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Application of Case-Based Learning Model on Science-11 Class Learning Outcomes on Digestive System Disorders

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ABSTRACT

Applying an appropriate learning model affects learning quality because it can improve learning activities in the classroom and strengthen students' understanding to achieve learning objectives. This study aims to determine the effect of applying the case-based learning model on students' cognitive, affective, and psychomotor learning outcomes and explain the response of science-11-grade students to the application of CBL in learning digestive system disorders. The subjects were 66 students from XI MIPA 1 (Control class) and XI MIPA 3 (treatment class) with the Quasi Experiment method. From the research results, it was concluded that there was a significant effect of CBL on cognitive product learning outcomes at the first and second meetings with a Sig. (2-tailed) 0.000 < 0.05. The N-gain value of experimental class students' cognitive product shows increased learning outcomes after learning with the CBL model. By applying the CBL model, cognitive process learning outcomes in the experimental class were higher than in the control class. Applying the CBL learning model affects affective and psychomotor learning outcomes and increases the positive response to 95.45%. The average percentage of student response questionnaire scores was 76.37%, meaning that students agreed that applying the CBL model can support their learning on digestive system disorders.

Keywords : Case-based learning, Digestive system disorders, Learning outcomes, Quasi-experiment

INTRODUCTION

Education in the 21st century demands creative, innovative, and imaginative outputs to prepare qualified and creative human beings by utilizing information technology (Asrizal et al., 2022). This demand is supported by Rahayu et al. (2022), who said that through 21st-century education, teachers prepare their students to live in the digital era, such as using their knowledge of subjects supported by the use of technology to facilitate experiences that advanced students learn to increase students' creativity, innovation, and motivation.

Curriculum renewal is an effort to improve the quality of human resources in education (Malawi & Kadarwati, 2018). Curriculum renewal aims to ensure that students receive an up-to-date education. The national education reference refers to the 2013 Curriculum, which fully encourages students to be active (Nugraha, 2022). The 2013 Curriculum (K13) is adapted to 21st-century educational competencies that align with national education goals, which include competencies in knowledge, attitudes, and skills in inductive learning methods.

However, in real conditions in the field, educators still use conventional learning

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methods not under the 2013 Curriculum reference. This fact is supported and strengthened by several research sources, such as Wahyuni and Berliani's research (2019) entitled 'Problems of 2013 Curriculum Implementation' in Elementary Schools.' In their research, they explained that teachers did not fully understand the concept of the 2013 Curriculum well, so they preferred to use conventional learning. In addition, the researcher also conducted a preliminary study to obtain information based on an interview with a Biology teacher at SMA Negeri 9 Banjarmasin.

The SMA Negeri 9 Banjarmasin biology learning activities use lecture and discussion methods, so the case-based learning model is not applied. In addition, students are less concentrated when the teacher explains the learning material. Students tend to be passive and are only quite active when discussion activities occur. According to K13, students must be active (student-centered), while the teacher is a facilitator and motivator. The 2013 Curriculum requires educators to master several teaching materials and understand the application of appropriate learning models according to the characteristics of the material for students (Rahmia & Safitri, 2020).

Studying biology means studying and understanding systematically about nature and living things (Berutu, 2018). In other words, studying biology can build thinking skills and develop skills, understanding, and awareness of knowledge related to its use for the actual application. According to Azzahra (2017), previously learning science and biology used many deductive methods. Students are often motivated to study biology only to improve their grades and fail to relate learning content to real life. This condition can affect student learning outcomes. Marlina and Sholehun (2021) state that external and internal factors can affect student learning outcomes. Syah in Azzahra (2017) also added that using strategies and methods to carry out learning activities can affect student learning outcomes.

The Case-based Learning (CBL) model is an inductive teaching method that presents a case as learning (Syarafina et al. 2017). The effectiveness of the CBL model has been proven in several studies, such as Azzahra (2017), Syarafina et al. (2017), Wospakrik (2020), and Mayer and Hendrayani (2022). Based on those studies' results, applying the CBL model helps improve student learning outcomes.

