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Analysis of Student Learning Media Needs in Object-Based Programming (OBP) Subjects

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Abstract

Object-Oriented Programming (OOP) is a fundamental course in computer science, particularly in software and application design. However, programming is often perceived as challenging by many students. Effective learning should stimulate creativity, actively engage students, achieve learning objectives effectively, and occur in conducive environments. One strategy to achieve this is by utilizing learning media tailored to students' needs. This study aims to analyze university students' needs in learning Object-Oriented Programming. A qualitative approach was employed using a case study method. The study examined students' perceptions of pair programming in OOP courses at the University of Muhammadiyah Sidoarjo (UMSIDA) within the Information Technology Education (PTI) program. The findings indicate that students predominantly use PCs or laptops for programming and require digital learning media to enhance their learning experience. They prefer materials that provide clear instructions and commands and are more comfortable with media that integrate text and visual elements. The analysis reveals a need for e-modules designed specifically for laptops/PCs, incorporating images, text, and detailed instructions for effective programming learning.

Keywords: students need, learning media, object-oriented programming

INTRODUCTION

Programming competence is a competency that must be mastered by students of the Information Technology Education Study Program (PTI) at Muhammadiyah University of Sidoarjo. One of the courses prepared so that students can master programming competencies is the Object-Based Programming (OBP) course. Object-based programming plays an important role in improving programming competencies by offering a balance between memory efficiency and security. Understanding object-oriented programming, particularly object interaction, is essential for programming competence (Bennedsen 2014). Novice programmers often struggle with OOP concepts, especially when learning technical languages (Malik et al. 2022). Object programming provides benefits such as increased productivity, code reuse, and better complexity management, thus fostering a healthy programming style (Hopper 1994). By mastering object-based programming, programmers can efficiently manage memory, optimize resource usage, and develop a structured approach to problem solving, thus improving their overall programming competency.

The Object-Based Programming (OBP) course is very important in the context of higher education and the technology industry because it provides a solid foundation for students to understand modern programming concepts that focus on

objects and classes (Taurusta, Astuti, and Hasanah 2020). By introducing concepts such as encapsulation, inheritance, and polymorphism, OBP supports scalable and structured software development, enables reuse of existing code, increases productivity in application development, and facilitates effective teamwork in complex software development (Batiha et al. 2023). In addition, proficiency in PBO is becoming a key competency sought after by the technology industry, helping students to enter the workforce well-prepared and supporting innovation and the development of new technologies.

Students often face challenges when learning object-oriented programming (OOP) due to its complexity and abstract nature. Research shows that students find OOP courses very difficult, leading to demotivation in learning programming (Batiha et al. 2023). Object-oriented programming courses are considered one of the most difficult courses at the undergraduate level, requiring significant effort to master the subject matter. Common problems identified in teaching and learning OOP include difficulties in understanding object orientation, classes, and object-oriented relationships. To overcome these challenges, strategies such as using active learning techniques, emphasizing basic programming concepts, and introducing the object-oriented paradigm early in the curriculum have been recommended (Gutiérrez, Guerrero, and López-Ospina 2022). Efforts to improve the learning experience include developing teaching tools that incorporate visualizations and analogies to help students overcome barriers and misconceptions in learning OOP concepts effectively.

Appropriate learning media plays an important role in supporting the teaching and learning process, especially in subjects such as OBP (Object Oriented Programming) which is very important in IT education. The use of appropriate learning media can improve students' engagement, understanding, and learning outcomes (Taurusta et al. 2020). Object-based learning media, such as interactive experiences with tangible objects, can significantly aid students in learning (McGowan, Hoffstaedter, and Creese 2022). Employing haptic perceptual styles through object-based learning enhances student engagement, satisfaction, knowledge retention, and critical thinking skills (Krismadinata et al. 2023). Additionally, utilizing collaborative programming platforms like Media Wiki can reduce the level of abstraction in object-oriented programming courses, leading to improved programming achievement and collaboration skills (Kusumah 2023). Interactive learning media, integrated into Learning Management Systems, can facilitate two-way communication between teachers and students, enhancing the online learning process(Sari, Ridhani, and Dewi 2022). Moreover, video-based learning media for Basic Programming classes have shown practicality and effectiveness in increasing student interest and comprehension (Batiha et al. 2023). These findings collectively suggest that object-based programming learning media can indeed be instrumental in supporting students' learning processes across various educational contexts.

The diversity of individual abilities and other factors that influence students' needs in using learning media are important aspects in the educational environment (I Gde Putu Agus Pramerta, et al., 2022; Putri and Sugiman 2019; Lempas and Soenarto 2021; Trisna Herawati and Sinarwati 2019). Different learning media, such as beads and number cards for math concepts, can cater to diverse learning styles and enhance problem-solving experiences (Al-Hajri et al. 2011). Research

emphasizes the importance of multimedia in improving soft skills, showing that students benefit more from multimedia-based learning compared to traditional print media. Media needs analysis underscores the importance of aligning media characteristics with student profiles to increase the effectiveness of the learning process. Factors such as cognitive style, gender, prior knowledge and culture play an important role in designing a multimedia learning system that accommodates the different needs and abilities of students.

