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# Accounting learning outcomes from problem-based learning

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## ABSTRACT

The main objective of this study is to examine and compare the educational achievements between problem-based learning and discovery learning approaches in the field of accounting. Understanding the concept is an important part of the process of learning and solving problems, both in the learning process itself and in day-to-day environments. Research using a quantitative method with an experimental approach is a true experimental design. The model of the experiment is the pretest-posttest control group design. According to earlier studies have shown that student's learn better through discovery learning (DL). It is evident that both methods contribute to the improvement of student outcomes. Being active, thinking critically, and increasing learner achievement are essential factors in the process of learning. In this study, it was discovered that the learning outcomes of problem-based learning models and discovery learning have notable disparities, with problem-based learning producing better learning outcomes. The conclusions from the study offer suggestions or input that can be conveyed and considered for future research. Schools should consider applying a problem-based learning (PBL) model. Students using PBL are required to find their own answers to problems by using their own thinking abilities to form a concept about the material being studied, so during learning activities, students will use their thinking abilities to the maximum.

**Contribution/Originality:** This research determines learners' interests and learning outcomes after treatment with a true experiment based PBL model. In the PBL model, the focus is on problems that are used as references in the learning process to ensure that learners are not only acquiring but are also motivated.

## 1. INTRODUCTION

Pedagogy refers to how teachers teach, both theoretically and practically. It usually takes the form of formal or non-formal pedagogy (Uliyandari, Candrawati, Herawati, & Latipah, 2021). Non-formal pedagogy includes everyday pedagogy such as manners and attitudes experienced in everyday life, and formal pedagogy consists of pedagogy in an educational institution (Hasanah, 2021). According to the Indonesia dictionary, pedagogy comes from the word educate, which means to maintain and provide training. From the basis of these words, it is clear that the role of pedagogy is to provide training to learners. Pedagogy is important for every individual because when we have knowledge we know what we didn't know before and can do things we couldn't before (Virtue & Hinnant-Crawford, 2019). The pedagogy we experience today is better than previous pedagogy, which had limited access for learners in accessing school lessons because technology was limited and was not as sophisticated as in today's digital era (Odell, Teresa, & Eric, 2019). Pedagogy today is facilitated by technology which, as time goes by,


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becomes more sophisticated (Caswell, 2019). To reach the current point, pedagogical development has undergone a long process (Ulutas, 2023). The curriculum in Indonesia started in 1994, which was refined to the 2004 competency-based curriculum, refined again to the pedagogy unit level curriculum, and then to the 2013 curriculum (Abdullah, 2015). Currently the curriculum is an independent learning curriculum that uses a scientific approach (Badar, 2017).

Pedagogy involves intentionally creating a structured learning environment to foster the development of learners' spiritual strength, self-discipline, individuality, intelligence, moral character, and the necessary skills for personal growth (Chan & Blikstein, 2018). Various parties, including the government, the business sector, the workforce, and academia, are involved in addressing the needs and concerns of individuals, society, and the country (Permatasari, Gunarhadi, & Riyadi, 2019). The advancement of science and technology plays a significant role in shaping the curriculum development. In this information era, the curriculum is increasingly dynamic and must always adapt to changes, especially in the field of accounting pedagogy (Compri, 2017). Accounting pedagogy is a teaching approach that assists in equipping learners to become educators in their respective fields. The Accounting Pedagogy expertise program is one of the options available to students at the Faculty of Economics. Accounting skills programs are part of the skills programs that are in high demand. In order to produce competent and well-trained graduates, it is essential to enhance the standard of education (Mattila, Hald, & Huynh, 2023). This can be achieved by implementing suitable instructional methods in every accounting class that encourage students to actively engage and develop their critical thinking abilities during the learning process (Crichton, Crichton, & Colville, 2022). According to earlier studies, using problem-based learning (PBL) and discovery learning (DL) as alternative approach enhance the caliber of instruction and student learning outcomes (Harsanti & Hadi, 2017; Pamungkas, 2016).