Digestive system disorders material relates to everyday experiences. Many of these problems are related to life, such as the increasing number of sufferers of digestive disorders in today's modern era due to the pattern or lifestyle of modern society. The primary purpose of choosing the CBL model for this material is that humans need to maintain the health of our bodies, especially the digestive organs, to live a good life. Students are invited to analyze a factual case related to the material through a case study. Furthermore, students seek information individually or in groups to solve the case and find the truth or information through the cases to make learning more meaningful. This relates to 21st-century education, including character, citizenship, critical thinking, creativity, collaboration, and communication.

Based on the description, to meet the learning outcomes and follow the demands of the 2013 Curriculum, students are expected to improve their learning outcomes according to passing grade standards and improve their attitudes and skills through the CBL learning model. Therefore, this study aims to determine the effect of applying the CBL model on student learning outcomes to become a more meaningful choice in learning activities, considering that biology learning activities at SMAN 9 Banjarmasin are still learning using lectures and discussion techniques.

METHODS

This study used a Quasi-experimental quantitative research method (quasi-experimental) with a nonequivalent control group design (pretest and posttest with a control group without random assignment). The experimental class was given a pretest before learning, after which they learned using the CBL model. At the end of the lesson, the experimental class was given posttest, as well as the control class. However, the difference is that the control class was not given the learning treatment with the CBL model.

The research was conducted offline or face-to-face at SMA Negeri 9 Banjarmasin. Two classes of test samples were taken: class XI MIPA 1 with 33 students (control class) and class XI MIPA 3 with 33 students (experimental class). The purposive sampling method was used to determine the sample. The independent variable in this study was applying the CBL learning model, while the dependent variable was the biology learning results of class 11 science students on the digestive system disorders sub-material. The research instruments were pretest and posttest, student worksheet assessment rubric, work/product assessment rubric, character and social behavior assessment, psychomotor assessment, and student response questionnaires after treatment using the CBL learning model on the digestive system disorders sub-material.

This study is divided into three stages: the preparation stage (observation, arranging permits for research, interviews, problem formulation, and preparation of research tools), the implementation stage (offline learning activities using CLDW e-learning media in the control class and experimental class, conducting an assessment, collecting data, and filling out student response questionnaires), and the final stage (data analysis, compiling discussions, and concluding)

The data analysis technique used is test and non-test. Cognitive product learning outcomes were analyzed using SPSS with N-gain analysis, normality test (Kolmogorov Smirnov One Sample), homogeneity test (Levene test), and hypothesis testing (Paired Sample T-Test). The results of the learning process cognitive, affective, psychomotor, and student responses were analyzed descriptively.

RESULTS AND DISCUSSION

Results

Cognitive Product Learning Outcomes

The cognitive product is the student's ability to understand the material by conducting an initial assessment (pretest) and a final assessment (posttest) to determine success in achieving the desired goals (Naseparat & Dian, 2019). The assessment was carried out in two meetings. A summary of the average cognitive product learning outcomes is presented in Table 1.

Table 1. Summary of the Average Cognitive Product Learning Outcomes

No.	Learning Topic	Cognitive product			
		Control (XI MIPA 1)		Experiment (XI MIPA 3)	
		Pretest	*Post-test*	*Pretest*	*Post-test*
1.	Digestive System Disorder	43.33	63.03	43.03	89.39
2.	Digestive System Technology	31.21	53.33	30.30	90.30

Based on Table 1, the posttest results for the experimental class with the CBL model are higher than the control class with the conventional learning model. The experimental class's average posttest score on digestive system disorders was 89.39, while the control class scored 63.03. Regarding digestive system technology, the experimental class also obtained a higher average than the control class; 90.30 for the experimental class and 53.33 for the control class.

Cognitive product learning outcomes data were analyzed using the N-gain test to see how students' cognitive learning outcomes were achieved after participating in learning activities on the digestive system disorders sub-material using the CBL model. In addition, the cognitive product learning outcomes data were tested in hypothesis with paired sample t-tests using SPPS 25.0. The hypothesis test confirms that the data must be normally distributed and homogeneous first. The following are the results of statistical tests on cognitive product learning outcomes at the first and second meetings.

N-Gain Analysis

The N-gain of treatment is used to estimate the effectiveness of a lesson or treatment in encouraging the understanding of concepts (Hake, 1998 in Guntara, 2020). The data processed into N-gain data results from the pretest and posttest. N-gain data of students in the first and second meetings are presented in Table 2.

