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Digitalization of Cashiering: An Exploratory Study of Students' Experiences in Developing Problem-Solving Skills

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ABSTRACT

Although digital transformation has become increasingly relevant in vocational education, there is still a lack of studies that explore how technology-based, problem-oriented projects enhance students' practical skills, especially in real-world MSME contexts. This research aims to explore students' experiences in developing problem-solving skills through the creation of cashier digitalization systems for Micro, Small, and Medium Enterprises (MSMEs) using a Problem-Based Learning (PBL) approach. This qualitative exploratory study involved interviews, observations, and documentation, with data analyzed using the Miles and Huberman model. The findings reveal that students successfully identified key problems such as unstructured manual transaction records, frequent calculation errors, and the absence of simple financial reporting in MSMEs. Their solution cashier systems built using Microsoft Excel VBA provided automated transaction processing, stock tracking, and printable reports tailored to each MSME's operational needs. The PBL process supported the development of students' critical thinking, technical, and collaborative skills, while also contributing to increased digital literacy among MSME partners. Beyond educational outcomes, the project also introduced MSMEs to accessible and low-cost digital tools, encouraging early steps toward broader digital transformation. This demonstrates that PBL can not only enhance learning but also deliver meaningful community impact, especially in improving operational efficiency and long-term financial management for MSMEs.

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1. INTRODUCTION

Education for adults requires a learning approach that aligns with their characteristics and needs. Andragogy, as a theory of adult learning, emphasizes the utilization of students' life

experiences and the relevance of learning materials to real-life contexts (Lubis, Sari, Lubis, & Margolang, 2024). According to Knowles (1980) adult learning should focus on internal motivation, experience-based learning, and practical application in daily problem-solving. In higher education, especially in applied or vocational courses, these principles are essential, as students bring diverse backgrounds and social contexts that affect how they absorb and apply knowledge.

One widely recommended approach to address these needs is Problem-Based Learning (PBL), which encourages students to engage actively in solving real-life problems, thus developing critical thinking, collaboration, and problem-solving skills (Papilaya & J. Tuapattinaya, 2022). Previous studies have affirmed that PBL fosters reflective and creative thinking, key elements in problem-oriented learning (Yew & Goh, 2016).

In the context of Accounting Information Systems (AIS), PBL provides students with opportunities to not only understand theoretical accounting concepts but also apply them practically in real business settings (Hidayati, Susilawati, & Harjono, 2021). While financial recording has been a common subject in accounting education, previous research has generally utilized manual bookkeeping methods or commercial accounting software. Some studies, such as H. Rahman, (2019) and (Adriant, Dewi, & Lestari, 2024), have explored the use of Microsoft Excel with VBA Macros in developing simple financial applications for MSMEs. These works show positive outcomes in terms of student engagement and technical competence. However, studies that specifically examine how PBL can be integrated with VBA-based cashier system projects to enhance students' problem-solving skills remain limited. Thus, this study positions itself to fill that gap by exploring how students experience and grow through a real-world cashier digitalization project using PBL.

Implementation of the Problem-Based Learning (PBL) approach, students taking the Accounting Information Systems (AIS) course are given the task of developing a Microsoft Excel Macro VBA-based cashier application for MSMEs. This project aims to provide practical solutions to the challenges of MSMEs in recording financial transactions manually. Using Macro VBA, students can design a system that automatically records transactions, manages stock, and produces simple sales financial reports. This assignment not only deepens the understanding of accounting concepts but also hones students' technical skills in dealing with real problems in the professional world (Barkah, Farida, & Yasmin, 2024;Ulfa & Laily, 2023).

One of the main challenges faced by many Micro, Small, and Medium Enterprises (MSMEs) in the city of Tegal particularly small businesses that still operate using manual cashier systems is the difficulty in recording financial transactions accurately and efficiently. Many of these MSMEs still rely on manual cash flow records, which are not only time-consuming but also prone to miscalculations and data loss (Hamise, Maharibe, & Lintong, 2020). In contrast, the rapid advancement of technology, particularly in the realm of business digitalization, demands that these enterprises shift to more automated systems to improve operational accuracy and efficiency.