## 2. LITERATURE REVIEW

### *2.1. Learning Model*

Learning is a process of interacting in situations that are around. Learning in the Big Indonesian Dictionary is trying to gain knowledge, practice, changes in behavior or responses due to an experience. Teaching is an activity of organizing and coordinating the environment and children, so that the learning process occurs (Sumantri, 2016). The process of teaching and learning is important in pedagogy where the teacher plays an important role and is a process of a series of changes and teacher-student interactions with reciprocal relationships and processes to realize predetermined learning objectives (Hanafiah & Suhana, 2009). Joyce & Weil (in Rusman (2018)) explains the learning model is a strategy applied to curriculum formation, designing learning materials, and guiding learning activities in class. In the Ministry of Pedagogy regulations Number 103 of 2014, the 2013 curriculum applies a learning model that is able to create scientific and social attitudes and increase curiosity. These types of learning are problem-based learning (Niluh, 2018), project-based learning (PjBL), and discovery learning (DL).

Hosnan (2014) explains that the PBL model uses real life problems as learning materials to help students think critically, solve problems and acquire knowledge; the teacher's task is to help learners develop skills. The advantages of the PBL model are: (1) Solving problems as a way to help students understand lessons, (2) Growing student activity during learning, and (3) Helping learners receive learning material. The benefits of the DL model are: (1) Helping to improve knowledge to solve problems in real life, and (2) Increasing learners' interest in continuous learning. Kurniasih and Sani (2014) stated that DL is a learning model that is used when teaching materials are not provided in their final form. DL helps learners analyze and solve problems on their own and is able to increase student activity, it helps learners to be more independent in acquiring knowledge and strengthens their understanding and memory, it creates conditions conducive to learning because it fosters a desire to discover and succeed, it strengthens self-design as it helps develop confidence in collaborating, it centers on learners' and teachers' input, ideas or solutions, and it helps learners to think more and work independently. Purwanto (2011)



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argued that learning outcomes are changes in attitude as a result of achievement. The PBL model is an educational method that utilizes actual problems to provide learners with the opportunity to develop their critical thinking and problem-solving abilities (Slameto, 2010). Additionally, this approach enables them to learn essential information and comprehend key ideas from the study materials.

According to Pamungkas (2016), problem-based learning is an educational strategy that involves students in hands-on learning. This paradigm places a strong emphasis on applying real-world situations as a basis for learning and comprehension through a variety of abilities. The integration of problems that are pertinent to learners' daily lives at home, at school, or in the community is given priority in this approach. The capacity for critical thinking and efficient problem solving can be done with problem-based learning. Problem-based learning presents various authentic problematic situations, and these become the starting point of learning and are meaningful to learners, which serves as material for investigation. The students' task is to investigate and solve the problems presented in the learning process. While each student must possess unique skills, during the PBL process, students study in groups to comprehend the challenges they encounter and work separately to acquire further information about problem solving (Kosasih, 2016). The nature of the problem varies according to the particular organization. Typically, the issues consist of actual problems encountered in daily life, which have been carefully chosen and modified to align with educational objectives and standards. According to Rahayu (2015), PBL is considered contextual since it utilizes real-life issues as learning material for students. The PBL approach aids learners in acquiring additional knowledge, enabling them to effectively tackle any challenges presented during group work and respond to assessment queries throughout the learning process. Rusman (2018) stated that the problem-based learning approach is used to stimulate students' high-level thinking that is oriented toward problems in the real world. Furthermore, the goal of problem-based learning is to teach students how to solve problems by employing an appropriate problem-solving strategy. It requires them to use their minds to comprehend concepts through circumstances and problems that are offered at the start of the learning process.

### *2.2. Learning Outcomes*

Learning is an individual process through mental, physical and social aspects to build ideas or experiences using material or information. Every individual will become an adult as a result of learning and experiences throughout life (Amiruddin, 2016). Learning is a process where mechanisms will change a person's behavior as a result of experience (Harsanti & Hadi, 2017). From the opinions above, it can be interpreted that learning is a process of changing an individual from not understanding to understanding both in terms of attitude and knowledge. Individuals who are in the learning process are expected to experience changes in accordance with the predetermined learning targets (Harsanti & Hadi, 2017). In the world of pedagogy, the main actors in the learning process are learners, who are expected to change according to the curriculum set by pedagogical institutions. According to Dimyati and Mudjiono (2006), learning always involves changes in the individual, be it maturity in thinking, behavior, or making a choice. Accounting is one of the subjects at the accounting pedagogy level. The accounting learning process will be influenced by the extent of previous knowledge of accounting (Adawiyah & Disman, 2020). Thinking abilities also influence the accounting learning process. The abilities that learners acquire during learning activities are known as learning outcomes (Hanafiah & Suhana, 2009). Learning outcomes, which encompass cognitive, emotional, and psychomotor skills, are specific competences or abilities attained by learners subsequent to the teaching and learning process (Suminar & Meilani, 2016). Learning outcomes are everything that students accomplish through specific exams that are based on the curriculum of the prior educational establishment. Learning outcomes relate to the changes in a person's knowledge, understanding, attitudes and behavior as a result of learning; however, changes caused by growth are not included in learning outcomes (Sahade & Ngampo, 2017). According to Sudjana (2005), learning outcomes are changes that a person has after going through the learning process. Learning outcomes are achievements obtained by someone in the form of changes in themselves after the