Research on the importance of using and developing learning media in object-based programming courses has been widely conducted (Taurusta et al. 2020; Wiguna, et al., 2023; Zakhia and Dermawan, 2021; Miftah 2018; Kusumah 2023). However, research in analyzing student needs in learning media had widely conducted (Saputri and Fransisca, 2020; Endriaswedi, et al., 2022; Yunus and Fransisca 2020; Tambunan, 2021; Shofa, et al., 2020), but there is no research that focuses on analyzing student needs for media development in object-based programming courses. This research aims to explore the needs of students on learning media in object-based programming courses. This research is expected to be a study of student needs in the development of OBP learning media in the future.

METHODS

This research uses a qualitative approach with a case study method. Researchers analyzed the needs of students in learning in object-based programming courses. This research will describe the analysis of the needs of Information Technology Education students for learning media in the Object-Based Programming course. The presence of the researcher acts as a key instrument during data collection, as well as a planner, as a data collector, as data analysis, as data interpretation, and as a reporter of research results.

This research was conducted at the University of Muhammadiyah Sidoarjo (UMSIDA) on students of the Information Technology Education Study Program (PTI) who were teaching Object-Based Programming courses. The data in this study were obtained from the results of extracting students through a researcher approach. The data obtained is the result of extracting from students is the main data source of qualitative data. Qualitative data in this study consisted of student behaviors, descriptions of learning media needs, student learning styles, and learning media preferences. Subjects/informants are determined by purposive sampling technique. The informants that will be used in this research are PTI students who are teaching Object-Based Programming courses, which are described in Table 1.

Table 1. Data Subjects and Data Sources

Class	Number of Subjects
A1	7

The data collection techniques used by researchers are interviews, observations, documentation, and triangulation. The instruments used in this research are interviews, document studies, and observations. The flow of individual case data analysis can be seen in Figure 1

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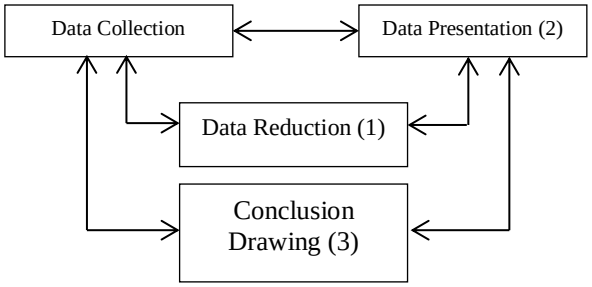

Figure 1. Flow of Individual Case Data Analysis

Initial Preparation Stage

a) Research planning, identification of the problem to be studied, and preparation of the research framework.
b) Selection of research locations based on relevant theoretical considerations, as well as in-depth research to understand the focus and formulation of the problem.
c) Selection of informants in accordance with the research objectives.
d) Preparation of equipment and materials needed for research.
e) Maintaining good relations with the research environment and paying attention to local norms and customs in dealing with the research situation.

Field Implementation Stage

Before using the research instruments, discussions will be held with experts in the field of information technology education. Data validity in this study is planned to be tested through follow-up observations and triangulation with other informants who have an understanding of the topic.

RESULTS AND DISCUSSION

The purpose of the interviews in this study was to find out the perceptions of students in the implementation of pair programming in the Basic Programming course. The interview was conducted on December 20, 2022. The list of interview questions related to student perceptions in the implementation of pair programming is shown in Table 2.

Table 2. Interview Questions

No	Questions
1	What gadget do you prefer to use to learn Programming?
2	In learning programming, do you need the help of learning media to learn?
3	How do you like to learn programming subjects?
4	What are your preferences in learning media selection?
5	What elements of learning media for programming do you need?

Interviews on the first question that was conducted on December 20, 2023 to 7 students who have been selected get the results as in Table 3 as follows:

Table 3. Interview Questions

Student	Answer
1	PC or Laptop
2	It's better to use a PC
3	Laptop
4	Use Laptop
5	Comfortable to use Laptop
6	Use Laptop
7	Laptop

Based on the results of interviews on the first focus question, about the preference for using gadgets in learning programming, all students prefer to learn using a PC/Laptop when learning programming. Students stated that they are more comfortable learning programming with a laptop. Students like learning with laptops because they find that laptops/PCs have a larger layer feature that makes it easier for them to read lines of code that consist of a lot of text. In addition, Laptop/PC performance is still the best compared to other gadgets.

This finding is in line with Patel's research (Patel, 2021) which states that laptops are the main choice for students to learn programming. In addition, Alsaggaf (Alsaggaf et al., 2012) in his research stated that students prefer to use laptops for programming lectures due to increased motivation, interactivity, and speed control. The use of laptops is positively received, thus enhancing the learning experience. Jordaan (Jordaan 2014) found that computer science students prefer to use laptops and tablets rather than mobile phones to learn programming, as shown by their positive attitude towards technology in the classroom.

