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Original Article

Increasing Learning Outcomes and Learning Engagement by Using Discovery Learning Assisted by Trello

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Abstract

The increasingly massive digitalization creates new challenges for the world of education in order to produce students who are ready to collaborate, communicate, and discuss at any time and under any conditions. The aim of this research is to implement the Discovery Learning model assisted by Trello to improve the learning outcomes and learning engagement of phase E students in Class X MPLB SMK Nasional Malang. This type of research is classroom action research carried out in 2 cycles with data analysis using percentage comparisons in cycle 1 and cycle 2. The results show that the implementation of this combination is able to maximize learning activities and increase students' learning outcomes. Scores at the end of the cycle increase in both the affective, cognitive and psychomotor domains. students help each other, which has an impact on increasing the speed of completing assignments. Students' learning engagement also increases at the end of the cycle, which can be seen from students becoming more active and participative in working on group projects.

Keywords: Discovery Learning, Trello, Learning Outcomes, Learning Engagement

1. Introduction

In recent years, the development of the times has resulted in massive digitalisation. The world of education has a big challenge to produce students who have high quality and are able to compete in the global era. To compete in the global era, students are required to be able to collaborate, communicate, and discuss at any time and under any circumstances (Devi et al., 2023). These demands mean that engagement plays an important role in the classroom. Learning outcomes reflect the success of learning. According to Benjamin Bloom, learning outcomes are changes in behaviour experienced after the learning process is carried out. Learning outcomes are divided into three domains, namely affective (moral aspects), cognitive (intellectual aspects), and psychomotor (skills) (Magdalena et al., 2020; Saftari & Fajriah, 2019). In assessing the success of learning, the three domains of learning outcomes must be balanced to achieve the learning objectives (Saftari & Fajriah, 2019). Therefore, learning models and media that can facilitate the achievement of these three domains are needed. The use of interesting and varied learning methods can make students more comfortable and involved in learning, as well as facilitate the acquisition of knowledge, so that they more easily understand the material, and learning outcomes are achieved (Inde et al., 2020; Jamaluddin & Hayati, 2022). One of the many learning models that can increase independence (Sunarto & Amalia, 2022), activeness and critical thinking skills (Inde et al., 2020) and improve learner achievement (Josephine et al., 2016; Suminar & Meilani, 2016) to achieve the learning objectives is Discovery Learning.

Discovery Learning is a student-centred model that allows for the process of self-constructing a concept or principle until a conclusion is reached (Handajani, 2020; Budiningsih, 2005). The application of the Discovery Learning model can transform a passive class into an active one, changing the condition of students who are accustomed to receiving information entirely from the teacher, to those who construct the acquisition of information by themselves (Handajani, 2020). In essence, Discovery Learning increases activeness in understanding the material so that learning objectives can be achieved through Learning Engagement.

Learning Engagement is one of the important factors in the achievement of learning outcomes (Anjarwati & Sa'adah, 2021). To measure learning outcomes, each school has set a standard score that must be met in each domain of learning outcomes. This is also applied at SMK Nasional Malang. The results of observations through interviews with teachers stated that in the Communication and Information Services element, some students' scores still did not reach the Criteria for Achieving Learning Objectives (KKTP). The teacher also mentioned that in some meetings, there were learners who seemed less interested in the learning process, while on other occasions seemed enthusiastic. This will have an impact on their engagement in learning, which also affects learning outcomes. In the Communication and Information Services (ICS) element, learner engagement is an important aspect, because this element is not fixated on the material, but also requires a lot of participation in practical studies. Considering this, a model that is able to increase learner engagement is needed (Learning Engagement). Discovery Learning is one of the right models to guide learners to be more active and able to think critically. (Inde et al., 2020; Tanjung et al., 2022).

This research implements the Discovery Learning model with the help of Trello media that will be applied to the Communication and Information Services element for phase E learners, because it is in accordance with the demands of their development in that phase. Discovery learning is expected to increase engagement because there is freedom of fact finding by learners, so that a concept can be explained from various points of view. With this exploration of concept discovery, they will understand more about the concepts they discover themselves, and learning outcomes will improve. The use of Trello media also supports the achievement of demands in the digital era, because Trello allows collaboration, discussion, and communication online. In addition, Trello can also visualise the tasks that are done, so that the engagement, efficiency and effectiveness of learning can increase (Laksana et al., 2023).

This research is important because previous research has shown that the use of Discovery Learning can increase activeness and grades as well as the minimum number of students who fail (Adi Prasetya & Tri Harjanto, 2020; Aldalur & Perez, 2023), sedangkan Trello dapat meningkatkan keterlibatan dan partisipasi (Laksana et al., 2023; Widayanti et al., 2022). The implementation of Discovery Learning combined with Trello media has never been done before. This study aims to implement the Discovery Learning model assisted by Trello on teacher and student activities, as well as to determine its effect on Learning Engagement and learning outcomes of class X SMK Nasional Malang.

2. Literature Review

2.1. Discovery Learning

The discovery learning model is a learning theory that does not present a material or teaching material in a final way, but allows an understanding of the theory, meaning, and relationship of a concept to other concepts through an intuitive process, then concluded

(Handajani, 2020:21; Budiningsih, 2005:43). Discovery Learning is a model that can make students become active and think critically, because it requires active involvement in the search for new theoretical concepts, so that students can actively find concepts (Inde et al., 2020; Tanjung et al., 2022). According to Handajani (2020), the Discovery Learning syntax consists of six stages, from stimulation to conclusion. The six steps can be summarised in Table 1.