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learning process. According to Suprijono (2009), the ability to think creatively and learn independently are important factors in online learning in the New Normal era. Another review that strengthens this opinion was expressed by Badar (2017), who argued that learning independence contributes to learning outcomes. The rest is contributed to by other variables aside from learning independence, which also includes learners' creative thinking abilities. The characteristics of learning outcomes are changes in behavior with conditions that have been determined and can be assessed and measured. Learners' learning success is demonstrated by changes in themselves from cognitive accounting learning outcomes (Maarif, 2018). From the discussion above, it can be said that the main factors that influence learning outcomes are learners' creative thinking abilities and the level of learning independence possessed by learners. The results of learning accounting are patterns of behavioral change which include cognitive, affective and psychomotor aspects obtained after the accounting learning process (Kurniawan, 2018). The process of learning accounting is marked with a value scale in the form of letters, symbols or numbers (Rahayu, 2015). This can be used as a benchmark for the success of student or individual accounting learning. Based on the aforementioned, the hypotheses proposed are:

*Ho: When employing the PBL and DL models, the learning outcomes are the same.*

*Hα: When employing the PBL and DL models, there are differences in the learning outcomes.*

## 3. METHOD

### *3.1. Research Design*

In the literature review, the research was in the form of quantitative investigations that employed an experimental strategy and a true trial design type, which separates a subject group into an experimental class and a control class (Sugiyono, 2015). The pretest-posttest control group design is the genuine experimental paradigm used for this study, and it is based on (Emzir, 2017). Table 1 shows the experimental design. The data collection method in experimental research uses the independent t-test method.

**Table 1.** Research design.

| Group | Pretest | Treatment | Posttest |
|---|---|---|---|
| Experiment | $T_1$ | X | $T_2$ |
| Control | $T_3$ | - | $T_4$ |

### *3.2. Research Population*

The population in this study were prospective teachers who were learning at Surabaya State University, and the sample comprises 51 prospective accounting pedagogy teachers. Purposive sampling was used to select learners who were prospective accounting teachers who were studying intermediate accounting courses. Arikunto (2013) argued that a test is a measurement tool used by applying predetermined instructions. The test questions were reviewed prior to the exam being administered.

### *3.3. Research Instrument*

The procedure for collecting data for this research was to conduct a literature study using national and international journals and articles that are relevant to the context of this research. The data in this literature study is in the form of pretest and posttest scores, which was analyzed to test the hypotheses using the independent t-test (Sujarweni, 2015).

### *3.4. Data Analysis Technique*

Context analysis examines the content that students will study through the development of concept maps that facilitate students' comprehension of the course material. The primary goals of this analysis are to determine which concepts need to be taught, organize them in a methodical manner, describe the pertinent concepts, and connect



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related concepts to create a concept map. An instrument's accuracy is determined by a reliability test. In this research, the validity test used Spearman's correlation and SPSS reliability tests. The revised pretest-posttest questions were then validated by material experts, who were asked to assess the revised questions by filling in the validation sheet. This was done to determine the suitability of the content and presentation. The research data was tested for normality and homogeneity with the independent t-test. The independent t-test was carried out prior to being administered during the learning process and was administered via SPSS software (Sujarweni, 2015). The test was administered using the results from the pretest and posttest. Ho is accepted if t count > t table employing df (n1 + n2 - 2) at a significance threshold of 5%. In Nuryadi, Tutut, and Utami (2017), the Institutional Review Board (IRB) of Surabaya State University approved this inquiry, and the Committee of Human Subjects Protection of the Second Affiliated xxx State University, Surabaya, Indonesia, accepted the protocols used in the study. The researchers respected the confidentiality of the respondents' identities, obtained informed permission in compliance with institutional policies, and obtained IRB protocol approval for the study at Surabaya State University, Surabaya, Indonesia. The Protection of Human Subjects Committee in Surabaya State University authorized the protocols utilized in the study.

