

Implementation of Problem Based Learning Models to Improve Learning Outcomes of Plant and Animal Cell Structures

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Abstract: Various learning problems teachers face in schools must be solved with alternative solutions supporting 21st-century learning, which develops student-centered learning and provides a problem-solving experience in the real world. The Problem-Based Learning (PBL) model was chosen as a solution, providing the broadest possible experience for students to think critically, creatively, collaboratively, and communicatively. This research aims to improve learning outcomes of plant and animal cell structures through a problem-based learning model. Data was collected in two SMAN 1 Kerambitan class XI MIPA meetings, totalling 27 people. Cognitive learning outcomes are taken at the end of the meeting, while affective and psychomotor learning outcomes are taken during the learning process. The learning results are then subjected to qualitative analysis to determine learning completeness. The scores obtained by students are compared with the minimum completeness criteria that apply in 70 schools. Cognitive learning results at the first meeting show an average score of 74 for the number of students. Twenty-four people completed it, and three did not, while at the second meeting, the average score was 82, and all students completed it. It can be concluded that implementing the PBL model can improve the learning outcomes of plant and animal cell structures.

Keywords: Learning Outcomes; PBL Model; Plant and Animal Cell Structures.

Introduction

Biology is a science that studies living things and their environment. Learning biology at school requires students to be able to understand, apply, and analyze conceptual and procedural knowledge and apply it to solve problems [1]. Teachers, as facilitators, are required to make various efforts to achieve the expected learning objectives. These efforts can include designing learning activities, creating media, compiling interesting teaching materials, creating student worksheets, linking learning to real life, and utilizing technology. Teachers must create positive learning environments and empower students to implement effective classroom management.

Learning problems faced by teachers during the learning process include the media used being less attractive, less use of student worksheet, less integration of TPACK (Technological Pedagogical Content Knowledge), students being less involved in learning with groups, less centered on students, students hear more explanations from the teacher. These problems must be solved with alternative solutions supporting 21st-century learning, which develops student-centered learning and provides problem-solving experience in the real world. The problem-based learning (PBL) model was chosen as a solution, as it can provide the broadest possible experience to students to develop innovation and learning skills.

According to [2], these skills include critical thinking, creativity, collaboration, and communication. [3] the PBL model involves students as active participants in the learning process; they can actively develop an understanding of science. Furthermore, students understand basic concepts related to problems and gain direct experience applying scientific methods to solve the issues and improve critical thinking and high-level thinking skills.

The PBL model aims to equip students to reason and interact between students [4]. The teacher's task in PBL is to raise real-world issues linked to the material [5]. As a consequence of choosing a PBL model, the learning tools must also be adjusted, including the methods, student worksheet, and learning media chosen. Learning media innovation should follow developments in technology, information, and communication. Selecting engaging media according to the characteristics of the material is essential to attract students' interest and motivation and help them understand the material faster and better so that cognitive learning outcomes increase.

Research Method

The PBL model was implemented in 2 meetings; the first meeting was held on October 10, 2023, and the second meeting was on November 10, 2023. This activity

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took place at SMAN 1 Kerambitan in class XI MIPA. The first meeting used the group discussion method, while the second used the practicum method.

Preparation for implementing PBL model learning begins with preparing an action plan and evaluation plan. Preparing an action plan by organizing the tools needed for learning, such as preparing a learning implementation plan (RPP), compiling teaching materials, compiling student worksheets, creating media, compiling test instruments to measure cognitive learning outcomes and non-test instruments in the form of observation sheets to measure affective and psychomotor learning outcomes.

Implementation of teaching and learning activities according to the syntax of the PBL model [6], which includes five stages, namely: (1). Orienting students to problems; (2). Organizing students to study; (3). Guiding investigations both individually and in groups; (4). Develop and present problem solutions; (5). Analyze and evaluate the problem-solving process.

Data collection on cognitive learning outcomes is carried out at the end of the meeting, while affective and psychomotor learning outcomes are carried out during the learning process. Reflection is carried out on the results of learning that has been carried out, both from students and teachers. The learning results are then subjected to qualitative analysis to determine learning completeness; the scores obtained by students are compared with the minimum completeness criteria that apply at the school of 70.

Results and Discussion

The observations at the first meeting, attended by 27 students, with material on the structure of plant cells and animal cells, showed that the PBL model with discussion methods, video media, and student worksheet students were enthusiastic and active in learning. Students are also skilled in discussing and speaking at the group presentation stage in front of the class. Students' responses to the learning process using the PBL model with video media were very positive; they could follow the PBL syntax very well, and learning was enjoyable. Cognitive learning results show an average score of 74; the highest score is 90, but three students still had not completed it (Table 1). This indicates that with the discussion method and video media, the learning outcomes have been effective but still need to be improved because there are still three people who have not completed it out of 27 people. According to [7], with discussion methods and audio-visual media, students can more easily receive information, increase learning motivation, learn more effectively, and improve secondary school biology learning outcomes. The research results [8] show that the discussion method significantly affects learning outcomes.