Table 2. N-Gain Test Results of Students' Cognitive Learning Outcomes

Meeting	N	*Pretest*	*Postest*	Gain	N-gain	Category
1	33	43.03	89.39	46.36	0.82	High
2	33	30.30	90.30	60.00	0.86	High

Information: ((n≥0,7=High), (0,3≤n<0,7=Moderate) dan n<0,3=Low))

Based on Table 2, the results of the N-gain score for the experimental class at the first meeting obtained a result of 0.82 > 0.7 with high criteria. The second meeting resulted in 0.86 > 0.7 with high criteria. Thus, there was an increase in students' cognitive learning outcomes using the CBL model at two meetings.

This increase is due to using the CBL model, which directly involved students in learning activities using actual cases. Students also dug up information to solve the case directly to increase their understanding of the material. Siberman (2004) in Koryati et al. (2020) explain that learning is not only to pour out material into students' minds but also requires the mental involvement and actions of the students themselves so that active learning activities produce long-lasting learning.

Hypothesis Test

A hypothesis test is carried out to test the truth of a statement statistically and draw conclusions about whether a hypothesis is accepted or rejected. Hypothesis testing helps prove whether a statement is a fact or a theory (Anuraga et al., 2021). Normality and homogeneity tests were carried out first as conditions for the hypothesis test. From the normality and homogeneity test results, the research data were normal and homogeneous with a Sig value > 0.05 at two meetings, so the two-sample difference test used was the parametric t-test. The results using paired sample t-test are presented in Table 3.

Table 3. Hypothesis Test Results of Students' Cognitive Product

Meeting	Mean	t	df	Sig. (2-tailed)
1	-46.364	-23.931	-32	.000
2	-60.000	-29.875	-34	.000

Based on Table 3, the first and second meetings obtained the same results (0.000 <0.05), so it can be concluded that this study rejected the null hypothesis (H0) and accepted the initial hypothesis (Ha). Thus, the hypothesis test results stated that the CBL learning model significantly affected the biology learning outcomes of class-11 science students at the first and second meetings on digestive system disorders at SMA Negeri 9 Banjarmasin.

Cognitive Process Learning Outcomes

The cognitive process results in this study were taken based on students' worksheets and work results with the help of an assessment rubric for two meetings. The summary of cognitive process learning outcomes at two meetings is presented in Table 4.

Table 4. Summary of Average Cognitive Process Learning Outcomes

No	Learning Topic	Cognitive Process			
		Control Class (XI MIPA 1)	Category	Experimental Class (XI MIPA 3)	Category
1	Digestive System Disorder	79,42	Fair	82,67	Good
2	Digestive System Technology	73,75	Fair	90,75	Good

Information: ((91-100=Very Good), (81-90=Good), (71-80=Fair), (61-70=Poor) (<60=Very Poor))

Based on Table 4, the control class got an average of 79.42 for the first meeting and 73.75 for the second. The experimental class average was 82.67 at the first meeting and 90.75 at the second. These results prove that the experimental class obtained higher learning outcomes than the control class because the steps in CBL emphasized students being more active than students who studied using teacher-centered conventional models (Syarafina et al., 2017).

Affective Learning Outcomes

Affective learning outcomes are behaviors that emphasize feelings and emotions (Mahmudi et al., 2022). The aspects observed in affective learning outcomes are character and social behavior.

Character Behavior

Assessment of character behavior was observed from the control class and the treatment class during the learning activities. Two observed aspects of character behavior are responsible and caring. The summary of the average character behavior is presented in Tables 5 and 6.

Table 5. Responsible Aspect

Meeting	Observed Aspect			
	Responsible			
	Control Class (XI MIPA 1)	Category	Experimental Class (XI MIPA 3)	Category
1	67,42	Fair	89,02	Good
2	66,67	Fair	75,76	Good

Based on Table 5, the character behavior of the control class students for the responsible aspect obtained a score of 67.42 at the first meeting and 66.67 at the second meeting, with the fair category in both. The experimental class scored 89.02 at the first meeting and 75.76 at the second in the good category.