## 4. RESULTS

Based on literature from several previous studies related to the comparison of student learning outcomes using problem-based learning (PBL) with discovery learning (DL), there are various opinions explained in the research by Wabula, Papilaya, and Rumahlatu (2020); Sahade and Ngampo (2017) and Ariyani, Suardana, and Devi (2020), who concluded that DL can improve student learning outcomes. However, several other studies yielded the opposite conclusion, such as Nurcahyo and Djono (2018); Oktaviani, Mawardi, and Astuti (2018) and Nuryadi et al. (2017), who found that PBL succeeded in increasing students' learning outcomes. The following shows the results of the control class pretest.

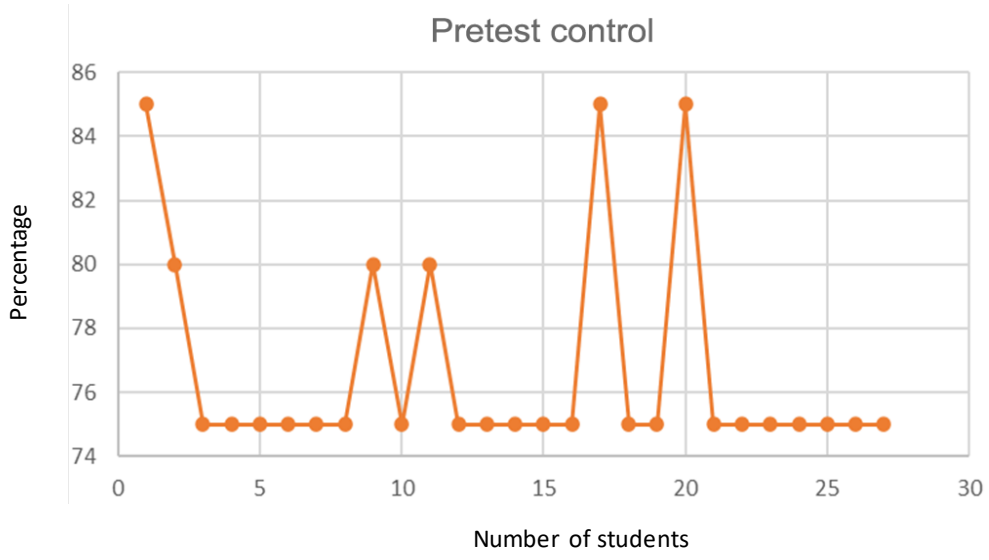


**Figure 1.** Control class pretest.

The recapitulation in Figure 1 of the ability scores of the pretest learning outcomes for the control class learners, which consisted of 27 learners, yielded the lowest average score of 77%, and the completeness score was above the average of 23%. In order to assess students' learning results prior to the treatment, a pretest was administered prior to the researcher presenting financial accounting content via book materials and whiteboards.



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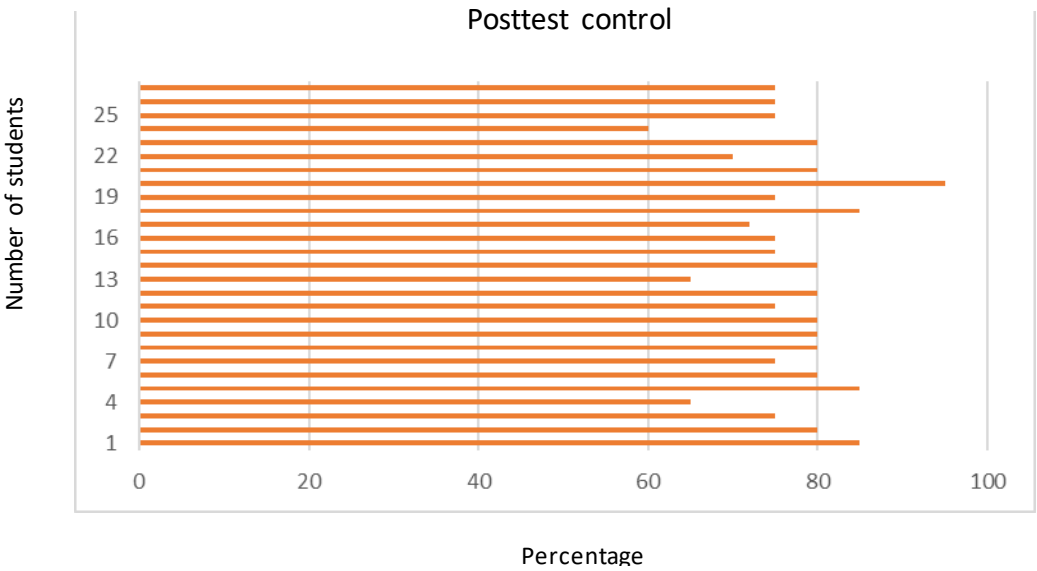