Table 1. Stages of Discovery Learning

Stages of Learning	Teacher activities
Stage 1	At the beginning of the lesson, the teacher asks questions, instructs reading books, or other activities that can prepare students for problem solving.
Stimulation	The teacher sorts out learning resources that can be used and instructs the identification of sources relevant to the problem at hand, then selects and assumes as a temporary answer.
Stage 2	The teacher helps and accompanies learners in data collection and exploration.
Problem identification	The teacher guides learners to sort and present the data obtained.
Stage 3	The teacher assists the learners in proving the information that has been sought previously, aligned with alternative findings, leading to the conclusion of the results.
Collecting data	The teacher guides the learners to conclude the findings

Source: (Handajani, 2020)

2.2. Trello web-applications

Trello is a cloud-based tool that is useful for managing workflows so that they are more structured, especially in project management (Johnson, 2017). Trello's interface is very easy to understand and use, making it ideal for a wide range of users, from individuals managing personal projects to organisations managing multiple projects and large teams (Johnson, 2017). To operate Trello only needs to use an internet connection, without the need to install software. Users can create an unlimited number of boards to group tasks, sub-tasks, task groupings, and the like on Trello. Trello also allows users to pair their google accounts, including google calendar. Project deadlines set on each board will be directly connected to the connected Google calendar account, so users can get reminders, and tasks / projects will not be neglected.

2.3. Learning Outcomes

Learning outcomes are changes in behaviour that are seen after learning is completed. These changes can be measured either qualitatively or quantitatively in the form of a value scale (numbers or letters), which can determine the level of success of students in achieving certain targets. Learning outcomes are divided into three domains, namely affective (moral aspects), cognitive (intellectual aspects), and psychomotor (skills) and all three must be balanced to achieve learning objectives (Magdalena et al., 2020; Saftari & Fajriah, 2019). In this study, learning outcomes in the cognitive domain were measured using tests in the form of multiple choice questions. The affective domain was assessed based on observations of students' attitudes/morals, and the psychomotor domain was assessed from discussion activities and presentations.

2.4. Learning Engagement

Learning engagement refers to the level of attention, curiosity, and enthusiasm shown by learners during the learning process (Anita & Susilawati, 2018). This definition is also

supported by Fredericks' opinion in Silvola et al. (2021) that learner engagement illustrates learners' commitment to learning. It reflects the quality of participation, commitment and investment in learning.

According to Fredericks in (Anjarwati & Sa'adah, 2021), there are three domains of Learning Engagement, which are interconnected and function simultaneously in human behaviour (Silvola et al., 2021). The three domains include: 1) Behavioural engagement (learners' behaviour), 2) Emotional engagement (learners' emotional reactions), and 3) Cognitive engagement (learners' psychological investment in learning).

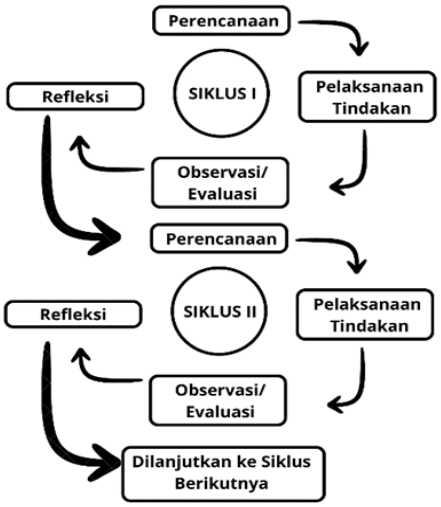
2.5. Communication and Information Services

Communication and Information Services (ICS) is one of several elements of the MPLB Basics subject. This subject is a subject that must be taken by class X SMK Office Management and Business Services. The Communication and Information service element discusses everything related to Information and Communication. This includes communication in the office, making leadership schedules, management information systems, and so on. In office communication material, students will learn about communication carried out in the office including oral communication and written communication, as well as some modern communication tools that can be used

3. Methods

This research method is Classroom Action Research (PTK) with 2 cycles in its implementation. The series of stages in each cycle include planning, implementation, observation, and reflection. This research was conducted by researchers with the help of observers to observe changes in the behaviour of students. The results of the observations in this study will be reflected on for action planning in the next cycle. By following the stages in each cycle, it is expected that in the last stage learning outcomes and engagement can increase.

This research was conducted at SMK Nasional Malang in the 2023/2024 academic year. The subjects studied in this study were phase E students in the field of MPLB expertise class X as many as 36 people. The following is a cycle of Classroom Action Research conducted:



Source: Retnaningrum, 2016

Figure 1. Classroom Action Research Cycle

The data taken in this study include: 1) data on students' and teachers' learning activities, 2) data on students' learning outcomes (affective, cognitive, and psychomotor), and 3) data on students' involvement in learning. The data will be analysed with 2 techniques, namely qualitative data analysis and quantitative data analysis. Qualitative data analysis is used to analyse data in the form of interviews, criticisms, suggestions, and field notes, then quantitative data analysis is used to analyse data obtained from tests and assessments by observers, which include learning activity data, learning outcomes data, and data on learner engagement. To analyse the success of teacher and learner activity actions, it is calculated using the formula and adjusted to the criteria below:

$$\%\text{Action Success} = \frac{\Sigma score\ obtained}{\Sigma maximum\ score} \times 100\%$$