Table 6. Caring Aspect

Meeting	Observed Aspect			
	Caring			
	Control Class (XI MIPA 1)	Category	Experimental Class (XI MIPA 3)	Category
1	87,12	Good	90,91	Good
2	86,36	Good	92,42	Very Good

Based on Table 6, the character behavior of the control class students for the caring aspect obtained a score of 87,12 at the first meeting and 86,36 at the second

meeting, with the good category in both. The experimental class scored 90,91 in the good category at the first meeting and 92,42 in the very good category at the second. From the two tables of character behavior aspects, it can be concluded that the character behavior of the experimental class students is higher than the control class. Overall, students' characteristic behavior for the experimental class achieved indicators of success in affective learning outcomes in the CBL learning model.

Social Behavior

Two aspects of social behavior observed are cooperating and giving opinions. The summary of the average social behavior is presented in Tables 7 and 8.

Table 7. Cooperating Aspect

Meeting	Observed Aspect			
	Cooperating			
	Control Class (XI MIPA 1)	Category	Experimental Class (XI MIPA 3)	Category
1	76,52	Good	96,21	Very Good
2	75,76	Good	100,00	Very Good

Based on Table 7, the social behavior of the control class students for the cooperating aspect at the two meetings was in a good category, with a score of 76.52 for the first meeting and 75.76 for the second meeting. The experimental class at two meetings reached the very good category, scoring 96.21 for the first and 100 for the second.

Table 8. Giving Opinion Aspect

Meeting	Observed Aspect			
	Giving Opinion			
	Control Class (XI MIPA 1)	Category	Experimental Class (XI MIPA 3)	Category
1	62,12	Fair	82,58	Good
2	65,15	Fair	82,58	Good

Information: ((91-100=Very Good), (81-90=Good), (71-80=Fair), (61-70=Poor) (<60=Very Good))

Based on Table 8, giving opinions at the first and second meetings in the control class was fair, scoring 62.12 for the first meeting and 65.15 for the second meeting. The experimental class at two meetings was in a good category, scoring 82.58 for both meetings. From the two tables of social behavior aspects, it can be concluded that the social behavior of the experimental class students is higher than the control class students. Overall, students' social behavior for the experimental class achieved indicators of success in affective learning outcomes in the CBL learning model.

Psychomotor Learning Outcomes

Psychomotor learning outcomes are related to motor skills (Mahmudi et al., 2022). This study's psychomotor learning outcomes were obtained from observations during the learning process. The summary of the students' average psychomotor is presented in Table 9.

Table 9. Summary of Students' Average Psychomotor

Meeting	Psychomotor			
	Control Class (XI MIPA 1)	Category	Experimental Class (XI MIPA 3)	Category
1	75.95	Good	92.42	Very Good
2	79.55	Good	94.51	Very Good

Information: ((91-100=Very Good), (81-90=Good), (71-80=Fair), (61-70=Poor) (<60=Very Poor))

Based on Table 9, the average psychomotor results of control class students at the two meetings met the good category, with scores of 75.95 for the first meeting and 79.55 for the second meeting. The experimental class fulfilled the very good category at two meetings, scoring 92.42 for the first meeting and 94.51 for the second meeting. Thus, it can prove that the CBL model can improve students' psychomotor learning outcomes, as seen from the high psychomotor scores of experimental class students.

Student Response

Student responses were obtained from observations through questionnaires after learning activities using the CBL model. The recap data of student responses is in Figure 1.

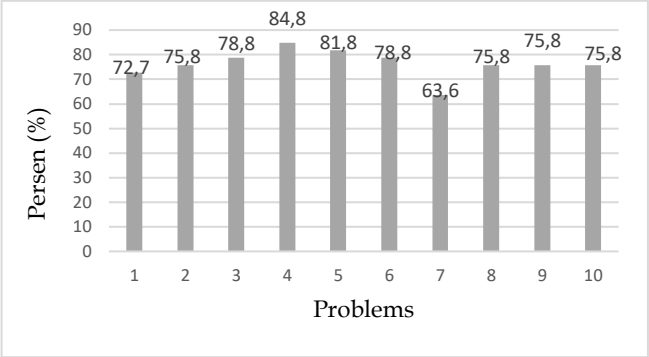

Figure 1. Student Response to CBL Model

Based on the data tabulation, overall, the application of the CBL learning model is agreed by students with 76.3%. The summary of the average percentage of students' positive and negative responses to the application of the CBL model is presented in Table 10.

