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Practical Session Quality and Perceived Learning Outcomes in an ERP Odoo Point-of-Sale Practicum: An Empirical Study in Computerized Accounting Education

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Abstract. This study examines the relationship between practical session quality and perceived learning outcomes in an enterprise resource planning (ERP) Point-of-Sale (PoS) practicum using Odoo at Politeknik Negeri Semarang, Indonesia. A quantitative, cross-sectional design was employed using questionnaire data from 50 respondents. Practical session quality was assessed through indicators concerning the clarity of instructions, ease of following practical activities, independent operation of the PoS module, adequacy of practical-session time, and relevance of assigned tasks. Perceived learning outcomes were measured through students' self-reported understanding of ERP concepts and PoS processes, ability to complete practical activities, and perceived achievement of learning objectives. The analysis used descriptive statistics, preliminary measurement assessments, standardized composite scores, and bootstrap resampling. The estimated association was positive but statistically nonsignificant ($\beta = 0.103$, $p = 0.430$). The model explained approximately 1.1% of the variance in perceived learning outcomes ($R^2 = 0.011$), indicating limited explanatory power for the specified predictor. An independently calculated heterotrait–monotrait ratio of 0.195 provided preliminary evidence of construct distinction. These findings do not imply that ERP practical sessions are ineffective; rather, they indicate that perceived practical-session quality alone did not explain students' perceived learning outcomes in this sample. The study contributes an exploratory account of ERP-based learning in computerized accounting education and highlights the importance of combining student perceptions with objective assessments of practical competence. The findings are limited by the single-institution sample, cross-sectional design, self-reported measures, and composite-score analytical approach.

Keywords: ERP education; practical session quality; perceived learning outcomes; Odoo Point-of-Sale; computerized accounting

1. Introduction

Enterprise resource planning (ERP) systems have become an important component of contemporary business operations by integrating information and processes across functions such as accounting, inventory management, procurement, and sales. Enterprise Resource Planning (ERP) is an integrated information system that connects various business functions ranging from finance, production, to human resources which is useful for strengthening the efficiency and coordination of organizational operations (Ramadita et al., 2025). As organizations increasingly rely on integrated digital systems to support operational efficiency and managerial decision-making, higher education institutions face the challenge of preparing graduates who can apply business information systems in practical contexts. ERP education therefore extends beyond conceptual understanding of business processes to include the ability to operate integrated applications, interpret transaction data, and understand the relationship between operational activities and accounting information. ERP implementation not only serves as a technological tool, but also drives structural and cultural changes in the organization (Munir et al., 2026) .However, the success of ERP implementation is not only determined by the technology itself, but is also influenced by user perceptions, competencies, and attitudes towards technological change (Misnawati et al., 2025). Within this context, practical learning plays an important role in bridging theoretical knowledge and the application of enterprise systems in real-world business environments.

ERP practicum is particularly relevant to accounting and computerized accounting education because it exposes students to the interaction between business transactions, operational workflows, and accounting records within an integrated system. Odoo, an open-source suite of business applications, provides a practical environment for examining these relationships through modules that support sales, inventory, purchasing, and financial management. Odoo ERP provides solutions for managing sales, raw material purchasing, inventory, production, and accounting, which allows for a smoother flow of information between company departments (Putri et al., 2025).

Its Point of Sale (POS) module enables students to explore sales transactions and their connections with broader business processes. Through structured practical sessions, students can develop procedural skills, understand transaction flows, and recognize how digital systems support business operations. However, the availability of an ERP application alone does not necessarily ensure meaningful learning. The educational value of an ERP practicum also depends on the quality of the learning activities through which students interact with the system.

Research on ERP education has demonstrated the educational value of hands-on activities and experiential learning. For example, reported positive learning outcomes from an ERP system design course that incorporated an open-source ERP platform, interactive laboratory activities, and project-based learning (Alharbi, 2021). Similarly, previous research examined student-perceived learning outcomes in ERP courses and identified the relevance of hands-on training, course structure, and instructor-related factors in understanding students' learning experiences (Alshare et al., 2011). Others also investigated whether hands-on ERP exercises support students' understanding of business process concepts (Rienzo & Han, 2011). These studies establish the importance of practical engagement in ERP education while highlighting the need to examine the specific characteristics of practical sessions and their relationship with perceived learning outcomes. Other research results show that the majority of students have a positive perception of the use of technology in learning, seeing it as a tool that enriches the learning experience (Firmansyah, 2026). Other research shows that the use of digital technology in learning can increase learning motivation, active student participation, and in-depth understanding of concepts through material visualization and interactive simulations (Aprilia et al., 2025). Other research results state that ERP learning using Odoo can provide an adequate learning experience for students (Indra Firmansyah et al., 2026).

Despite this growing body of research, the relationship between practical session quality and perceived learning outcomes in an ERP Odoo Point of Sale (POS) practicum warrants further investigation. Practical session quality concerns the learning experience created through the organization and delivery of practical activities, including the clarity of instructions, relevance of exercises, opportunities for direct system interaction, and support provided during the learning process. These dimensions differ from the quality of learning materials, which primarily concerns the content and resources used to support learning. Distinguishing between these aspects is important because students may evaluate instructional materials positively without necessarily perceiving equivalent benefits from the practical sessions themselves. In ERP education, where students must translate procedural instructions into system operations and understand the implications of business transactions, examining practical session quality offers a more focused perspective on the learning process.