**Figure 2.** Posttest results of the control.

In Figure 2, the results of the recapitulation of the ability scores of the control class learners' learning outcomes were below the average mastery of the class, amounting to 44% of learners, while the acquisition of grades above the average class learning completeness is 56%. This value was obtained after the learning process using book materials in the subject of Financial Accounting. The posttest score was obtained by the researcher after the learners carried out learning activities in Financial Accounting using equipment, materials, books and blackboards, where this data was taken to determine the ability of learners' final learning outcomes as a control class.

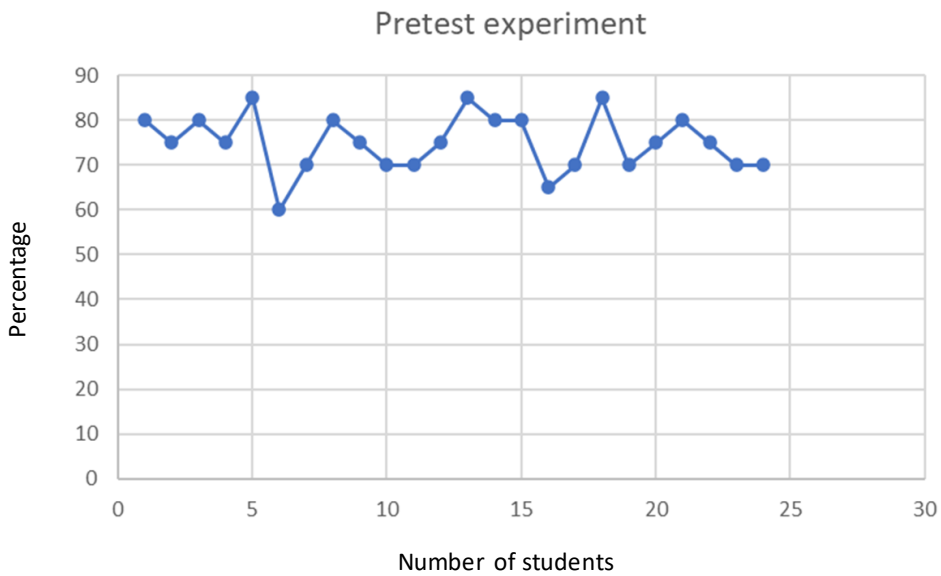


**Figure 3.** Experiment class pretest.

Figure 3 shows that recapitulation of the pretest scores on student learning outcomes using PBL obtained scores below the average of 63%, while 37% obtained scores above the average. The pretest value for the experimental class was obtained before Financial Accounting learning using contextual learning materials. The results of this value were taken to determine learners' initial learning outcomes prior to the learning process using contextual learning materials.