Table 2. Criteria for Successful Action

Score	Criteria
81 - 100	**Very good**
61 - 80	Good
41 - 60	Fair
21 - 40	Less
0 - 20	Very Poor

Source: (Arikunto, 2017)

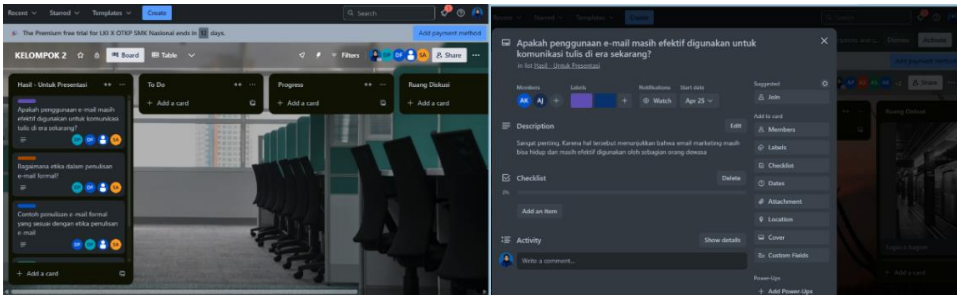
To analyse the success rate of learning outcomes and learning engagement, the following formula was used:

$$Score = \frac{Value\ obtained}{Maximum\ value} \times 100\%$$

4. Results and Discussion

4.1. Research Result

This study implemented the Discovery Learning model combined with Trello to improve learning engagement and learning outcomes. This research was conducted over two cycles. In cycle I, the learning was conducted by applying the Discovery Learning mode without using Trello media. Then in cycle II, learning was carried out by applying a combination of Discovery Learning and Trello. The following is a description of learner activities using Trello in cycle II.



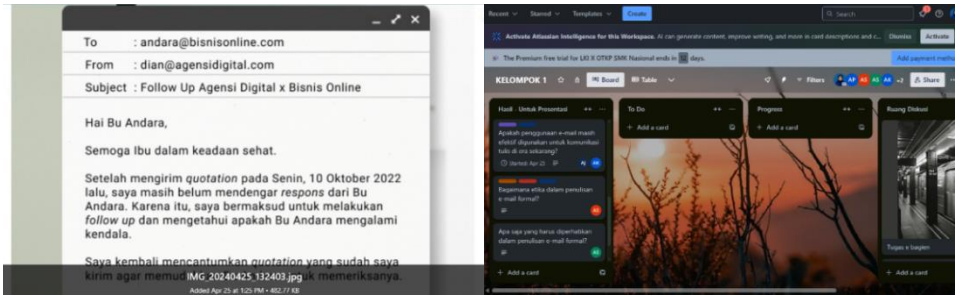


Figure 2. Learner Activity on Trello

Learning activities start from the initial, core, and closing activities. In each cycle, at the beginning of learning, students are given a stimulus in the form of a lighter question related to the material to be worked on. Then in the core activities, students are given an overview of the material to be learned, faced with a problem in the form of a project to solve, then given the opportunity to find and process information as an answer, and finally presented. Furthermore, in the closing activity, students are given the opportunity to prove their findings, and conclude the results of the learning that has been done.

4.1.1. Research Result

Learning activities come from the results of observations with observers, and are complemented by field notes, to observe changes in the activities of students and teachers while using the discovery learning model with the help of Trello. Indicators of teacher activity in this study are presented in the following table:

Table 3. Indicators of teacher activity

Aspect	Indicator	
	Cycle I	Cycle II
Pre-learning	Readiness of space, tools, and learning media	Readiness of space, tools, and learning media
Early learning activities	Greet students	Greet students
	Presence the students	Presence the students
	Deliver apperception and motivation	Deliver apperception and motivation
Core activities	Deliver learning objectives	Deliver learning objectives
	Explain the concept outline of office communication, oral communication, and written communication	Explain the concept outline of office communication, oral communication, and written communication
	Provide a sparking question	Provide a sparking question
	Dividing learners into groups	Dividing learners into groups
	Explain the activities that learners will do	Explain the activities that learners will do
	Instruct learners to discuss to find out the cause of the problem topic	Instruct learners to discuss to find out the cause of the problem topic
	Guide learners to obtain information from various sources	Guide learners to obtain information from various sources
	Encourage learners to be active in group discussions	Encourage learners to be active in group discussions through Trello

	Guiding learners to write the information obtained coherently	Guide learners to write the information obtained in the card on Trello
	Instruct learners to present the results of the discussion	Instructing learners to present the results of the discussion
Closing activities	Provide feedback on the results of the learners' discussion	Provide feedback on the results of the learners' discussion
	Instructing students to conclude the learning outcomes	Instructing students to conclude the learning outcomes
	Reviewing the learning process	Reviewing the learning process
	Deliver closing greetings	Deliver closing greetings

From these indicators, the success of teacher activity actions in this study is presented in the following chart

