not focused on the problems discussed. In other words, they seem to only follow discussion activities without contributing to problem-solving. Meanwhile, 30% of students focused on the material presented through PowerPoint slides. They had not yet focused on the cases and steps to solve the cases discussed. Thus, their ability to solve mathematical problems provided in the guise of pharmacy-related instances remained suboptimal. One of the problems was the lack of Student Worksheets, which could be utilized to solve situations in a systematic manner. Student worksheets should serve as a guide for students in the learning process to discover concepts through discussion activities carried out.

Student worksheets have been examined in previous studies to help students develop their creative thinking skills (Bashith et al., 2019; Istiqomah & Suparman, 2020; Nurcahyo & Fatmawati, 2022; Santika et al., 2019; Sari & Wulanda, 2019; Suprapto et al., 2023; Umriani et al., 2020). Prior research focused on designing student worksheets using case studies (Aneliana et al., 2022; Sinaga et al., 2023; Syafina & Suparman, 2019) and problem-based learning (Duyen & Loc, 2022; Putri & Admoko, 2022; Wahyuni & Kurniawan, 2019; Zidny et al., 2021). Meanwhile, this study focused more on the analysis of the needs of student worksheets based on the case method to develop pharmacy students' problem-solving skills focusing on concentration calculation material. A lesson plan based on the case method, which lecturers utilized to organize learning activities for the whole semester, supported the implementation of the case method in the pharmaceutical mathematics course (Hamida et al., 2021). The objective of this study is to ascertain what kind of case-method based student worksheets lecturers and students need in order to enhance their problem-solving skills. This is a preliminary survey to create student worksheets for the pharmaceutical mathematics course that are based on the case method.

METHODS

This study aims to improve students' problem-solving abilities by conducting a needs analysis of the case method-based student worksheets. This study employed a survey method on students from pharmacy study program of Universitas PGRI Adi Buana Surabaya from July to September 2024, using a quantitative approach. The sampling technique used was purposive sampling, involving 2 lecturers teaching pharmaceutical mathematics and 68 students of the pharmacy study program. Data were collected through interviews with lecturers teaching in the pharmaceutical mathematics course that had been carried out specifically related to the use of the case method and efforts to develop problem-solving skills in learning activities. Questionnaires were distributed to investigate students' needs for case method-based student worksheets to develop their problem-solving skills (Castellanos et al., 2009; Marbán & Fernández-Gago, 2022; Maulidia et al., 2019; Ozturk & Guven, 2016; Rennick & McKay, 2018; Schindler & Bakker, 2020; Unissa et al., 2018).

Table 1. Questionnaire for case method-based student worksheet needs analysis

No	Indicator	Description
1	Student response on the understanding concepts in learning pharmaceutical mathematics	1. Responses on the difficulty in understanding concepts. 2. Responses on the importance of problem-solving skills in the form of case studies.
2	Student response on difficulties in learning concentration calculation material	1. Responses to the concentration calculations material in the form of case studies. 2. Responses on the difficulty of learning the materials in the pharmaceutical mathematics course.

No	Indicator	Description
3	Student response on the application of case method-based learning to develop problem-solving skills	1. Responses on the ease of case method-based learning. 2. Responses on motivation in case method-based learning to develop problem-solving skills.
4	Student responses on the use of case method-based student worksheets	1. Responses on the importance of student worksheets in learning pharmaceutical mathematics. 2. Responses on case method-based student worksheets.

The data obtained from the interview were analyzed using a descriptive qualitative technique to obtain an overview of the lecturers' needs in pharmaceutical mathematical lectures. Meanwhile, the data from the questionnaire were analyzed using percentages. The percentages were categorized (Mashitoh et al., 2021; Nurhatmanti et al., 2021; Trilani & Sudihartinih, 2022) to find the needs of students on student worksheets.

Table 2. Student needs level categories

Percentage score	Needs category	Description
$0\% \leq x < 25\%$	Very low	Not necessarily needed
$25\% \leq x < 50\%$	Low	Not needed
$50\% \leq x < 75\%$	High	Needed
$75\% \leq x < 100\%$	Very high	Highly needed

RESULTS & DISCUSSION

This study was conducted by interviewing lecturers who taught in the pharmaceutical mathematics course to determine their needs for case method-based student worksheets. The interview revealed that during learning activities, lecturers used the case method in accordance with the semester lesson plan, which was aimed to promote collaborative and participative courses. The lecturers considered that the case method was perfectly suited to be used in the pharmaceutical mathematics course to offer students with the opportunity to enhance their abilities and potential in solving pharmacy-related issues that arise in everyday life. Case-based learning (Choi & Lee, 2009; Gholami et al., 2021; Koehler et al., 2020; Yoo & Park, 2015), entails realistic situations and the application of critical thinking skills to address challenges presented in the form of cases.