To address these challenges, students enrolled in the Accounting Information Systems (AIS) course from the D3 Accounting Study Program at Politeknik Harapan Bersama were assigned to develop a cashier application using Microsoft Excel Macro Visual Basic for Applications (VBA). The project was implemented by partnering with selected MSMEs located in the Tegal city area. The use of Excel VBA not only offers time-saving benefits in transaction processing but also enables students to apply their academic knowledge in real-life contexts, thereby preparing them for future professional challenges. Through this activity, students contribute directly to MSMEs by offering efficient and effective solutions for transaction recording, while also enhancing the financial management practices of these enterprises (Adriant et al., 2024).

After one semester of learning, an evaluation was conducted to explore students' learning experiences in developing problem-solving skills through the cashier digitalization project. The project provided students with a practical opportunity to design technological solutions aligned with the needs of MSMEs, particularly in the areas of transaction documentation and basic financial reporting. The evaluation examined not only students' technical competencies in creating Excel VBA-based systems but also their ability to manage time, adapt to field constraints, and develop effective and user-friendly applications.

This exploratory study seeks to understand how real-world projects like cashier digitalization can develop students' problem-solving skills and how such experiences enhance their learning process while contributing meaningful solutions to the community.

2. METHOD

Qualitative research with an exploratory study approach aims to deeply understand certain phenomena that have not been widely studied before, by exploring the views, experiences, and perceptions of participants (Creswell & Poth, 2013). This research was conducted on students of the D3 Accounting Study Program at Politeknik Harapan Bersama, specifically those enrolled in classes 4A and 4B who were taking the Accounting Information Systems (AIS) course. The project was implemented over a period of half a semester, comprising seven class sessions, during which students were assigned to develop a cashier application for selected MSMEs (Micro, Small, and Medium Enterprises) in the Tegal city area.

The project delivery involved a structured process starting from group formation, field surveys to partner MSMEs, problem identification, system design using Microsoft Excel Macro VBA, and continued with testing and evaluation of the application. Each session was conducted under the guidance of lecturers through interactive class activities and consultations. The focus of this study is to explore how students' involvement in this real-world project contributed to the development of their problem-solving skills, particularly in terms of technological proficiency, practical application, and analytical ability in the context of digital transformation in MSMEs. These key aspects will be further elaborated in the Results and Discussion sections, providing deeper insight into the learning outcomes and challenges faced by students throughout the project.

This study uses primary data obtained directly from students through various data collection techniques, namely in-depth interviews, documentation, and observation during the implementation of the cashier digitization project. (Sugiyono, 2017) (Firman, et al., 2024). Interviews were conducted to explore students' experiences, views, and reflections, while documentation was used to analyze records related to the project process, such as reports and work results. The observation technique was conducted to directly observe students' involvement in solving problems during the project.

While triangulation is inherent in the use of multiple sources, this study explicitly applies methodological triangulation by cross-checking data obtained from interviews, documentation, and observations to ensure the validity of findings. When discrepancies arise—such as inconsistencies between student narratives and actual observations—researchers will revisit the documentation and use comparative analysis to resolve them. The triangulation process will not only strengthen the credibility of the findings but also enable the researchers to gain a more comprehensive understanding of the phenomena under study. The data collected were analyzed using the Miles and Huberman model data analysis method. Miles, Huberman, & Saldaña (2014), which includes three main stages: data reduction, data presentation, and conclusion or verification. This process was iterative to ensure accuracy and depth of analysis. (Hasan, 2022).

3. RESULTS AND DISCUSSION

3.1 Results

The results of this study refer to the stages of Problem-Based Learning (PBL) (Ertmer & Glazewski, 2018; Hmelo-Silver & Eberbach, 2019; Savery, 2015) Related to the cashier digitalization project, which is designed to develop the problem-solving skills of students in class 4A and 4B D3 Accounting of Harapan Bersama Polytechnic. At the orientation to problem stage, students are introduced to the challenges of implementing digital cashier technology. Through the organization-to-learn stage, they work in groups to formulate strategies, followed by independent or group investigations to gather supporting data and information. The solution development stage becomes the core of the project, where students design a digital cashier system, elaborate on the results, and receive feedback. Finally, through the reflection stage, students embark on a learning process to strengthen problem-solving skills relevant to the world of work.