This issue is particularly relevant to accounting and computerized accounting programs, in which ERP practicum activities connect operational transactions with integrated business information. The Odoo POS module provides a specific setting for examining this relationship because students interact with sales processes within an enterprise system rather than learning business procedures exclusively through theoretical explanations. Understanding how students perceive the quality of these practical sessions and how such perceptions relate to their perceived learning outcomes can inform the design of more effective ERP learning experiences. It can also contribute to business systems education by identifying aspects of practical instruction that deserve attention when integrating enterprise applications into higher education curricula.

Accordingly, this study examines the relationship between practical session quality and perceived learning outcomes among students participating in an ERP Odoo POS practicum. The study addresses the following research questions:

1. How do students perceive the quality of practical sessions in the ERP Odoo POS practicum?
2. To what extent is practical session quality associated with students perceived learning outcomes?
3. How well does practical session quality explain variations in perceived learning outcomes within the proposed exploratory model?

To address these questions, the study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the measurement properties of the research constructs and the relationship between practical session quality and perceived learning outcomes. The principal contribution lies in its focused examination of practical session quality as a distinct construct in ERP-based learning, extending the discussion beyond the general adoption of ERP systems or the evaluation of learning materials. By examining the Odoo POS practicum in an accounting education

context, the study provides empirical insight into the perceived educational value of hands-on enterprise system activities and offers a basis for further investigation of instructional quality in business systems education.

2. Literature Review / Theoretical Background

2.1. ERP Systems in Higher Education and Accounting Practicum

Enterprise resource planning (ERP) systems integrate business processes and organizational data within a shared information environment, enabling users to understand how operational activities relate to financial and managerial information. In higher education, ERP systems provide opportunities for students to experience business processes through integrated applications rather than studying individual functions in isolation. This integration is particularly relevant to accounting education, where transaction processing, inventory movements, sales activities, and financial reporting are interconnected components of organizational operations.

The educational value of ERP systems lies not only in students' ability to operate software but also in their understanding of the business logic underlying system transactions. Through ERP practicum activities, students can observe how operational decisions generate information, how transactions move across business functions, and how integrated systems support organizational coordination. These experiences can help connect accounting concepts with the digital environments in which contemporary accounting and business activities take place.

Previous research has investigated the use of ERP systems as pedagogical tools and the factors associated with students' learning experiences. Rienzo and Han examined the use of hands-on ERP exercises to facilitate students' understanding of business process concepts, highlighting the relevance of experiential engagement in ERP education (Rienzo & Han, 2011). On the other hand, Alshare et al investigated factors associated with student-perceived learning outcomes and satisfaction in ERP courses, demonstrating the importance of examining the educational experience rather than treating ERP exposure as sufficient evidence of learning (Alshare et al., 2011). Alharbi also described the development of an ERP system design course incorporating an open-source platform and practical learning activities (Alharbi, 2021). Collectively, these studies position ERP practicum as a meaningful context for investigating how instructional arrangements relate to students' perceived learning.

Within this context, the Odoo Point of Sale (POS) module offers a specific environment for learning about digitally supported sales operations. POS transactions can be connected to product information, inventory processes, and other relevant business functions, providing opportunities for students to understand the operational relationships embedded in an ERP system. Nevertheless, the learning value of this environment depends partly on how practical activities are organized and experienced. Consequently, ERP practicum should be examined not merely as exposure to a technological platform but as a structured educational process in which the quality of practical sessions may influence students' perceptions of their learning outcomes.

2.2. Experiential Learning Theory

Experiential Learning Theory (ELT), developed by (Kolb, 1984), provides a theoretical foundation for understanding the relationship between practical learning experiences and perceived learning outcomes. The theory conceptualizes learning as a process through which knowledge is developed by transforming experience. Its learning cycle consists of four interconnected stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. These stages describe how learners engage in an activity, reflect on their experience, develop conceptual understanding, and apply what they have learned in subsequent situations.

In an ERP practicum, concrete experience occurs when students perform transactions directly within the application. Reflective observation takes place when they examine the results of their actions and consider how the system processes business transactions. Abstract conceptualization involves connecting these experiences with accounting principles and business process concepts, while active experimentation involves applying that understanding to different transactions or scenarios. The quality of the practical session can influence the extent to which these learning opportunities are available and meaningful to students.

Through a systematic review and revision of Kolb's experiential learning model, emphasized the importance of contextually meaningful experiences, critical reflection, and the application of knowledge to practical problems (Morris, 2020). This perspective is relevant to ERP education

because operating a business application does not automatically produce conceptual understanding. Students must be able to interpret their activities and connect system operations with the underlying business processes.

Experiential Learning Theory therefore supports the conceptual expectation that practical session quality may be associated with perceived learning outcomes. When practical activities are organized clearly, provide opportunities for active engagement, and enable students to connect system operations with relevant concepts, students may perceive greater learning benefits. Nevertheless, ELT does not establish that every positive practical experience necessarily leads to higher learning outcomes. The relationship remains an empirical question, particularly when outcomes are measured through students' perceptions rather than objective assessments of knowledge or skills.

2.3. Practical Session Quality in ERP Education

Practical session quality refers to students' perceptions of how effectively practical learning activities are organized, delivered, and supported. In technology-oriented education, this construct concerns the learning process rather than the technological system alone. Relevant considerations include the clarity of procedural instructions, the logical sequencing of exercises, the relevance of tasks to learning objectives, opportunities for hands-on interaction, and the support available when students encounter difficulties.