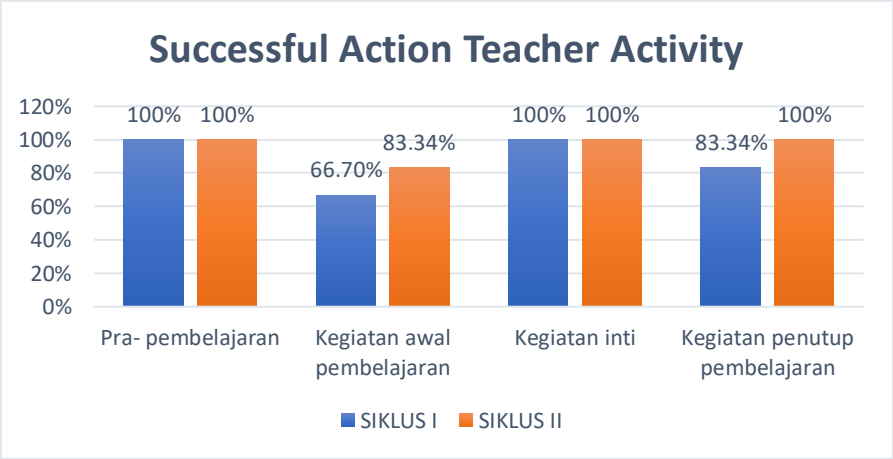


Figure 3. Successful Action of Teacher Activity

In cycle I, the success of teacher activity actions obtained an average score of 87.51%, while in cycle II the average score increased to 95.83%. This shows an increase of 8.32% in the success rate of teacher activity actions. This shows that the teacher has done a series of discovery learning very well. Indicators that have not been fulfilled well by the teacher are conducting attendance as well as providing apperception and motivation in cycle I. Whereas in cycle II, the indicator that has not been fulfilled is conducting attendance at the second meeting.

Researchers also observed changes in students' learning activities. Indicators of learner activity observed are presented in the following table, along with the results of observations in this study.

Table 4. Indicators of Student Activity

Aspects	Indicators
Activeness	Actively listening to the teacher's explanation Actively seeking information from various sources
Ask	Ask questions about unclear material/instructions Ask questions about other groups' presentations
Discipline	Present on time in participating in learning

Aspects	Indicators
	Sitting in accordance with the group that has been determined
Cooperation	All group members work together to solve the problems given Present the whole work result
Creative	Creative in presenting information from the discussion Creative in answering a question
Engagement	All group members involve themselves in the project Learners are active in the discussion

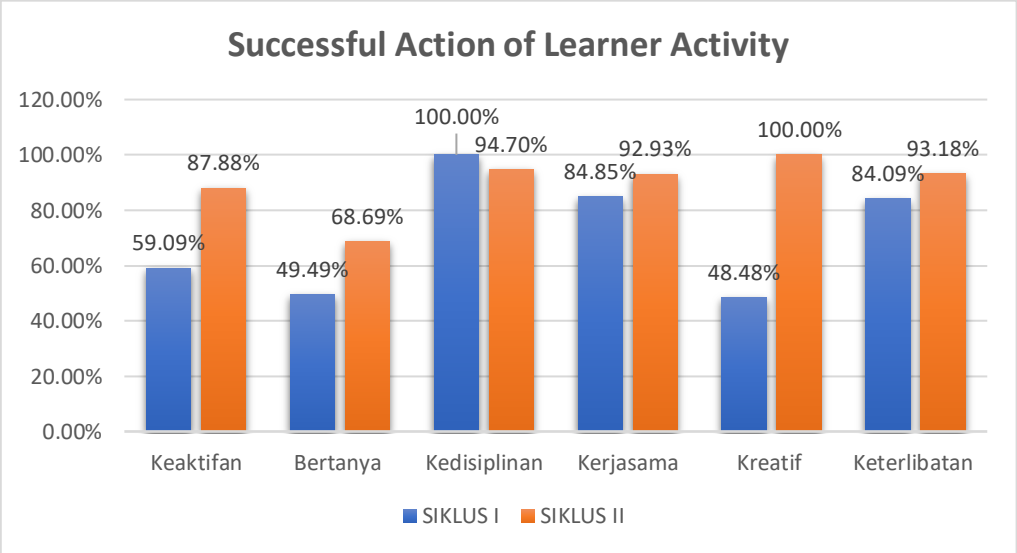


Figure 4. Successful Action of Learner Activity

The success of learner activity actions in cycle I had an average of 71%, while in cycle II it increased by 18.56%, to reach 89.56%. All aspects increased from cycle I to cycle II except in the aspect of discipline. In cycle II, the discipline aspect decreased by 5.3%. The indicator that was not met in cycle II was the presence of students on time. This happened because some learners did not arrive on time in the 2nd meeting of cycle II because at that time the lesson started after the prayer break. Then the aspect with the highest increase was the creative aspect. This happened because in cycle 2, learners showed higher creativity in working on project assignments and making presentation media through Trello.

4.1.2. Learning Outcomes

The learning outcomes measured include all 3 domains, namely affective, cognitive, and psychomotor. Learning outcome data was measured from tests and observations of learning activities over two cycles based on the achievement of the indicators used. Affective learning outcomes in this study were observed based on the following aspects and indicators:

Table 5. Indicators of Affective Domain Learning Outcomes

Aspects	Indicator
Attitude	Learners ask or interact with the teacher Learners ask or interact with other learners Learners do the tasks as instructed Learners are active in discussions, expressing their opinions, and listening to other people's opinions
Interests	Learners have and use learning resources related to learning materials Learners do tasks according to the Learner Worksheet (LKPD)
	Learners are enthusiastic in participating in learning Learners record learning materials
Self-Concept	Learners delegate themselves to group tasks according to their expertise Learners complement each other's strengths and weaknesses between group members for the success of the task Learners express the difficulties they experience to the teacher Learners easily understand the teacher's explanation related to the material
Values	Learners listen carefully to the teacher's explanation as a form of trust in the teacher Learners are able to complete the assigned tasks Learners are able to express their opinions confidently Learners make presentations with confidence
Morals	Learners help group mates/other learners who are having difficulties Learners do the task honestly Learners show commitment and involvement in task/project activities Learners are able to resolve difficulties/obstacles in task completion