3.1.1. Problem-oriented, Digital Implementation Challenges

In this activity, students are grouped into small teams of 4-5 people, with each group tasked with assisting one MSME. The selected MSMEs are exempted. At the initial discussion stage, students began to discuss the conditions of MSMEs, such as ineffective manual transaction recording, frequent calculation errors, and unstructured financial reports. One of the students said in the discussion:

"Well, if it continues like this, it will be difficult for MSMEs to grow. We have to find solutions that are easy for them to use."

This discussion encourages students to be more critical in understanding the problems faced by MSMEs and come up with various creative ideas to help them.

During the discussion, the atmosphere was lively with various arguments being thrown at each other. There were students who proposed to use a cashier application that was already available in the market, but other members realized that it might be too complicated and expensive for small MSMEs.

"Why bother using expensive applications? We better make it using Excel VBA, it's cheaper, simpler, and we can set it according to us, tailored to the needs of MSMEs," said one of the students" (researcher observation during discussion).

This interaction not only demonstrates their ability to think critically but also builds cooperation in developing applicable solutions. This approach is in line with the findings. Hasibuan (2021), Zulfikar (2020) and Ulfa & Laily (2023), which states that Excel VBA-based solutions are very suitable for MSMEs with limited resources.

At the end of the discussion, each group agreed that the best solution was to create a Macro VBA-based cashier application according to what the lecturer taught in the AIS Practicum course. Students realize that features such as transaction automation, data validation, and fast financial reports can be an added value for MSMEs. A student said:

"It's best to use VBA, they don't need to buy expensive software, and we can help set it up so it's easy to use. We just make it according to their needs, so it's not complicated and can work immediately. If there's a problem, we can also help with troubleshooting, so they don't depend too much on the given software."

This is corroborated by the findings. Rahman (2019) which shows that the use of VBA is able to improve the operational efficiency of MSMEs without burdening them financially. This

agreement not only reflects students' understanding of the problems faced by MSMEs, but also their success in applying theory to create practical and relevant solutions.

3.1.2. Organization for Learning and Group Investigation

At the organizational stage of learning, students conduct direct surveys of MSME locations to understand how daily operations are carried out, including how transactions are recorded, stock management, and report preparation. One of the students explained to the researcher:

"When we look at MSMEs, they still use notebooks for daily transactions. If there is a miscalculation, the owner is confused about where to find the mistake."

This is in line with the findings. Yusuf (2020) Which states that many MSMEs still rely on error-prone and time-consuming manual recording.

After the survey was completed, the students discussed again to develop a solution that suits the needs of MSMEs. In the discussion, they agreed to make a cashier application based on Ms. Excel Macro VBA because it was considered simpler, cheaper, and more applicable. Based on the researcher's observations, a dynamic discussion took place with students exchanging ideas to ensure that the solution they designed was really on target. Some students seemed enthusiastic in expressing their opinions, while others asked questions to improve the application design. One of the moments observed was when students actively explained how VBA features could be adapted to the specific needs of MSMEs, such as automating transaction recording and creating simple reports. This approach supports Rahim & Fauziah's (2021) research, which emphasizes the importance of digital solutions that are easy to use and relevant to the specific needs of MSMEs.

Moving on to the group investigation stage, at this stage the group compiled the cashier application business process. Students began to design a workflow for recording transactions and creating simple sales reports. They also prepared an Excel template as the basis for the application plan. The division of tasks is done fairly, all children get their respective tasks, such as documenting the required features, making workflow plans, or preparing materials for consultation with lecturers. When asked about the results of their observations in MSMEs, one of the students said:

"MSME owners want it to be easy to use, not complicated, if possible there is a sales report."