The lecturers realized that the use of the case method in pharmaceutical mathematics lectures was not optimal for only a few students were active and able to solve problems related to case studies, while other students were relatively passive in solving problems. The observation results show that 70% of students had not focused on the problems discussed during the lecture. Students were less motivated to answer lecturers' questions unless asked to answer by the lecturers. This shows that their ability to explain and bravery to argue directly during the learning process is still low. Case method (Danilin, 2021) can develop analytical skills, creative thinking, critical thinking, communication skills, practical skills, and social and reflective skills. The use of the case method in higher education classes can stimulate students to continue to think and innovate in solving problems faced during the learning process and in everyday life. As an effort to optimize the use of the case method in pharmaceutical mathematics lectures, the lecturer in charge

of the course considers it necessary for student worksheets to guide the students in discussion and in solving problems discussed in lectures.

Table 3. Need analysis on student worksheets for the first indicator

Description	Statement	Response (%)			
		Strongly Agree (SA)	Agree (A)	Disagree (D)	Strongly Disagree (SD)
Difficulty in understanding concepts	I feel enthusiastic to learn the concept of concentration calculation	59	40	1	0
	The concept of concentration calculation is easy to understand	24	69	7	0
	I do not know the concept of concentration calculation	0	4	71	25
The importance of problem-solving skills	The material of concentration calculation requires the ability to analyze problems	66	32	2	0
	Learning that involves the ability to analyze, evaluate, and create	38	53	9	0
	Memorizing the material studied	51	49	0	0
	Analyzing problems makes me lazy	0	0	47	53

Source: Primary data processed, 2024

The results of the questionnaire data analysis were presented in Table 3, indicating that the first indicator of student responses to understanding concepts in order to develop problem-solving skills in pharmaceutical mathematics courses for concentration calculation materials. This first indicator consisted of two descriptions, namely on the difficulty of understanding concepts and the importance of problem-solving skills.

Students showed an average score of 83% for the difficulty they had grasping the concepts. This demonstrates that the majority of students had no issue understanding the concepts covered in the pharmaceutical mathematics course. 40% of students were very motivated in learning the concept of concentration calculations, and 47% believed that the notion of pharmaceutical mathematics calculation is simple to understand. Meanwhile, 48 students disagreed that they did not know the concept of pharmaceutical mathematics because the concept was difficult to understand. In the second description regarding the importance of problem-solving skills in learning pharmaceutical mathematics, the average score was 87%. 45 students strongly agreed that the concentration calculation material required analytical skills, while 36 students agreed that learning involved the ability to analyze, evaluate, and create. 35 students strongly agree that they try to memorize the

material that has been studied, and 36 students disagree that analyzing problems makes them lazy to study pharmaceutical mathematics for concentration calculation material. It can be concluded that students have realized the importance of understanding concepts in order to develop problem-solving skills in learning pharmaceutical mathematics.

The second indicator of student responses toward the difficulty of learning the concentration calculation material is presented in two assessment descriptions. The first description concentrated on the concentration material which had an average of 77%. 49 students agreed that they understood the math, whereas 5 disagreed. Meanwhile, 44 students agreed that they could make concentrations and calculations with the formula that had been studied, but 13 other students did not agree with this. 48 students disagreed that they did not understand the relationship between the formula and the percentage of concentration calculation, but 6 other students agreed with it. The second description of the difficulty of learning the material of concentration calculation with an average of 84%, can be detailed from the first statement regarding the enthusiasm for studying the material independently that 37 students agreed with it. 36 students felt challenged to learn more about concentration calculation material, and 32 students disagreed. Out of 32 students who disagreed, 31 of them disagreed and ignored the material that had been studied. The details of the data are presented in Table 4 below.

Table 4. Need analysis on student worksheets for the second indicator

Description	Statement	Response (%)			
		Strongly Agree (SA)	**Agree (A)**	**Disagree (D)**	**Strongly Disagree (SD)**
Concentration calculation material	I understand the calculation studied	21	72	7	0
	I can make concentration calculations from the materials and formulas studied	16	65	19	0
	I do not understand the relationship between the material formula and the concentration calculation	0	9	71	20
Difficulty learning concentration calculation material	I feel motivated to study the material independently	40	54	4	2
	Concentration calculation material makes me want to study it further	44	53	3	0
	I ignore the material that has been studied	0	6	48	46

Source: Primary data processed, 2024

The third indicator measures students' responses to the application of case method-based learning to develop problem-solving skills, with the first description on the ease of

implementing case method-based learning obtained an average of 89%. Meanwhile, the second description indicates students' motivation in case method-based learning to develop problem-solving skills with an average of 84%. Details on the percentage of the third indicator questionnaire data are presented in Table 5.