The results of the research observed in students from these indicators are presented in the following chart:

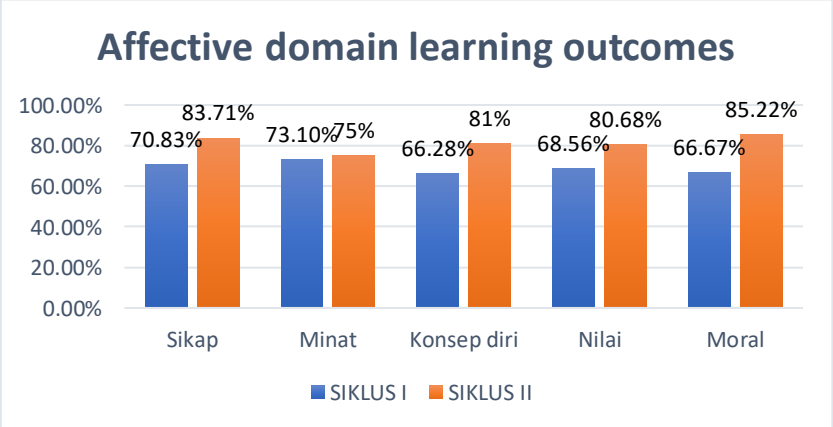


Figure 5. Affective domain learning outcomes

Affective learning outcomes in cycle I reached an average of 69.09%. Then in cycle II, the average increased by 12.04% until the percentage of achievement became 81.13%. All aspects of the affective domain increased from cycle I to cycle II. The most significant increase in aspects is the moral aspect with an increase of 18.55%. In cycle I, interaction between students was dominant in the discussion session. When working on assignments, they tend to work on tasks as they have been divided into their respective internal groups. But in cycle II, learners seemed more active in helping their group mates both in completing unfinished tasks,

operating Trello, and answering questions from other groups. Then the aspect with the lowest increase was the interest aspect with a percentage increase of 1.9%. This shows that students have a fairly good interest in using the Discovery Learning model and in combination with Trello.

The next learning outcome studied by the author is cognitive domain learning outcomes. The following are the results of cognitive domain measurements in this study:

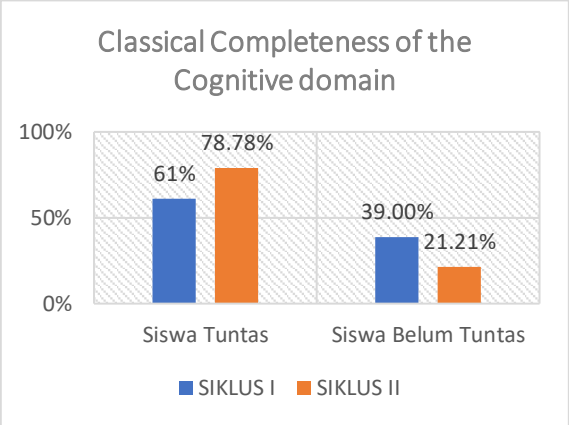


Figure 6. Average Cognitive Learning Outcomes

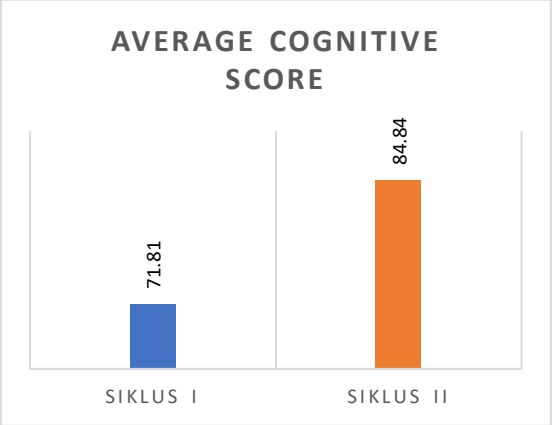


Figure 7. Classification of Cognitive Learning Outcomes

In cycle I, the class average value of the tests conducted was 71.81. Then in cycle II, the class average value increased by 13.03% to 84.84. In terms of classical completeness, cycle I had a completeness percentage of 61%, while in cycle II it increased by 17.78% to 78.78%. In cycle I there were 13 students who were not complete, seen from the scores that were below the KKM. Then in cycle II there was an increase in cognitive learning outcomes, so that there were only 7 students who were declared incomplete. In addition to the use of the Dsicovery Learning and Trello models, another factor that can cause an increase in cognitive learning outcomes in cycle II is students who are familiar with the material that has been studied in the previous cycle. The grids of the post-test questions for cycle I and cycle II are the same, only different in the types of questions, so that students understand more about the material at the end of cycle II. The last learning outcome studied by the author is the psychomotor domain. The assessment rubric for the psychomotor domain in this study is measured based on the following indicators:

Table 6. Indicators of Learning Outcomes in the Psychomotor Domain

Aspects	Indicators
Work Preparation	Preparing equipment
Work Implementation	Conduct a discussion Generate many ideas
Result	Making a presentation Making media for presentation Pay attention to the sentences in the writing