The importance of these instructional characteristics is consistent with the findings who examined student-perceived learning outcomes and satisfaction in ERP courses using a model based on the Unified Theory of Acceptance and Use of Technology (UTAUT) (Alshare et al., 2011). Their study of 102 students found that student attitude had the strongest significant direct relationship with perceived learning outcomes and satisfaction. Course structure and hands-on training also had indirect relationships with these outcomes through performance expectancy and effort expectancy. The findings suggest that practical engagement should be considered alongside instructional organization and students' perceptions of the relevance and usability of ERP learning.

Further investigated whether hands-on ERP experience supports students' understanding of business process concepts. Their study extended ERP education research by examining knowledge acquisition related to business process concepts through practical exercises rather than relying exclusively on students' self-assessments (Rienzo & Han, 2011). This distinction is important because the presence of practical activities, the quality of the learning experience, and the knowledge students ultimately acquire represent related but conceptually different aspects of ERP education.

For the Odoo POS practicum, practical session quality can be understood through the organization of transaction exercises, the accessibility of instructions, the opportunity to perform system operations, and the connection between practical tasks and accounting-related business processes. These characteristics describe how students experience the practicum rather than how they evaluate the content of a learning module or the technical performance of Odoo itself. This distinction provides a basis for investigating practical session quality as a separate construct.

2.4. Perceived Learning Outcomes

Perceived learning outcomes represent students' subjective assessments of what they believe they have learned through an educational experience. In ERP education, these perceptions may concern their understanding of business processes, familiarity with system operations, ability to perform practical tasks, and confidence in applying concepts introduced during the practicum. Such outcomes are relevant because students' evaluations provide insight into how they experience the educational process and whether they believe the activities have supported their learning.

However, perceived learning outcomes should not be treated as equivalent to objectively demonstrated learning. Students may report that an activity has improved their understanding without achieving a corresponding level of performance on an examination or practical assessment. Conversely, students may acquire knowledge or skills that they do not fully recognize in their own evaluations. Distinguishing perceived outcomes from objective achievement is therefore important when interpreting survey-based research.

Alshare et al explicitly examined student-perceived learning outcomes in ERP courses, establishing a precedent for studying learning from the students' perspective (Alshare et al., 2011). Their findings also indicate that these perceptions are associated with several aspects of the educational experience, including student attitude, course structure, and hands-on training.

Similarly, described an ERP system design course grounded in experiential learning and using an open-source ERP platform to develop students' knowledge and practical experience (Alharbi, 2021). Together, these studies support the relevance of examining students' perceptions while recognizing that perceived outcomes capture a particular dimension of educational effectiveness rather than the entirety of learning achievement.

In the present study, perceived learning outcomes are examined in relation to students' experiences in an ERP Odoo POS practicum. The focus is on the learning benefits students perceive from participating in practical sessions, rather than on objectively measured improvements in accounting knowledge or software proficiency. This operational distinction determines the scope of the study's conclusions.

2.5. Relationship Between Practical Session Quality and Perceived Learning Outcomes

The relationship between practical session quality and perceived learning outcomes can be explained through the interaction between instructional design, learner engagement, and experiential knowledge development. Practical sessions provide opportunities for students to apply concepts in a simulated business environment, while the quality of those sessions determines how effectively students can engage with the activities and interpret their results. When practical tasks are clearly structured and aligned with learning objectives, students may find it easier to connect individual system operations with broader business processes.

Experiential Learning Theory provides a basis for this relationship because learning develops through engagement with experience, reflection, conceptual understanding, and subsequent application (Kolb, 1984). In ERP practicum activities, students may encounter difficulties when instructions are unclear, task sequences are disconnected, or the relationship between transactions and accounting consequences is insufficiently explained. Such difficulties may affect their perceptions of how much they have learned, even when the ERP application itself functions as intended.

Empirical evidence from ERP education offers additional support for examining this relationship. Found that hands-on training and course structure were indirectly related to student-perceived learning outcomes through students' performance and effort expectancies (Alshare et al., 2011). Their findings suggest that the educational benefits of ERP implementation depend partly on how learning activities are structured and experienced. However, their model incorporated several explanatory factors, meaning that the relationship between practical session quality and perceived learning outcomes cannot be assumed to be independent of other influences.

Other approached the issue from the perspective of knowledge acquisition, investigating the contribution of hands-on ERP exercises to students' understanding of business process concepts (Rienzo & Han, 2011). Their work complements perception-based research by emphasizing the importance of examining what students learn from practical engagement. Taken together, these studies suggest that practical experience is an important component of ERP education, while leaving room to investigate how students' evaluations of the quality of practical sessions relate specifically to their perceived learning outcomes.

Based on this theoretical and empirical foundation, the present study examines the following proposed relationship:

H1: Practical session quality is positively associated with perceived learning outcomes among students participating in the ERP Odoo POS practicum.

This hypothesis represents an expected relationship derived from experiential learning theory and prior ERP education research. Its direction and statistical significance must be established through empirical analysis rather than assumed in advance.