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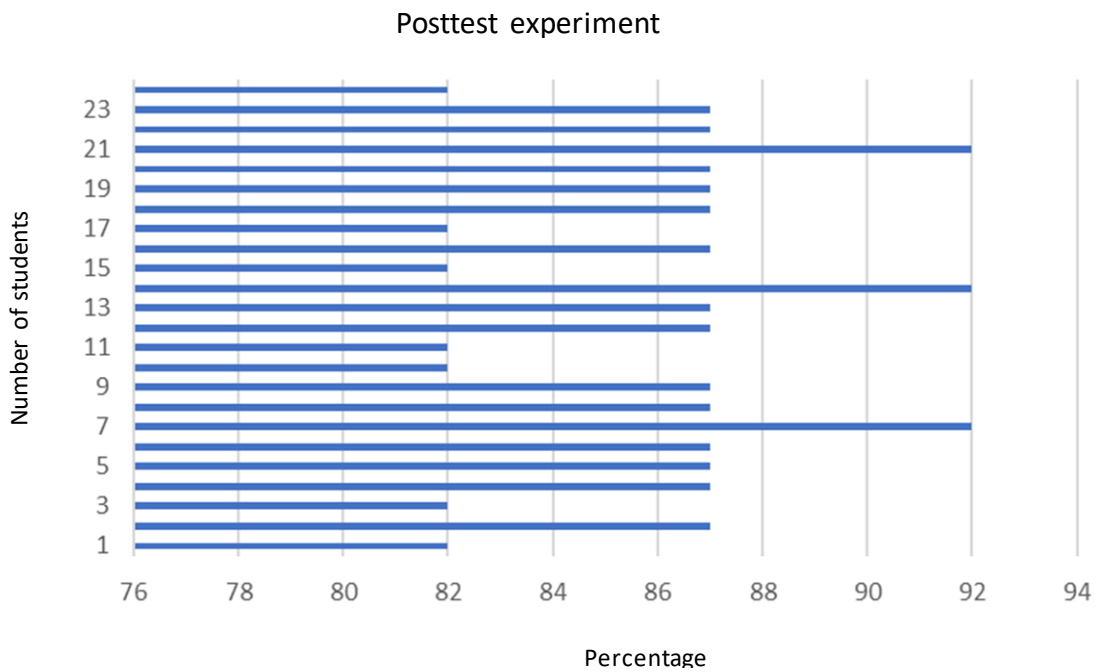


**Figure 4.** Posttest class experiment.

It is evident from Figure 4 that learners' learning outcomes in the experimental class were recapitulated following the implementation of contextual learning materials during the financial accounting learning process where the learning completeness score was above the average of 91%. The remaining 9% got below the average grade of learning completeness. Next is the prerequisite test, specifically, the data normalcy test, which was conducted using the Kolmogorov–Smirnov test to ascertain whether the learning objectives of the experimental class and the control class differ in any way. The purpose of the normality test is to ascertain whether or not the data distribution is normal; if it is, parametric statistical tests will be employed.

**Table 2.** Kolmogorov–Smirnov sample test.

| Kolmogorov–Smirnov | | Control | Experiment |
|---|---|---|---|
| N | | 27 | 24 |
| Normality parameters[a,b] | Mean | 77.000 | 80.670 |
| | Standard deviation | 4.420 | 3.691 |
| Most extreme differences | Absolute | 0.177 | 0.214 |
| | Positive | 0.175 | 0.214 |
| | Negative | -0.177 | -0.203 |
| Kolmogorov–Smirnov Z | | 0.921 | 1.048 |
| Asymp. sig. (2-tailed) | | 0.364 | 0.222 |

**Note:** a. Test distribution is normal.
b. Calculated from data.

According to the results in Table 2, the control class's data distribution is normal because its significant value of 0.364 is more than 0.05. Additionally, it was discovered that the experimental class's data was consistently distributed, with a significance value of 0.222, higher than an alpha of 0.05. The next test compared the means of the two classes is the statistical group test. This is done to get the mean for either the control class or the larger experimental class.



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**Table 3.** Summary of the pretest-posttest results.

| Descriptive | Class | N | Mean | Standard deviation | Std. error mean |
|---|---|---|---|---|---|
| Value | 1.00 | 27 | 77.000 | 4.420 | 0.851 |
| | 2.00 | 24 | 80.670 | 3.691 | 0.753 |

Table 3 provides a summary of the average pre- and post-test results for the experimental class and the control class. The value of the experimental class, problem-based learning, is represented by number 2, whereas the value of the control class, discovery learning, is represented by number 1. Compared to the control class (77), the experimental class's pretest-posttest mean value of 80.6 was greater. It can be inferred that the learning objectives that the students in the experimental class have met differ from those of the control class because the average posttest score for the experimental class is greater than that of the control class. The test was used by the researchers to evaluate the learning objectives of the control and experiment groups as part of their precondition assessment. In order to analyze the hypotheses and determine if the generated data is homogeneous or differs from the data reviewed using the pretest and posttest results for the experimental class and control class, the homogeneity test employs an independent sample t-test.