Each group also conducts regular consultations with the lecturer in each lecture schedule to get input. Research Hakim & Ramdani (2019) supports this process by stating that group discussions and intensive consultations with supervisors can increase student creativity in designing practical and efficient solutions. This process ensures that the solutions designed by students not only fit the needs, but are also realistic to be implemented in MSMEs.

3.1.3. Development and Problem Solving, Cashier Digitalization is the Solution

At this stage, students begin to develop the Ms. Excel Macro VBA-based cashier application that they have designed according to the needs of MSMEs. This process begins with the initial build-up of the system, where students arrange the layout of the cashier application, including the design of tables containing input forms, item data, and sales report displays. During this process, students were seen sharing tasks and helping each other. One of the students when interviewed said:

"At first we were confused about where to start, but when we divided the tasks and started working together, it became easier. Those who are good at Excel did the formatting, those who know VBA started to enter the script."

They then entered Excel formulas to automate calculations, such as transaction totals, discounts, and taxes, before finally integrating VBA Macro features for data validation and automatic sales receipt report generation. Students became increasingly enthusiastic as the features they developed began to function properly, demonstrating how they were putting their theoretical understanding into practice. This process is in line with the research. Rahman & Wicaksono (2020), which found that the application of Excel Macro VBA in small businesses can improve the efficiency of recording transactions and reduce input errors, making it easier to manage MSME finances.

Hidayat & Saputra (2022) Emphasized that problem-based learning improves critical thinking and problem-solving skills, especially in the context of technology-based application development. From the observations of the lecturers, students showed solid teamwork skills and supported each other in completing this project. The lecturer noted:

"They don't just focus on their respective parts, but also actively discuss and test the features that have been created. If something goes wrong, they immediately find a solution together."

This shows that students are not only honing their technical skills in using Excel and VBA but also practicing problem-solving and collaboration skills. Prasetyo & Lestari (2021) also stated that learning that implements technology-based projects, such as the creation of simple applications, can improve students' understanding of the application of digital solutions in the industrial world, which is important for their career preparation. In the process of completing the application, students faced several technical obstacles, such as VBA scripts that did not run/errors and errors in data input validation. However, by discussing and trying different ways, they managed to find solutions to the problems that arose, showing how this learning can train students' resilience and adaptability in facing technological challenges.

Presentation and Evaluation

Each group conducted a limited trial of the Ms. Excel Macro VBA-based cashier application that they had designed in their respective MSMEs. Students conduct tests and ensure that the features developed can function properly. After the application is proven to run as needed, students then compile an activity report that includes the design process, implementation, and challenges faced during development. Next, each group printed their report results to be collected. After the report collection, a presentation session followed. During the presentation session, students from other groups were allowed to ask questions, provide input, and share experiences related to the challenges they faced during the development process. From the lecturer's observation, students seemed active in discussing and criticizing each other's solutions. The lecturer took notes:

"I saw students not only reflecting on their work, but also being able to take criticism and suggestions well, and showing a deeper understanding of the solutions they developed."

This evaluation helps students refine their solutions, as revealed. Widodo & Pratama (2023), that the application of Problem-Based Learning can improve students' critical thinking and problem-solving skills through evaluation-based discussions.

3.1.3. Reflection and Closure, Perfecting the Process

At the end of the series of lessons, students reflected on their experience in developing a cashier application based on Ms. Excel Macro VBA, discussed the technical challenges faced, and how they found solutions through discussion and collaboration. Lecturers observed that students not only completed the project according to the needs of MSMEs but also showed improvement in critical thinking skills and independent problem-solving. This is in line with the research. Suryadi & Kusuma (2022), which confirms that the Problem-Based Learning approach is effective in building students' analytical and collaborative skills in solving real-world problems.