2.6. Research Gap and Conceptual Contribution

Existing ERP education research has examined several dimensions of the relationship between enterprise systems and student learning. Rienzo and Han (Rienzo & Han, 2011) investigated knowledge acquisition through hands-on ERP exercises, while Alshare et al examined student-perceived learning outcomes and satisfaction in relation to factors including hands-on training, course structure, and student attitudes (Rienzo & Han, 2011; Alshare et al., 2011). On the other hand, Alharbi demonstrated the relevance of experiential learning in the design of an ERP course using an open-source platform (Alharbi, 2021). Collectively, these studies establish a foundation for understanding ERP systems as educational tools and practical activities as an important component of enterprise systems education.

Nevertheless, three distinctions provide the basis for the present study. First, practical session quality is conceptually different from the general availability of hands-on training. Participation in a practical activity does not necessarily indicate that the activity is clearly organized, appropriately sequenced, or supportive of students' learning. Examining students' perceptions of practical session quality therefore provides a more focused perspective on the instructional experience.

Second, the relationship between practical session quality and perceived learning outcomes differs from the relationship between learning materials and student satisfaction. Learning materials concern the content and resources provided to students, whereas practical session quality concerns the delivery and experience of activities through which students interact with the system. A study of learning materials and satisfaction in the ERP Odoo POS practicum provides a related context, but it does not directly establish whether practical session quality is associated with perceived learning outcomes. The distinction is important because satisfaction and perceived learning outcomes are related but non-equivalent constructs.

Third, the specific context of the Odoo POS practicum in accounting and computerized accounting education provides an opportunity to examine this relationship within an integrated business application. Although previous studies have investigated ERP education more broadly, the present study focuses on students' experiences of practical sessions involving POS operations and their perceptions of learning benefits in that setting. The study thus narrows the analytical focus from ERP education in general to the relationship between the quality of practical activities and perceived learning outcomes in a specific ERP learning environment.

To address these gaps, this study integrates experiential learning theory with a focused empirical model linking practical session quality to perceived learning outcomes. PLS-SEM is employed to examine the measurement properties of the constructs and evaluate the proposed structural relationship. Its use supports an exploratory investigation of the specified model; it does not, by itself, establish causal effects or guarantee generalizability beyond the population and context examined.

The principal contribution is threefold. Theoretically, the study applies the perspective of experiential learning to distinguish the quality of practical sessions from participation in hands-on activities alone. Empirically, it examines the association between practical session quality and perceived learning outcomes in an ERP Odoo POS practicum. Methodologically, it uses PLS-SEM to assess the measurement model and the proposed relationship within a focused exploratory framework. These contributions provide a basis for understanding students' perceptions of practical learning in ERP-based business education without equating perceived outcomes with objectively demonstrated learning achievement.

3. Methodology

3.1. Research Design

This study employed a quantitative explanatory survey design to examine the relationship between practical session quality and perceived learning outcomes in an ERP Odoo Point-of-Sale (PoS) practicum. Research instruments are used to measure the value of the variables being studied(Sugiyono, 2013). A quantitative approach was adopted to measure students' perceptions using structured questionnaire responses and to evaluate the proposed relationship between the two research constructs. The explanatory orientation of the study reflects its focus on assessing whether variations in perceived practical session quality are associated with variations in perceived learning outcomes.

The study was conducted in the context of computerized accounting education at Politeknik Negeri Semarang (Polines), Indonesia. The research focused on students' experiences of using the Odoo ERP system, particularly its POS module, in practical learning activities. Data were collected through a questionnaire during 2026. The research model specified practical session quality as the independent variable (X) and perceived learning outcomes as the dependent variable (Y).

3.2. Population and Sample

The study involved 50 students from the Computerized Accounting study program at Politeknik Negeri Semarang who had experience using the Odoo ERP system. Participants were selected through purposive sampling, a non-probability sampling technique in which respondents are selected according to criteria relevant to the research objectives. In this study, experience using

Odoo was the principal criterion for respondent selection because the research required participants to evaluate practical learning activities involving the system.

The selection of respondents with direct experience of Odoo POS practicum provided a basis for examining perceptions grounded in actual participation in ERP-based learning. The sample size was 50 respondents. Given the exploratory focus and the relatively limited sample, the findings are interpreted within the context of the participating students rather than assumed to represent all students in computerized accounting education.

3.3. Measurement Variable

The study examined two constructs: practical session quality and perceived learning outcomes. Both constructs were measured using indicators from the questionnaire administered in the context of the ERP Odoo Point-of-Sale (PoS) practicum. Responses were recorded on a five-point Likert-type scale, with higher scores representing more favorable perceptions.

Table 1 Constructs and Measurement Indicators

Construct	Code	Measurement indicator
Practical session quality	X1	Clarity of practical instructions
Practical session quality	X2	Ease of following practical activities
Practical session quality	X3	Ability to operate the PoS module independently
Practical session quality	X4	Adequacy of practical-session time
Practical session quality	X5	Relevance of assigned tasks
Perceived learning outcomes	Y1	Understanding of ERP concepts
Perceived learning outcomes	Y2	Ability to complete practical activities
Perceived learning outcomes	Y3	Understanding of PoS processes
Perceived learning outcomes	Y4	Perceived achievement of learning objectives

Source: Study questionnaire.