The results of this study on aspects of the psychomotor domain in this study are written in the following chart

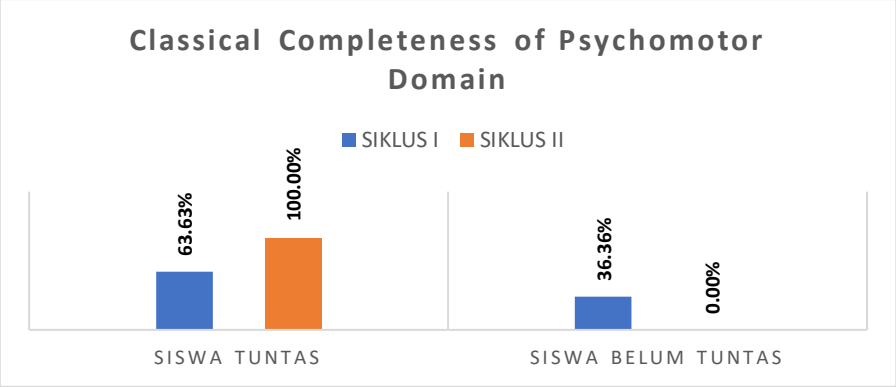


Figure 8. Percentage of learning outcomes in the psychomotor domain

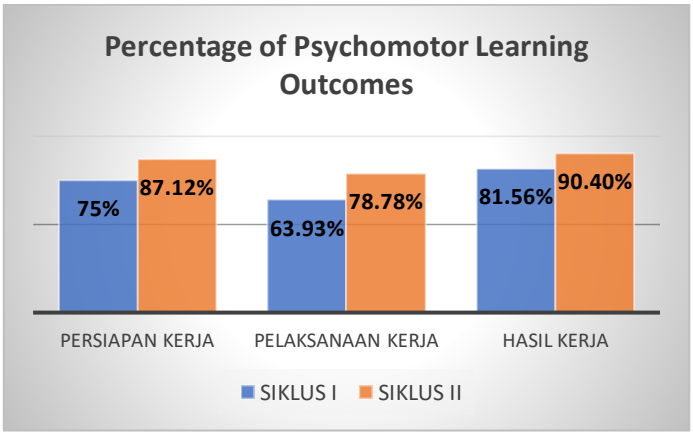


Figure 9. Classical Completeness of Psychomotor Learning Outcomes

In cycle I, the average value of psychomotor learning outcomes was 71.43. Then in cycle II, the class average increased by 12.5% until the class average became 83.93. From each stage starting from work preparation, work implementation, and work results, there was an increase from cycle I to Cycle II. This was also in line with the increase in classical completeness from cycle I to cycle II by 36.37%. In cycle I, the classical completeness of students was 63.63% with 12 people declared incomplete. Then in cycle II, all students were declared complete so that the classical completeness touched 100%. The aspect of the psychomotor domain with the highest increase from cycle I to cycle II was the aspect of work execution. In cycle II, the implementation of work can be done by students more easily because Trello facilitates the division of project tasks, progress monitoring, deadline reminders, and several other features.

This resulted in more effective and efficient implementation of learners' work, so there was a significant increase in cycle II.

4.1.3. Learning Engagement

The learning engagement indicators measured include: 1) behavioural, 2) emotional, and 3) cognitive. Learning engagement data is obtained from observations made by observers, in accordance with indicators that reflect these three aspects. The indicators are presented in the following table:

Table 7. Learning Engagement indicator

Indicator	Activity
Behavioral Engagement	Learners follow the learning instructions coherently Learners pay attention to learning carefully Learners are neat when participating in learning
	Learners do not cause commotion outside of classroom learning procedures
Emotional Engagement	Learners feel happy and interested in learning Learners are able to face problems or challenges in learning
	Learners actively ask the teacher if there is something that is not understood Learners actively discuss with other learners
Cognitive Engagement	Learners see from various points of view in problem solving Learners are able to express many ideas or thoughts Learners complete tasks on time Learners react positively to failure as a process of learning

The data of learning engagement measurement results for two cycles are presented in the following figure.

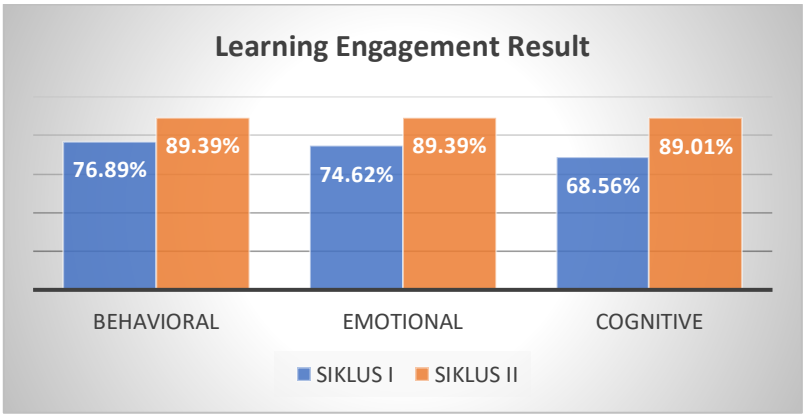


Figure 10. Learner Learning Engagement

The average percentage of students' learning engagement score in cycle I was 73.35%. Then the score increased by 15.91% in cycle II and reached 89.26%. Each aspect of learning engagement increased from cycle I to cycle II. Of the three aspects of learning engagement, the cognitive aspect experienced the highest increase of the other two aspects, which increased by 20.45% from cycle I to cycle II. In cycle I, some indicators of cognitive engagement had not been met by some learners. However, in cycle II, the majority of learners were able to fulfil these indicators, so that all groups could complete the task on time, and the ideas presented