Table 5. Need analysis on student worksheets for the third indicator

Description	Statement	Response (%)			
		Strongly Agree (SA)	Agree (A)	Disagree (D)	Strongly Disagree (SD)
Ease of implementing case method-based learning	Case discussions make it easier for me to understand the material	62	35	3	0
	The material is easy to understand because it is linked to daily events	74	25	1	0
	Case method learning is not suitable for pharmaceutical mathematics courses	0	3	62	35
Motivation in case method-based learning to develop problem-solving skills	I feel motivated to learn material related to everyday problems	54	46	0	0
	Case discussions create motivation for learning problem-solving skills	41	59	0	0
	I never learned further the problems that have been discussed	0	7	68	25

Source: Primary data processed, 2024

42 students strongly agreed that case discussions make it easier for them to understand the material on concentration calculations, while 50 of them strongly agreed that daily events associated with learning materials make it easier for them to understand the material. Meanwhile, 42 students disagreed that case method learning was not suitable to be implemented in the pharmaceutical mathematics course. This shows that case method-based learning makes it easier for them to learn. In the second description, 37 students strongly agreed and 31 students agreed that material associated with daily problems makes them motivated to learn. 40 students agreed that case discussion makes them feel motivated to learn problem-solving skills. However, 46 students disagree and the rest of the students

strongly disagree with the statement that students never learn further from the problems discussed in the lecture. From the third indicator, it was found that students are accustomed to case method-based learning and are motivated to develop problem-solving skills through pharmaceutical mathematics learning. This supports previous studies on the implementation of the case method in the taxation course which was found to be able to increase students' awareness of the importance of taxes (Hamida et al., 2021; Misra & Anggraeni, 2022). Furthermore, the case method is one of the learning method options that lecturers can use to train students' higher-order level thinking skills by actively discussion in groups and linking theory to cases around the students (Grenha Teixeira et al., 2019; Jennings et al., 2023; Qamar et al., 2016). The implementation of the case method indicates a positive influence, especially the increasing ability of the students to think and solve problems, their intellectual skills, and their autonomous learning (Besche et al., 2022; Bi et al., 2019; Danilin, 2021; Gholami et al., 2021).

The last indicator of the questionnaire is to investigate the students' responses to the use of case method-based student worksheets, consisting of two descriptions, namely the importance of student worksheets in pharmaceutical mathematics lectures and case method-based student worksheets which are presented in Table 6.

Table 6. A need analysis of student worksheets for the fourth indicator

Description	Statement	Response (%)			
		Strongly Agree (SA)	**Agree (A)**	**Disagree (D)**	**Strongly Disagree (SD)**
The importance of student worksheets in Pharmaceutical Mathematics Lectures	Student worksheets make the material easier to understand	38	60	2	0
	Student worksheets can be a guide in lectures that encourage independent learning	43	56	1	0
	Student worksheets only add to the workload	0	10	68	22
The importance of case method-based student worksheets	Cases or problems in student worksheets make it easy for me to understand the material	34	66	0	0
	Student worksheets based on the case method make me understand problems related to concentration calculations	35	56	9	0

Description	Statement	Response (%)			
		Strongly Agree (SA)	Agree (A)	Disagree (D)	Strongly Disagree (SD)
	Cases or problems make me too lazy to study them	0	5	54	41

Source: Primary data processed, 2024

In this fourth indicator, the first description obtained an average of 82% of students who feel the importance of student worksheets in pharmaceutical mathematics lectures, as seen from 41 students agreeing that student worksheets make the material easier to understand, 38 students agreeing that student worksheets are a lecture guide that encourages them to learn independently, and 46 students disagreeing that student worksheets only add to their work. The second description obtained an average of 83% of students agree with the case method-based worksheet. This can be seen from 45 students agreeing that the cases in the student worksheet make it easy for them to understand the material, 38 students agreeing that the case method-based student worksheet understands the problems related to concertation calculations, and 37 students disagreeing that the cases make them lazy to study. It can be concluded that students understand the importance of student worksheets in lectures, especially case method-based student worksheets to develop problem-solving skills. The response to the last statement shows that students need case method-based student worksheets to develop problem-solving skills in pharmaceutical mathematics courses, as presented in Table 7.

Table 7. Conclusion of student worksheet needs analysis questionnaire data

Indicator	Percentage (%)	Category	Description
1	85	Very high	Highly needed
2	80,5		
3	86,5		
4	82,5		
Needs analysis average	83,63		

Source: Primary data processed, 2024

Based on the results obtained from the four indicators of student worksheet needs analysis, it shows that the average percentage of achievement for the student worksheet needs analysis questionnaire was 83.63% with a very high category. The average obtained indicates that the need for student worksheets for pharmaceutical mathematics courses was very much needed to develop problem-solving skills for students of the pharmacy study program at Universitas PGRI Adi Buana Surabaya applied to the pharmaceutical mathematics course. Student worksheets are needed to support learning (Maulana & Sopandi, 2022; Rifandi et al., 2023; Siregar et al., 2023; Utaminingsih et al., 2021). Furthermore, previous studies on the development of student worksheets containing learning syntax suggests that student may become more independent in identifying concepts that can improve their learning outcomes (Asep, 2023; Qamar et al., 2016). In contrast, one study discovered that creating student worksheets can help students overcome learning challenges, particularly with problem-solving skills (Mutiasari et al., 2023).

CONCLUSION

The results of the study indicate that lecturers and students of the pharmacy study program at Universitas PGRI Adi Buana Surabaya need student worksheets based on the case method to develop problem-solving skills in the pharmaceutical mathematics course. Thus, this study can be a reference for the next stage of further study in developing student worksheets based on the case method to optimize learning with the method that can teach problem-solving skills that have been tested for validity, practicality, and effectiveness in pharmaceutical mathematics lectures in the pharmacy study program at Universitas PGRI Adi Buana Surabaya.

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