The independent variable in this study is Practical Session Quality (X), which reflects students' perceptions of the quality and manageability of the Odoo Point-of-Sale (PoS) practicum. It is measured using five indicators: clarity of practical instructions (X1), ease of following practical activities (X2), ability to operate the PoS module independently (X3), adequacy of practical-session time (X4), and relevance of assigned tasks (X5). Indicator X3 is included in this construct because it captures students' perceived ability to carry out practical activities without continuous assistance and thus reflects the perceived manageability of the practicum. The dependent variable is Perceived Learning Outcomes (Y), measured through students' reported understanding of ERP concepts (Y1), ability to complete practical activities (Y2), understanding of PoS processes (Y3), and perceived achievement of learning objectives (Y4).

Although the ability to operate the PoS module independently may also be interpreted as a learning achievement, this study distinguishes it from the broader learning outcomes construct based on the operational definitions adopted for each variable. Practical Session Quality focuses on students' perceptions of the practical learning process, whereas Perceived Learning Outcomes focuses on their reported understanding and perceived achievement. Nevertheless, the conceptual proximity between independent system operation and perceived learning outcomes represents a potential measurement limitation. Future studies could distinguish instructional-process characteristics from demonstrated operational competence more explicitly by measuring session design separately from students' performance on standardized PoS tasks.

Practical session quality represents students' perceptions of the clarity, accessibility, time adequacy, independence, and relevance of practical learning activities. Perceived learning outcomes represent students' self-assessments of their understanding of ERP concepts, ability to complete practical activities, understanding of PoS processes, and perceived achievement of learning objectives.

The outcome construct is designated as perceived learning outcomes rather than student satisfaction because its indicators focus on students' perceptions of understanding and task achievement, rather than their overall satisfaction with the practicum. These self-reported indicators should not be interpreted as direct measurements of objectively demonstrated competence.

The questionnaire is treated as a study-specific instrument in this analysis. No verified published source for the complete set of items was established from the available documentation; consequently, the items are not claimed to have been adopted verbatim from a previously validated scale.

3.4. Data Preparation

The analysis used 50 respondent records. An entirely empty row in the original spreadsheet was excluded. One missing response for indicator X4 was replaced with the mean of the corresponding indicator. Where a response was recorded as two adjacent categories, such as "Agree" and "Strongly Agree," the arithmetic midpoint of their numerical values was used.

These procedures produced a numerical dataset for analysis. However, mean imputation and midpoint coding may influence the distribution of the responses and the resulting estimates. The findings should therefore be interpreted with these data-preparation decisions in mind.

3.5. Analytical Procedure

The analysis was conducted as an exploratory composite-score analysis using the available questionnaire dataset. It was not a complete PLS-SEM estimation performed in SmartPLS. The analytical procedure consisted of three stages. First, descriptive statistics were calculated to summarize responses to the nine indicators. Second, preliminary measurement properties were examined using indicator–composite correlations, Cronbach's alpha, composite reliability, and average variance extracted (AVE). Third, the association between practical session quality and perceived learning outcomes was estimated using standardized composite scores.

Approximate inferential statistics for the structural relationship were obtained through 5,000 paired bootstrap resamples. Discriminant validity was examined using the heterotrait–monotrait ratio of correlations (HTMT), calculated independently from the prepared respondent-level dataset. The resulting statistics are reported as exploratory estimates rather than as outputs from a complete PLS-SEM estimation procedure.

Because the analysis was based on composite scores, the indicator–composite correlations reported in this study should not be interpreted as outer loadings estimated by SmartPLS. Similarly, the path coefficient, bootstrap statistics, reliability estimates, and HTMT value should not be presented as original SmartPLS output. This distinction is maintained throughout the Results, Discussion, and Conclusion sections. The results provide preliminary evidence about the observed data and do not constitute definitive validation of a PLS-SEM model.

3.5.1. Measurement Model Assessment

The measurement model was assessed to examine the relationship between the questionnaire indicators and their corresponding constructs. The assessment focused on indicator reliability, internal consistency reliability, convergent validity, and discriminant validity, as applicable to the specified measurement model.

Indicator reliability was examined through the outer loadings of the measurement items. Internal consistency reliability was evaluated using composite reliability and, where appropriate, Cronbach's alpha and rho_A. Convergent validity was assessed using average variance extracted (AVE), while discriminant validity was examined to determine whether practical session quality and perceived learning outcomes represented empirically distinguishable constructs.

These assessments provided the basis for evaluating whether the measurement model was sufficiently reliable and valid for interpreting the structural relationship. The results of the measurement model assessment were considered before drawing conclusions from the structural model.

3.5.2. Structural Model Assessment

Following measurement model assessment, the structural model was evaluated to examine the relationship between practical session quality and perceived learning outcomes. The analysis focused on the estimated path coefficient, its statistical significance, and the coefficient of determination (R^2) for perceived learning outcomes.

The path coefficient was used to assess the direction and magnitude of the relationship between the independent and dependent constructs. Statistical significance was evaluated through

bootstrapping in SmartPLS. The coefficient of determination was used to assess the proportion of variance in perceived learning outcomes explained by practical session quality within the specified model.

The proposed structural relationship was expressed as follows:

$$Y = \beta X + \varepsilon$$

where (Y) represents perceived learning outcomes, (X) represents practical session quality, (β) represents the structural path coefficient, and (ε) represents the residual component.

The corresponding research hypothesis was:

H1: Practical session quality is positively associated with perceived learning outcomes among students participating in the ERP Odoo POS practicum.

The hypothesis was evaluated using the estimated path coefficient and its statistical significance. The interpretation of the findings considered the magnitude and direction of the estimated relationship alongside the model's explanatory power. Because the study employed a survey design and measured perceptions through questionnaire responses, the analysis was interpreted as evidence of association rather than definitive proof of causality.