Table 10. Summary of Students' Average Response to CBL Model Application

Total	Student Response				
	SA	A	UD	D	SD
Percentage	45,45%	49,99%	4,54%	0,00%	0,00%
Positive Response		95,45%			
Negative Response				4,54%	

Information: ((Strongly Agree=SA), (Agree=A), (Undecided=UD), (Disagree=D), and (Strongly Disagree=SD))"

Based on the average response of experimental class students (XI MIPA 3) to the learning process by applying the CBL model, students' positive response was 95.45%, and the negative response was 4.54%. Therefore, it can be concluded that the students' positive responses to learning with the CBL model were higher than the negative responses.

Discussion

Assessment gathers information about student performance to make decisions (Rasyid, 2012 in Wahyono, 2019). The assessment aims to determine students' learning abilities to make improvements and increase learning and provide feedback for improving the implementation of learning activities (Wahyono, 2019).

Learning outcomes are an overview of the results achieved by students after carrying out learning activities. Syafrida (2019) states that learning outcomes result from students' efforts in skills, intelligence, skills, and behavior. Sumarni (2019) also argues that learning

outcomes are changes in behavior that occur in an individual regarding knowledge, skills, attitudes, habits, understanding, and mastery, all carried out consciously, have positive goals, and are continuous and permanent.

Cognitive Learning Outcomes

Cognitive learning outcomes refer to students' knowledge before and after learning activities (Berutu & Tambunan, 2018). In this study, the cognitive learning outcomes assessed were cognitive products and cognitive processes. Cognitive product illustrates students' mastery of theoretical understanding of learning concepts before and after learning (Rahmadyanti et al., 2022). In comparison, the cognitive process contains processes and conclusions from student observation results and hones their skills in interpreting, storing, and obtaining information (Hamadha, 2018).

Based on the study's results, CBL learning significantly affects cognitive product learning outcomes, where the first and second meetings obtain Sig. value <0.05. Therefore, the initial hypothesis is accepted, and the null hypothesis is rejected. The CBL learning model also significantly affects students' cognitive process learning outcomes because it emphasizes the scientific process during learning activities so that students can develop scientific understanding.

The cognitive process learning outcomes of the experimental class tended to be higher in the control class, presumably because the type of student worksheets given differed according to the model applied. The control class' student worksheets are more straightforward than those of the experimental class, which contain cases and their solution steps. Therefore, the scores obtained by the experimental class were higher because they were triggered to solve life-related cases. These results are consistent with the strengths of CBL, where students can apply theory to real contexts, think critically about complex matters, and choose what actions to take (Syarafina et al., 2017).

The CBL model affects student learning outcomes significantly. This effect is due to the stages or steps in CBL learning involving students in learning using realistic stories, which provide opportunities for students to integrate various sources of authentic information. The provision of cases that can be studied retrospectively is by finding solutions to cases and trying to solve them interactively (Syarafina et al. 2017) so that solving cases related to this material will be easier for them to remember. Case-based learning encourages students to analyze, interpret, and practice the knowledge gained and to exchange ideas with other students (Dewi & Hamid, 2015).

The use of appropriate learning media can affect learning outcomes. Technology-based learning media such as CLDW were used in this study for both classes. According to Smaldino et al. (2012) in Sutrisno and Siswanto (2016), specially designed media or technology can make teaching effective for all learners and help them reach their highest potential. Thus, media or technology improve the quality of learning in the classroom and enable students to reach their full potential.

The experimental class's cognitive product and process learning outcomes at the second meeting showed higher results than the first. This difference is because students are still adapting to the model used, so they are not optimal in the first meeting. According to Olvah (2022), the learning model applied at the initial meeting requires habituation from students, so, at the initial meeting, there will sometimes be obstacles. In the second stage, students will become familiar with the model used by the teacher so that they will prepare themselves for learning activities.

Affective Learning Outcomes

Affective learning outcomes relate to attitudes during learning. This follows the opinion of Sudjana (2013) in Hutapea (2019), which explains that the affective domain is the ability of students' attitudes and values, such as attention to lessons, discipline, learning motivation, respect for teachers and classmates, study habits, and social relations.