3.2 Discussion

The implementation of the cashier digitalization project was carried out over seven structured learning sessions. Referring to the stages of Problem-Based Learning (PBL) as outlined by Ertmer & Glazewski (2018), the study observed how students' problem-solving skills evolved at each phase:

Table 1. PBL Stage and Student Development Summary

No.	PBL Stage	Student Activity	Skill Developed
1	Orientation to Problem	Identify MSME cashier problems	Critical thinking
2	Organization to Learn	Group formation, field survey to MSMEs	Team collaboration
3	Group Investigation	Workflow design & task division	Analytical & planning skills
4	Solution Development	System development using Excel VBA	Technical & coding skills
5	Presentation & Evaluation	Testing application, reporting, and presentation	Evaluation & feedback processing
6	Reflection	Reflection and discussion on learning outcomes	Self-assessment & problem-solving

Table 1 summarizes the six stages of the Problem-Based Learning (PBL) process experienced by students throughout their involvement in developing a digital cashier system for MSMEs. Each stage is linked to specific student activities and skill development outcomes that reflect their engagement with real-world problem-solving. In the initial phase, students focused on identifying issues in manual transaction recording, encouraging critical thinking. This was followed by group formation and field visits to MSMEs, which fostered teamwork and contextual understanding of user needs.

Students then moved to workflow design and task distribution, sharpening their analytical and planning skills. The solution development stage served as the core of the learning process, where students built an Excel VBA-based cashier application, directly applying technical knowledge. This was followed by testing and presentation sessions, where students practiced evaluation and response to feedback. Finally, the reflection stage enabled students to assess their learning journey and the challenges faced, further enhancing self-evaluation and problem-solving competencies. The table illustrates how a structured PBL approach, when applied in a technology-driven context, serves as an effective and meaningful method for student skill development.

3.2.1 Short-term, High-impact

The findings demonstrate that the use of the Problem-Based Learning (PBL) approach within the Accounting Information Systems course offers significant pedagogical value. Through real-world applications and collaboration with local MSMEs, students not only understood theory but also translated it into practical solutions. Their ability to design Excel VBA-based cashier systems tailored to user needs shows deep integration of conceptual and technical competencies.

These results align with previous studies, Hasibuan (2021); A. Rahman & Wicaksono (2020), which found that VBA macros are practical tools for MSMEs due to their low cost and flexibility. Likewise, the collaborative and solution-oriented learning observed supports the research by Prasetyo & Lestari (2021) and Suryadi & Kusuma (2022), affirming that technology-based projects sharpen students' thinking and teamwork.

The novelty of this study lies in its focused implementation of PBL within a short period (seven meetings), involving vocational accounting students who directly interacted with real MSMEs in a localized setting. While previous research often focuses on long-term or theoretical learning, this study proves that short-term, practice-driven projects can deliver impactful results in building professional readiness and applicable problem-solving skills. This model offers a replicable framework for vocational education where time is limited but competency-based outcomes are prioritized.

4. CONCLUSION

Based on the results of this study, students' experiences in developing problem-solving skills through the creation of cashier digitalization systems for MSMEs demonstrate that the Problem-Based Learning (PBL) approach can be effectively applied in practical course settings. The main findings highlight that students were able to systematically identify problems faced by MSMEs, such as difficulties in transaction recording design appropriate technology-based solutions using Microsoft Excel VBA, and collaborate effectively in system development tailored to the needs of local businesses. Throughout the learning process, students engaged in group discussions, field investigations, application testing, and peer evaluations, all of which contributed to the development of critical thinking, analytical skills, and teamwork. Moreover, students not only deepened their theoretical understanding of accounting information systems but were also able to implement that knowledge in real-world settings. As a result, the digital cashier applications they created provided tangible benefits to MSMEs by improving transaction recording efficiency and financial documentation quality. At the same time, these activities served as meaningful learning experiences that enhanced students' readiness for the professional environment. However, this study has certain limitations. It focused only on a limited number of student participants from two classes and involved MSMEs within a single geographic location (Tegal city), which may affect the generalizability of the findings. In addition, the project duration only seven class sessions may have constrained the depth of system development and the extent of skill mastery. Future research could expand the scope by involving a more diverse student population across different institutions or cities, extending the project duration, and incorporating comparative studies using alternative tools or programming languages. Furthermore, longitudinal studies could be conducted to observe the long-term impact of PBL-based system development on students' career competencies and on MSMEs' operational sustainability.

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