3.6. Ethical Considerations

The study was conducted on a voluntary participation basis. Participants received an explanation of the research before completing the questionnaire. These procedures were intended to support informed participation in the study.

The methodological information available for this study establishes voluntary participation and the provision of a research explanation. No claim is made regarding formal institutional ethics committee approval or a specific written consent procedure.

4. Results

4.1. Respondent and Data Overview

The analysis was based on 50 students from the Computerized Accounting Study Program at Politeknik Negeri Semarang who had experience using the Odoo ERP system. The study examined the relationship between practical session quality (X) and perceived learning outcomes (Y). The measurement model consisted of five indicators for practical session quality (X1–X5) and four indicators for perceived learning outcomes (Y1–Y4).

Table 2 Research Sample and Model Structure

Item	Description
Sample size	50 students
Research setting	Computerized Accounting Study Program, Politeknik Negeri Semarang
Analytical method	Partial Least Squares Structural Equation Modeling (PLS-SEM)
Independent construct	Practical Session Quality (X)
Dependent construct	Perceived Learning Outcomes (Y)
Indicators for X	5 (X1–X5)
Indicators for Y	4 (Y1–Y4)

4.2. Measurement Model Assessment

The preliminary measurement assessment examined the relationships between individual indicators and their respective standardized composite scores, together with internal consistency and convergent validity estimates. The indicator–composite correlations are presented to improve transparency regarding the observed measurement structure.

Table 3 Indicator–Composite Correlations

Construct	Indicator	Indicator description	Correlation
Practical session quality	X1	Clarity of practical instructions	0.732

Practical session quality	X2	Ease of following practical activities	0.839
Practical session quality	X3	Ability to operate the PoS module independently	0.788
Practical session quality	X4	Adequacy of practical-session time	0.752
Practical session quality	X5	Relevance of assigned tasks	0.877
Perceived learning outcomes	Y1	Understanding of ERP concepts	0.804
Perceived learning outcomes	Y2	Ability to complete practical activities	0.834
Perceived learning outcomes	Y3	Understanding of PoS processes	0.872
Perceived learning outcomes	Y4	Perceived achievement of learning objectives	0.839

Note: These values are correlations between the indicators and their respective standardized composite scores calculated from the prepared dataset.

The indicator–composite correlations ranged from 0.732 to 0.877 for practical session quality and from 0.804 to 0.872 for perceived learning outcomes. X5, which represents the relevance of assigned tasks, had the highest correlation within the practical-session construct. Y3, which represents understanding of PoS processes, had the highest correlation within the perceived-learning construct. These values describe the relationships between the indicators and the constructed scores; they should not be interpreted as evidence of a fully validated PLS-SEM measurement model.

The reported outer loadings ranged from 0.732 to 0.877 for practical session quality and from 0.804 to 0.872 for perceived learning outcomes. Both constructs also demonstrated Cronbach's alpha and composite reliability values above 0.70. The average variance extracted (AVE) values exceeded the commonly used threshold of 0.50, indicating adequate internal consistency and convergent validity based on the available summary statistics.

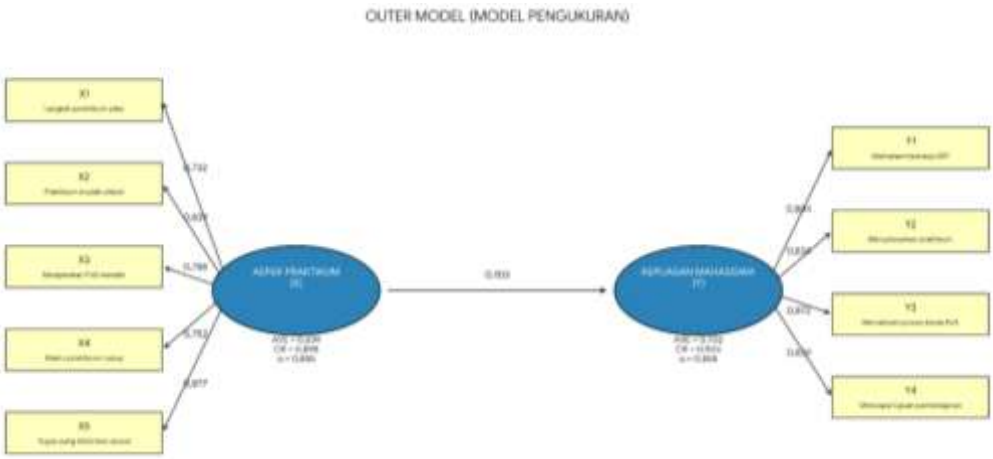


Figure 1 Outer Model

The preliminary estimates of internal consistency and convergent validity are presented in Table 4. Because the analysis was based on an exploratory composite-score approach rather than a complete PLS-SEM estimation in SmartPLS, the indicator values are reported as indicator–composite correlations rather than outer loadings. The reliability and AVE values are also presented as preliminary estimates and should be interpreted in light of this analytical approach. Additionally, the communality value should exceed 0.50, and the Average Variance Extracted (AVE) value should be above 0.50 (Ghozali, 2008)

Table 4 Measurement Model Assessment

Criterion	Practical Session Quality (X)	Perceived Learning Outcomes (Y)	Common guideline
Outer loading range	0.732–0.877	0.804–0.872	Approximately ≥ 0.70
Cronbach's alpha	0.855	0.858	≥ 0.70
Composite reliability	0.898	0.904	≥ 0.70
AVE	0.639	0.702	≥ 0.50

Note: Cronbach's alpha, composite reliability, and AVE are preliminary estimates calculated from the prepared dataset using the exploratory composite-score procedure.