Based on the research results on affective learning outcomes, the treatment class got a high average score on aspects of character and social behavior. This value proves that the CBL model affects students' affective learning outcomes, especially in increasing student interaction and group participation. At this stage, the CBL learning model emphasizes that students care about and be responsible for the assignments the teacher gives. Group members are responsible for helping other members to solve the cases given and care for each other. According to Zulfikar (2018), case learning requires active participation and encourages students to be responsible for their learning.

The CBL learning model also encourages students to be active during the learning process, one of which is solving cases through group discussions. In addition, the purpose of CBL is collaborative learning with group discussions to improve students' ability to interact and increase togetherness to achieve the desired goals (Syarafina et al., 2017). Thus, this opinion aligns with the research results where the CBL model affects students' affective learning outcomes.

Psychomotor Learning Outcomes

Psychomotor learning outcomes relate to student skills. Sudjana (2013) in Hutapea (2019) also argues that the psychomotor domain is a form of skill and ability to act individually. These research results are an advanced stage of new affective learning outcomes in students' tendency to behave. The psychomotor assessment was obtained from observation sheets of student activity during learning. In this study, the aspects of the psychomotor domain studied were part of the aspects of process skills, such as finding sources of information in relevant textbooks or the internet, carrying out activities based on determined work steps, presenting discussions results in front of the class, and collecting products from the discussion results.

Based on the research results, applying CBL in the experimental class made students more involved during the learning activities. Their involvement creates a sense of enthusiasm for students in learning and emphasizes science process skills, such as analyzing problems or cases, collecting data or information, designing problem solutions, and making conclusions through discussion.

Other skills shown in applying the CBL learning model are the ability to think critically and creatively when solving cases and think innovatively when providing solutions to a given case. In addition, the increase in students' communication skills is due to communication between group members and with groups. This reason is supported by Torreda et al. (2015), quoted in Dewi & Hamid (2015), which state that case learning can improve communication and collaboration skills and improve students' critical, creative, and innovative thinking skills. Zulfikar (2018) also argues that the CBL learning model helps students learn appropriate problem-solving theories. This model also changes passive students into active students who actively explore and find solutions to problems.

Student Response

Based on student response data, the experimental class has a total response of 76.37%, with a positive response of 95.45%. It means that students agree that applying the CBL learning model to material on digestive system disorders can support their learning. Obtaining a negative percentage of 4.54% from the results of the student questionnaire indicates that in

applying the CBL model, it is necessary to continue to make improvements or improvements so that students are ready to carry out learning activities through the application of CBL.

CBL, in addition to improving learning outcomes, also increases responsiveness to the information needed to solve cases and respond to input from other groups. A good response can solve a problem well (Zulfikar, 2018). Based on the previous explanation, it was concluded that the CBL model improves students' cognitive, affective, and psychomotor learning outcomes on digestive system disorders biology material. Students also agree that the CBL model can support their learning.

When filling out the response questionnaire, it was found that some students chose undecided in several statements. Students who chose undecided were not used to learning which requires them to be more active than the teacher. Students' habit of constantly receiving information or learning material from the teacher confuses them when they must find it independently. The students' unpreparedness for CBL is the obstacle and causes some students to choose undecided.

Another obstacle of this study is the diverse character of students. Therefore, researchers must understand the students who will be observed and how to direct these students so that they are under the stated research objectives and time. Other obstacles include adapting to the applied model, the variety of students' cognitive skills, and the habituation of using technology-based learning media such as CLDW. Therefore, in this study, the role of the teacher still dominates in directing students during learning activities.

CONCLUSION

From the results of research on the application of the case-based learning model, it was concluded that there was a significant effect of CBL on product cognitive learning outcomes at the first and second meetings with a Sig. (2-tailed) 0.000 < 0.05. The N-gain value of experimental class students' cognitive product shows increased learning outcomes after learning with the CBL model. By applying the CBL model, cognitive process learning outcomes in the experimental class were higher than in the control class. Applying the CBL learning model affects affective and psychomotor learning outcomes and increases the positive response to 95.45%. The average percentage of student response questionnaire scores was 76.37%, meaning that students agreed that applying the CBL model can support their learning on digestive system disorders.

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