by each group varied from various points of view. In addition to the use of the Discovery Learning model and Trello, this can be caused by learners who are familiar with the material and learning process, so they show more involvement in the cognitive aspect. Then the aspect of Learning Engagement with the lowest increase is the emotional aspect. This could be due to the Discovery Learning model is one of the newly implemented learning models, so learners need time to adapt to the model. As a result, the improvement from cycle I and cycle II was not significant.

4.1.4. Reflection

After cycle I was completed, the researcher and the observer conducted a reflection to improve the shortcomings that occurred in cycle I. In this cycle, the teacher has implemented the Discovery Learning model very well. In terms of learner activities, 4 out of 6 aspects have received good and very good ratings. However, there are two aspects that fall into the sufficient category, namely cooperation and creativity. In this cycle, the cooperation of students is considered quite lacking and needs to be improved again. From the creative aspect, some students have not shown this aspect, seen from the preparation of discussion results for presentation. After reflection from cycle I, the implementation of cycle II showed an increase in the success of learning actions. the success of teacher actions increased from the previous cycle with the same category, namely very good. Learners' activities also increased, as evidenced by all aspects of the success of actions that obtained the very good category.

4.1.5. Feedback from Learners

Feedback from learners is presented in this study to show the impact of using Discovery Learning with the help of Trello media.

Table 8. Feedback from Learners

ASPECT	FEEDBACK
Discovery Learning	It was quite challenging because I had to explore materials outside of books and modules. On the other hand, it was quite fun because I was able to gain a lot of new knowledge while searching for materials from other sources. The teacher also gave feedback at the end so that the material was conveyed clearly.
Use of Trello	It was fun, having never heard of or used Trello before.
Trello media	Easy to use, but the limited internet at school is a bit of a difficulty. The appearance of Trello is attractive, making it easier to divide tasks and complete tasks more creatively.
Increase learner engagement	The use of Trello makes all members participate in doing the task because the teacher can monitor the division and work on the board. Students are also very enthusiastic about designing their work through Trello.

4.2. Discussion

The implementation of Discovery Learning was carried out in cycle I without using Trello media. In its implementation, learners conducted discussions and worked on group assignments directly like discussions in general. In this cycle, most learners seemed to actively coordinate the task, while the rest followed the instructions of their group mates. This also applies in the discussion session. All groups have divided the task work to each group member. However, in some groups, members did not help each other and only did the task according to the division. The different abilities of each student led to differences in the completion time

of each task done. This had an impact on the completion of group assignments that were not on time.

In contrast, in cycle II, learners were able to complete the assigned tasks before the time given was over. Based on the observation, in this cycle learners helped each other, because the progress of each member's work could be monitored through Trello. This means that learners are more collaborative and involved in working on tasks when compared to cycle I. This is in accordance with research (Devi et al., 2023) which states that the use of Trello supports learner collaboration for more effective results, is supported by (Widayanti et al., 2022) who stated that in practice, Trello can make learners active, collaborative, and enthusiastic in learning (Laksana et al., 2023) also mentioned that the use of Trello can increase learner engagement and participation which also has an impact on improving the quality of learning. In addition, the observation results also showed that learners were more motivated to complete their assignments immediately because they saw the progress of their group mates who had finished first. This may be due to the implementation of both Discovery Learning and Trello in cycle II. Based on the research

(Tanjung et al., 2022), after the implementation of Discovery Learning, students were more active and completed the assignment on time than the previous cycle. Then if it is connected with the use of Trello (Widayanti et al., 2022) stated that the use of Trello can increase the speed of students in working on project assignments and is supported by (Laksana et al., 2023) who mentioned that Trello can maximise the effectiveness and efficiency of learning.

Based on the achievement of teacher activity indicators in this study, the success of teacher activity actions has a percentage of success with very good indicators. This shows that the teacher has implemented learning with the Discovery Learning model well. In cycle I, the teacher needs to monitor the discussion conducted by students directly. Whereas in cycle II, teachers can minimise direct monitoring of discussions because students' progress can be monitored from Trello. This will facilitate the activities carried out by the teacher so that learning can be more effective. This result is in accordance with research (Shchetynina et al., 2022) that Trello is proven effective and can be applied for learning, also supported by research results (Devi et al., 2023) who stated that Trello facilitates collaboration, progress monitoring, and more effective discussions (Harjito et al., 2022) also mentioned that classroom management can be recorded systematically and comprehensively.

The learning outcomes of students increased from cycle I to cycle II both in the affective, cognitive, and psychomotor domains. The implementation of Discovery Learning is proven to be able to improve learning outcomes. This is in accordance with the research results (Adi Prasetya & Tri Harjanto, 2020) which shows an increase in student learning outcomes after the application of the Discovery Learning model, which is also supported by research (Inde et al., 2020) and (Tanjung et al., 2022) with the same results, which have an impact on improving learning outcomes. The greatest improvement in learning outcomes was in the cognitive domain. The average score of students increased from cycle I to cycle II. In addition, the number of learners whose scores were not complete was minimised in cycle II. These results are relevant to the research (Aldalur & Perez, 2023) which states that the use of Discovery Learning has an impact on increasing students' scores and the lack of students who fail.