Discriminant validity was examined using the heterotrait–monotrait ratio of correlations (HTMT). The estimate was calculated independently from the prepared dataset containing 50 respondent records.

Table 5 Discriminant Validity Assessment

Construct pair	HTMT
Practical session quality – Perceived learning outcomes	0.195

Note: HTMT was calculated independently from the prepared respondent-level dataset

The HTMT estimate was 0.195, below the commonly used threshold of 0.85. This result provides preliminary support for distinguishing practical session quality from perceived learning outcomes in the observed data. The estimate should nevertheless be interpreted cautiously because the analysis used standardized composite-score calculations rather than a complete PLS-SEM measurement-model procedure.

4.3. Structural Model Assessment

The structural model indicated a positive but small relationship between practical session quality and perceived learning outcomes (**β** = 0.103). However, the relationship was not statistically significant ((t = 0.795), (p = 0.430)). The coefficient of determination (R^2 = 0.011) indicated that practical session quality accounted for approximately 1.1% of the variance in perceived learning outcomes in the estimated model.

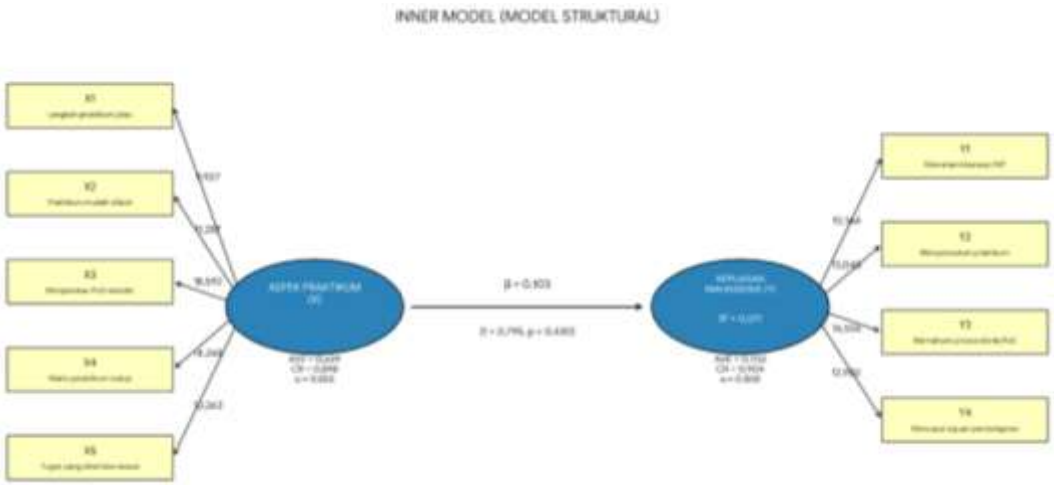


Figure 2 Inner Model

Table 6 Exploratory Structural Relationship

Relationship	β	t-statistic	p-value	Approximate 95% bootstrap confidence interval
Practical session quality → Perceived learning outcomes	0.103	0.795	0.430	[−0.152, 0.342]

Note: N = 50. Inferential statistics were obtained through 5,000 paired bootstrap resamples of composite scores

4.4. Summary of Findings

The measurement results supported the internal consistency and convergent validity of the two constructs based on the reported reliability and AVE statistics. In contrast, the structural model did not support the proposed hypothesis that practical session quality was positively associated with perceived learning outcomes. Although the estimated path coefficient was positive, its magnitude was small and it was not statistically significant. The low (R^2) value further indicated that the model explained only a limited proportion of the variation in perceived learning outcomes among the sampled students.

5. Discussion

The results indicate a positive but statistically nonsignificant association between practical session quality and perceived learning outcomes ($\beta = 0.103$, $p = 0.430$). The model explained approximately 1.1% of the variance in perceived learning outcomes ($R^2 = 0.011$). These findings suggest that practical session quality, as operationalized in this study, had limited explanatory power within the estimated model. They do not establish that practical sessions are ineffective or that their quality is unrelated to learning outcomes in other settings.

The low coefficient of determination ($R^2 = 0.011$) has practical implications for the design and evaluation of ERP-based learning. In this exploratory model, practical session quality accounted for approximately 1.1% of the variance in students' perceived learning outcomes. This indicates that favorable perceptions of practical-session delivery, as measured by the five indicators, were not sufficient to explain differences in students' perceived learning outcomes in the observed sample.

For ERP educators, this finding suggests that evaluating a practicum solely through students' perceptions of clear instructions, manageable activities, sufficient time, independent system operation, and relevant tasks may provide an incomplete picture of learning. These aspects remain important considerations in instructional design, but their perceived quality should not be assumed to translate directly into stronger conceptual understanding or learning achievement.

Practical sessions could therefore be designed to connect system operations more explicitly with the underlying accounting concepts and business processes. For example, students could be required to explain the accounting consequences of PoS transactions, trace the relationship between sales and inventory records, identify the effects of transactions on financial reports, and complete standardized tasks independently. Rubrics that assess both task completion and conceptual explanation could help instructors identify whether students can transfer procedural experience into accounting knowledge.