The interview on the second question, "in learning programming, do you need the help of learning media in learning?" which was conducted on December 20, 2023 to 7 students who have been selected to get the results as in Table 4 as follows:

Table 4. Second Question Answer

Students	Answer
1	Yes, I Need that
2	Need learning media to study at home
3	Need learning media very much
4	I need learning media
5	Yes, I need learning media
6	It's better if I had learning media
7	No, I can find references on the internet

Based on the results of interviews on the second focus question, namely about in learning programming, do you need the help of learning media to learn, 6 students stated that they needed the help of learning media in learning programming. 1 student stated that they did not need learning media because these students could find learning resources or materials from the internet. The finding states that the majority of students need the help of learning media in learning programming.

This finding is in line with Hutabarat's research (Vinet and Zhedanov, 2011) which states that the use of interactive learning media increases the effectiveness of programming learning by visualizing abstract concepts and involving students in the process. In addition, Araujo (Araujo, et al.,2018) in his research found that learning programming through media, such as image creation, increases student

motivation and understanding. Contextualizing programming with media tools has a positive impact on learning outcomes and student engagement.

The interview on the second question, namely "How to learn in the subject of programming that you like?" which has been conducted on December 20, 2023 to 7 students who have been selected to get the results as in Table 5 as follows:

Table 5. Third Question Answer

Students	Answers
1	When learning programming, it's better to read
2	It's better to read
3	Reading
4	I Enjoy Reading
5	I Prefer to read
6	I Prefer to read, because watching video tutorial is confusing
7	I Prefer Reading

Based on the interview results on the third focus question, regarding how students' learning preferences in learning programming, all students stated that they prefer reading in learning programming. This means that the reading method is the preferred method for students in accessing learning resources for programming competence. Some reasons students prefer reading over other methods is that reading does not cause confusion when accessing learning resources.

This finding is in line with Lopez-Pernaz's research (López-Pernas, et al., 2021) which found that Students prefer reading slides to searching, copying, and pasting when learning programming. Videos are consumed less, and forums are used when struggling, in accordance with the research. In addition, Endres research (Endres et al. 2021) found that technical reading training showed larger programming ability gains than spatial training in novice programmers. Reading trained participants excelled in tracing through code, suggesting reading material can benefit learning programming.

The interview on the second question, namely "What are your preferences in the selection of learning media?" which was conducted on December 20, 2023 to 7 students who have been selected to get the results as in Table 6 as follows:

Table 6. Fourth Question Answers

Students	Answers
1	Module
2	Learning Modules
3	E-Modules
4	Module
5	E-Module
6	E-Module Media
7	Learning Module

Based on the interview results on the third focus question, regarding What are your preferences in the selection of learning media, all students stated that they prefer modules as learning media to help them learn programming. Digital modules are the students' choice. This is because students want to access learning media using a PC/Laptop. This finding is in line with Hasanah's research (Taurusta et al., 2020)

which states that students need E-Modules in object-based programming courses. In addition Ningtyas and Jati (2018) found that students need e-modules in learning programming based on the project-based learning method.

The interview on the fifth question, "What elements in the programming learning media do you need?" which was conducted on 20 December 2023 to 7 students who have been selected to get the results as in Table 7 as follows:

Table 7. Fifth Question Answers

Students	Answers
1	Text
2	Text
3	Text
4	Text and Image
5	Image text
6	Image text
7	Text and image

Based on the interview results on the third focus question, namely regarding What elements in the programming learning media do you need, all students stated that they need text elements in the learning media. In addition to text, some students also need image elements to be able to learn programming well. This shows that in learning programming, students need text and image elements in their learning media.

This finding is in line with Su's research which states that students need elements of text and images in learning object-based programming. The Visualized OOP Learning Tool combines visualized objects and operations to aid in understanding OOP concepts effectively. In addition, Cheung in his research also found that students benefit from a text-enhanced graphical programming environment that combines text and images to facilitate learning object-based programming effectively. Kaasboll in his research also found that students benefit from visualizing objects in programming environments to reduce complexity, indicating that elements of text and images aid in learning object-oriented programming.

CONCLUSION

Students prefer using PCs/laptops as their primary learning tools for Object-Based Programming (OBP) courses. They recognize the need for effective learning media to support their programming skills. The majority of students emphasize their preference for reading and accessing material, which indicates a strong need for e-modules as a primary learning resource in OBP courses. Additionally, students highlighted the importance of incorporating text and image elements in the learning media they use. Based on these findings, it is clear that students require e-modules that contain both text and visual elements to enhance their learning experience in OBP courses.

Further research could explore the development and effectiveness of specific e-module designs tailored to different programming courses. Additionally, investigating the long-term impact of using digital learning media, such as e-modules, on students' performance and engagement in OBP courses could provide valuable insights. Research could also explore how different types of media (e.g.,

interactive media or video-based content) affect students' learning preferences and outcomes.

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