**Table 4.** Independent sample T-test.

| Independent sample T-test | | Levene's test for equality of variances | | T-test for equality of means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean difference | Std. error difference | 95% confidence interval of the difference | |
| | | | | | | | | | Lower | Upper |
| Value | Equal variances assumed | 0.285 | 0.596 | -3.192 | 49 | 0.002 | -3.667 | 1.149 | -5.975 | -1.359 |
| | Equal variances not assumed | | | -3.227 | 48.826 | 0.002 | -3.667 | 1.136 | -5.950 | -1.383 |

The homogeneity test results using Levene's test are displayed in Table 4 for both the control and experimental classes. The homogeneity test's significance was higher than alpha 0.05, indicating that the results were homogeneous. The control and experimental classes' Levene's test values obtained a significance value of 0.596. There are similarities between the experimental and control classes. It is evident from Table 3 that the independent t-test findings yielded a significant value of 0.002, which is less than 0.05. Accordingly, it can be concluded that, even though Ho is rejected and Ha is accepted, there will probably be a significant difference in the learning process and the outcomes of students who are provided with contextual learning materials compared to those who continue to use books and blackboard materials. Early on in their study, Siregar and Listiadi (2005) compared the pretest results of the control class's average pretest results to those of the experimental class and discovered that the latter had higher pretest scores overall. Following the acquisition of the data, several treatments were administered to the control groups utilizing problem-based learning models for discovery learning, and experimental classrooms that employ problem-based learning models for discovery learning.

## 5. DISCUSSION

A posttest was carried out after the learning model was applied, and the results were used to decide which of the two learning models should be used. The experimental class's posttest scores were lower than those of the control group. The average posttest results increased in the experimental class but not in the control group. These results demonstrate that the control class, which employed the discovery learning (DL) strategy, and the



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experimental class, which employed the problem-based learning (PBL) paradigm, had different student learning outcomes. A problem is presented in the learning process known as issue-based education where the learners are faced with a problem that challenges them to learn and work hard as a group to solve a problem so that an interaction process occurs between stimulus and response. PBL aims to help learners deal with problems in real life situations and learn how adults play a role.

The PBL model is a form of learning that is based on the constructivism paradigm which prioritizes learners in learning and is oriented toward learning activities. PBL is a process approach to learning related to real world problems as a context for thinking so that learner can develop skills and think critically to solve problems and gain knowledge and understand concepts related to the material discussed. PBL can offer students a dynamic learning environment. Learning to solve problems is an approach that is very effective for teaching thinking processes, helps learners process the information they have received, and helps learners build knowledge of their social and physical surroundings. The PBL model is essentially thinking or reasoning by applying various knowledge that has been previously obtained to solve various new problems that have never been encountered before. According to the statements of the experts above, the PBL model is a way for learners to understand the material being taught by using existing problems in the environment and providing solutions.

Oktaviani et al. (2018) found that the average pretest for experimental group I was 65.94 and the average pretest for the experimental group II was 65.11. Furthermore, the two groups were given different treatment, utilizing a PBL model for experimental class I and a DL model for experimental group II. Following various treatments, a posttest was administered to both groups; the mean score was 80.24 for experimental class I and 72.34 for experimental class II. This shows that when it comes to learning outcomes, PBL models perform better than DL models. The aforementioned studies aimed to ascertain how the application of discovery learning and problem-based learning models affects student learning outcomes as sub-variables. Pretest-posttest was used by each researcher to gather data. Apart from the previously mentioned research, the study by Mulyati, Idmi, and Arfiyanah (2018) titled "Discovery Learning Model to Improve Student Learning Outcomes in Accounting Subjects" is also worth mentioning. The DL paradigm in accounting education has the potential to increase student engagement and comprehension, which can enhance learning results. Research by Mulyati et al. (2018) demonstrates how discovery learning can enhance student learning outcomes, which were 66.7% in cycle 1 and grew to 100% in cycle 2, indicating a boost in the use of discovery learning. In an effort to enhance student learning results, a number of studies also used variants of the two learning models. Maarif (2018) conducted a study on project-based learning and discovery learning models to improve the understanding of Pancasila as the basis of the state and view of life in PKN learning and concluded that employing modified versions of DL and PBL can enhance student learning outcomes in the areas of knowledge, abilities, and attitudes. Furthermore, studies by Wabula et al. (2020) and Adawiyah and Disman (2020) demonstrate how PBL and DL models can enhance student learning results. The learning style known as discovery-based learning places special emphasis on the process of discovering the concept of a subject matter by learners when the learners are not presented with learning in its finished/complete form but rather they are expected to discover.