The low R^2 also indicates that other potentially relevant factors may need to be considered in future research. These may include prior ERP experience, accounting knowledge, student engagement, instructor feedback, system usability, and the alignment of practical exercises with learning objectives. However, these factors were not included in the present model and cannot be identified as explanations established by this study. Further research should measure them directly and examine whether they improve the explanatory power of the model.

Accordingly, the practical implication is not to reduce the importance of hands-on ERP learning, but to evaluate it more comprehensively. Student perceptions of the learning experience should be combined with evidence of demonstrated performance and conceptual understanding. Such an approach would provide a stronger basis for improving ERP practicum design than relying on perceived session quality alone.

Several explanations remain plausible but were not directly tested. Students' perceived learning outcomes may also be associated with prior ERP experience, accounting knowledge, student engagement, instructor support, or alignment between practical tasks and learning objectives. In addition, the questionnaire measures perceived learning rather than objectively assessed competence, which may limit the extent to which the outcome captures students' actual ability to perform ERP-related tasks. These possibilities should be regarded as alternative explanations for further investigation rather than findings established by the present data.

The results should also be interpreted in relation to previous research on experiential learning and enterprise systems education. Research by (Rienzo & Han, 2011) examined ERP hands-on experience and business-process learning, distinguishing students' self-assessments from measured knowledge acquisition. (Jewer & Evermann, 2015) investigated the use of open-source systems in experiential enterprise-systems education, while (Alharbi, 2021) described an ERP

course designed to support students' learning through practical activities. These studies provide a relevant educational context for examining ERP-based learning, but differences in research design, instructional setting, and outcome measurement mean that their findings should not be treated as direct equivalents of the present results.

The findings therefore support a cautious interpretation of the proposed relationship. Favorable perceptions of practical-session design should not automatically be equated with learning achievement. In ERP-based computerized accounting education, practical activities may be strengthened by explicitly connecting software operations with accounting principles, transaction flows, and integrated business processes. Assessments that require students to execute transactions independently and explain the accounting consequences of those transactions could complement questionnaire-based evaluations.

The analytical approach also places limits on the conclusions. The reported measurement and structural estimates were obtained through composite-score calculations and bootstrap resampling, rather than a complete PLS-SEM estimation procedure in SmartPLS. They should therefore be regarded as exploratory estimates, not as definitive validation of the proposed structural model. Further research using a fully specified and reproducible analytical procedure would be needed to establish the robustness of the relationship.

Future studies could use larger samples across multiple classes or institutions, incorporate additional explanatory variables, and compare self-reported learning with objective performance assessments. Longitudinal or pre-test and post-test designs could also help determine whether improvements in practical-session quality correspond to measurable changes in students' ERP knowledge and operational competence.

6. Conclusion

This study examined the relationship between practical session quality and perceived learning outcomes in an ERP Odoo Point-of-Sale practicum at Politeknik Negeri Semarang. Based on 50 respondent records, the exploratory composite-score analysis produced a positive but statistically nonsignificant association between the two constructs ($\beta = 0.103$, $p = 0.430$). The estimated model explained approximately 1.1% of the variance in perceived learning outcomes ($R^2 = 0.011$). Therefore, the analysis did not establish a statistically significant association between practical session quality and perceived learning outcomes in the observed sample.

The findings suggest that students' perceptions of practical-session delivery alone may provide an incomplete basis for evaluating ERP learning. Instructors may benefit from combining clear instructions, relevant practical tasks, and opportunities for independent system operation with assessments that examine students' understanding of accounting concepts and integrated business processes. Objective performance measures could complement students' self-reported perceptions and support more comprehensive evaluation of practicum effectiveness.

The results must be interpreted in light of the study's limitations. The sample comprised 50 respondents from a single academic setting, and the cross-sectional questionnaire design does not support causal conclusions. The outcome construct reflects perceived learning rather than objectively demonstrated competence. In addition, the analysis used standardized composite scores and approximate bootstrap procedures rather than a complete PLS-SEM estimation in SmartPLS. The reported measurement and structural statistics should therefore be considered exploratory estimates rather than definitive validation of a structural model.

Future research should use larger and more diverse samples, distinguish instructional-process characteristics from learning-achievement indicators more explicitly, and examine additional factors such as prior ERP experience, student engagement, instructor support, and system usability. Studies combining questionnaire responses with standardized PoS performance tasks, accounting-based case assessments, or pre-test and post-test measures could provide stronger evidence about how ERP practicum design relates to learning. Overall, this study offers a preliminary examination of practical session quality in computerized accounting education while highlighting the need for more comprehensive and reproducible assessment of ERP learning outcomes.

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Author Contributions (CRediT)

The first author contributed to conceptualization, methodology, investigation, and writing – original draft. The second author contributed to data curation, formal analysis, and visualization. The third author contributed to investigation, validation, and writing – review and editing. All authors reviewed the manuscript and approved the final version for publication.

Conflicts of Interest

The authors declare no conflict of interest.

Data Availability

The data supporting the findings of this study consist of questionnaire responses collected from students participating in the ERP Odoo Point-of-Sale (POS) practicum at Politeknik Negeri Semarang. Due to privacy considerations, the raw respondent-level data are not publicly available. Access to the data may be considered upon reasonable request to the corresponding author, subject to applicable institutional requirements and participant privacy protections.

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