In psychomotor learning outcomes, the indicators measured include work preparation, work execution, and work results. The average class score increased in cycle II, which initially had a good category, to very good. Observations showed that learners were in the good category in preparation, execution, and could collect good work results. In cycle I, learners

conducted direct discussions as usual. Some learners were considered very active in the discussion, while the rest were less active. However, in cycle II, almost all learners showed interest and activeness in the discussion session, especially in the operation of Trello in working on project tasks. This is relevant to the research conducted by (Cahyani & Prapanca, 2021) that Trello received a positive response from learners, which was also supported by (Widayanti et al., 2022) Then from the percentage aspect of work results, learners also experienced an increase in cycle II. In cycle II, learners were more creative in processing presentation media, also showing better presentation skills. This can be seen from the increase in self-confidence, the contribution of evenly distributed cooperation, the level of understanding of the presentation material, and the orderliness of the delivery of the problems presented. These results are relevant to the research (Fahmi et al., 2019) that Discovery Learning allows learners to gather information independently, so that what is found in the search process will be easier to remember, which has an impact on increasing understanding of a concept. In addition, (Susmiati, 2020) also mentioned that Discovery Learning can make learners confident, fluent in speaking, and more expressive as a representation of their interest in learning.

Then the lowest increase in learning outcomes of the other three domains is the affective domain. In cycle I, the average affective learning outcomes were good. In this cycle, some indicators were well met, but there were several other indicators that still received low scores, namely in the aspects of self-concept, values, and morals. Some students still did not show confidence in delegating group tasks, confidence in expressing their opinions, and involvement in working on tasks/projects. Then in cycle II, the average affective learning outcomes increased by obtaining a very good predicate. In this cycle, aspects that previously received low scores experienced positive changes. Learners looked more confident and were able to be more collaborative in working on tasks. These results are relevant to the research by (Adi Prasetya & Tri Harjanto, 2020) and (Inde et al., 2020) which states that the use of Discovery Learning can increase the activeness of students, as well as supported research (Aldalur & Perez, 2023) that this model can make learners more motivated, have fun, and refer to positive emotions that make them pay more attention in class. In terms of engagement, these results are relevant to the research (Laksana et al., 2023) that Trello can increase learner engagement and participation. Research by (Widayanti et al., 2022) also reinforced the results of this study by stating that Trello makes learners active and collaborative, as well as enthusiastic in learning.

Learners' Learning Engagement increased from cycle I to cycle II, from initially presenting results in the high category to very high. In cycle I, learners' engagement in learning was considered high. However, based on the observation, some learners still did not show maximum involvement in the discussion session. But in cycle II there was an increase in learner involvement when compared to the previous cycle. Based on the observation, learners were involved with each other in working on group tasks that they had previously divided. Each group member helped their group mates who had not completed their part of the task. In preparing materials for presentation, learners also gave each other input based on their understanding from various points of view. The results of this study are relevant to the research (Arwaty & Lullulangi, 2022) which proves that Discovery Learning can increase Student Interest because it is more focused on the learning process. besides that, (Laksana et al., 2023) also mentioned that the use of Trello can increase learner engagement and participation, thus improving the quality of learning. The results of the study support the results of this study that the combination of Discovery Learning and Trello can increase students' Learning Engagement.

Overall, almost all aspects of teacher activity assessment, learner activity, affective, cognitive, psychomotor learning outcomes, and learning engagement have increased from cycle I to cycle II, and are interrelated between aspects. The aspect of engagement in the assessment of the success of learner activity actions increased from cycle I to cycle II, which was also in line with the increase in the aspect of interest in affective learning outcomes. The increase in both aspects is also directly proportional to the increase in overall learning engagement of students. This happened because it was clear that there was an increase in learner engagement after implementing Discovery Learning assisted by Trello. Furthermore, the creative aspect in the assessment of learner activity also increased, which was in line with the increase in the work aspect in the assessment of psychomotor learning outcomes. In cycle II, learners did show an increase in their creativity in the style of discussion and preparation of presentation media.

5. Conclusion

Based on the research that has been conducted along with the analysis, the implementation of the Discovery Learning model assisted by Trello has been carried out well, and proven to be able to maximise learning and improve learning outcomes and learning engagement of students. The most significant improvement in learning outcomes is cognitive, psychomotor, and the lowest is affective. The use of Trello can make learning more effective and efficient. Trello allows members in the same board to monitor each other's task progress, thus maximising learner collaboration and the efficiency of teacher assistance in discussion sessions.

Based on the results of the researcher's observations, the increase in students' learning engagement results can be maximised, but due to limited facilities for using computers and the internet, the increase in learning engagement from cycle I to cycle II is only 15.91%. The aspect of learning engagement with the most minimal increase is behavioural engagement, due to the limited research time so that students cannot adapt well to the learning pattern with the newly applied model. Therefore, it is expected that further research can use maximum facilities and time for better learning achievement. This research only applies the Discovery Learning model assisted by Trello media in the MPLB study field, so that further research can apply this model to other fields of study. In this study, Trello had a positive impact on improving learning outcomes and learning engagement of students. In addition, Trello can be used freely by various parties, so teachers are advised to make Trello as an alternative learning media.

6. References

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