There are several theories that underlie the discovery-based learning model, including constructivist learning theory, Jaen Piaget's theory, and Jerome Bruner's discovery theory. Constructivism theory also has an understanding of learning that emphasizes the process rather than the results. Real actions gain understanding or knowledge, and learners build their understanding of the phenomena they encounter using their experiences, cognitive structures and beliefs. Thus, learning according to constructivism theory is a process that constructs knowledge through experience. Knowledge is not the result of receiving information directly from other people, such as teachers or other educators, but is the result of a construction process carried out by each individual. Knowledge that goes through the process of construction by each individual will provide something in the long term or will be more mastered and stored or remembered for longer by each individual. Piaget was one of the



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constructivist pioneers, and he maintained that children build their own knowledge through firsthand interactions with their surroundings. According to Piaget, action is the source of knowledge, and children's ability to actively control and interact with their surroundings has a significant impact on cognitive development. In this instance, the book serves as an information source, and the teacher plays the function of facilitator. Piaget's theory outlines cognitive development from infancy to adulthood. In Piaget's view, cognitive structures are organized and interconnected groups of memories, actions and strategies used by children to understand the world around them. In babies, the cognitive structure they have is reflex. The process of constructing knowledge mentioned by Piaget starts from scenes, assimilation, accommodation, and equilibration. According to Piaget, the more a person is able to differentiate one stimulus from another, the more schemata they have, which are cognitive structures that are always changing and developing due to assimilation and accommodation. Piaget argued that people create new knowledge from their experiences through the processes of adaptation and assimilation. Assimilation happens when a person's perception of the real world aligns with their new experiences. They integrate the novel experience into the preexisting structure. Reintegrating one's mental images of reality to align with new experiences is the process of assimilation. Accommodation is a process that helps turn failure into success by teaching us new things. When we hope that the world will work in the way we want, and it turns out the opposite is true, then we are likely to experience failure. By accommodating these new experiences and reintegrating our desired models, we gain new things from learning about failure. In its implications for the learning process, learners organize the learning material they study in a final form that corresponds with a child's cognitive development. Independent learning is promoted for students, and active learning occurs when concepts and principles are applied. This idea states that when a teacher provides students with examples that demonstrate the rule that serves as the source, they will be able to uncover rules, concepts, theories, definitions, and more. This will allow the learning process to proceed smoothly and creatively. Inductive guidance is used to help learners comprehend a broad truth. The opposite of this approach is called expository learning, learning by explaining. In this case, learners are given general information and are asked to explain this information through specific and concrete examples.

## 6. CONCLUSION

The learning models in the Independent Learning Curriculum, specifically problem-based learning (PBL) and discovery learning (DL), can enhance student learning outcomes and foster critical thinking skills because they encourage learners to actively solve problems. The PBL paradigm employs a problem that can assist learners in honing their critical thinking abilities and problem-solving techniques. The education of discovery helps learners to discover through the learning process so that they can improve their reasoning skills and think critically to solve a problem. The conclusions from the research study of the literature obtained suggestions or input that can be conveyed and considered, namely (1) Schools should consider applying PBL or DL as an alternative in accounting lessons to increase activity, learners' critical thinking skills, and student learning outcomes; (2) Teachers are expected to be able to create a learning atmosphere that is conducive and not monotonous and can apply the appropriate learning models to enable active learning and improve student learning outcomes; (3) Teachers are expected to be able to implement PBL and DL models to the fullest in accordance with predetermined objectives; and (4) For further research, a variety of learning models should be included to make the learning process even more interesting to increase student learning motivation.

## 7. LIMITATIONS AND RECOMMENDATION FOR FUTURE RESEARCH

Seeing the increasingly rapid development of the times supported by technological advances inevitably stimulates pedagogy to adapt accordingly. It also fosters learning opportunities for learners (grown learning). The learning model is one of the methodologies created by the world of pedagogy in order to achieve change. The implementation of learning models involves learners (teachers) and learner (learner). Teachers should be



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professional in carrying out their functions by using a methodology to teach learners in a non-constant way, meaning that teachers must innovate and create changes for themselves and their learners.

The limitation of this research is that if learners do not intend to try or do not think the issue under study is tough to solve, they will be unwilling to try. Some learners believe that if they don't comprehend the information required to solve the problem, there's no use in trying to tackle the topic under study since they won't learn what they want to. This model of problem-based learning can be implemented in a learning process to gain feedback on it, particularly from teachers.

In what ways does the PBL model align with 21st century needs? Expanding the sample and research area will enable future researchers to generalize the study's findings. It is envisaged that various research techniques and statistical testing tools can be used by future researchers to investigate the problem-based learning paradigm.

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