The observations at the second meeting showed that in the PBL model with the practicum method, students experienced changes in their learning; they were more enthusiastic, enthusiastic, and active in learning. Students are also more skilled in discussions and speaking at the

group presentation stage in front of the class. Students' responses to the learning process using the PBL model with practicum methods, video media, and student worksheet were very positive; they could follow the PBL syntax very well, and the learning was delightful. Practical learning through microscope observations of dicot and monocot cells, students can discover concepts that cannot be found with the naked eye. The opinion of [9] states that the integration of various media aims to make learning effective and efficient. [10] Not all biological symptoms and phenomena can be observed directly with the naked eye. [3] added that with PBL, students understand basic concepts related to problems and gain direct experience in applying scientific methods to solve problems and improve their critical thinking and high-level thinking skills.

The cognitive assessment results at the second meeting showed an improvement from the first meeting, with an average score of 82, the highest score was 100, and all 27 students completed (Table 1). These results can be understood because aspects of biological learning include processes and products. As a process, biology is studied through the scientific method. Biology learning is related to the concept of knowledge and the process of discovery with practicums. According to [11], practicums are a method of teaching and learning activities for mastering applicable material. [12] added, by doing practicums, students are encouraged to carry out science process skills, such as observing, classifying, measuring, calculating, predicting, communicating, asking questions, making conclusions, controlling variables, formulating problems, making hypotheses, and designing experiments. In addition, according to [13], for representative high school students, the shape of cells is essential to understanding their function and work and supporting students' knowledge in making learning easier in high school and as a basis for studying.

The PBL model with the practicum method shows that the results of all students are complete; the learning completeness obtained is an indication that students understand the material more efficiently, improve their attitudes and skills in working in the laboratory, the experience gained through practicum can provide more substantial and more extended memories. Practicums can train students' science process skills through practicum activities, making abstract concepts easier to understand. According to [14], the practicum is a bridge between the development of knowledge, attitudes, and skills. Astari [15] stated that science process skills are often identified with the process skills approach, which emphasizes the integration of various complex mental, physical, and social skills that can be used as drivers for higher abilities. Masruri [16], practicum provides the opportunity to gain real experience in improving understanding of theory and specific knowledge-related skills. [17] added that practicums play a role in developing scientific attitudes, while [18] stated that practicums develop students' science process skills.

Implementation of learning at both the first and second meetings uses student worksheet. Teacher

creativity in designing student worksheet makes learning not dull; students are interested, enthusiastic and motivated to complete learning in a fun situation. Student worksheet is designed not only in the form of writing but is equipped with pictures and not only in the form of questions but also given activity steps so that they can solve problems and think critically until they can find concepts. Like the research results of [19], learning using student worksheet resulting from PBL development can improve students' problem-solving abilities. According to [20], the advantage of using problem-based student worksheet is that it makes it easier for students to study independently, learn to understand, and complete written assignments. It also increases efficiency and motivation and provides active and consistent learning opportunities with student-centered learning. [21] Problem-based student worksheet improves student communication in group discussions, allowing them to develop ideas and thoughts in solving various problems. [22] added that the issues presented in the student worksheet present concrete situations in learning that require students to understand the complex problems, so students are encouraged to understand the knowledge they have learned and apply it to problems that occur in real life.

Table 1 Cognitive Learning Results

No	Rating result	Meeting 1	Meeting 2
1	The highest score	90	100
2	Lowest value	60	80
3	Average	74	82
4	Students complete	24	27
5	Students do not complete	3	0
6	Completion percentage	89	100

Video media complements the learning process in the first and second lessons, making it easy for students to understand the material. The chosen media follows students' characteristics in the 21st-century information technology era so that students become motivated and enthusiastic about participating in the learning process. Good motivation and enthusiasm make students participate in the learning process with a feeling of enjoyment without pressure, which impacts better learning outcomes. Video media is an exciting medium because it has an attractive appearance with writing and images, making it easy for students to observe. Video media is very suitable for material that is difficult to explain orally. Research results [23] show that video media increases learning motivation, learning independence, and student learning outcomes. Pratiwi [24] indicates that the PBL model, with the help of audio-visual media, effectively improves learning outcomes and critical thinking skills, and all students achieve learning mastery. [25] added that multimedia with the PBL model is a valuable tool for conveying and presenting messages systematically and in a planned manner, creating conducive learning and optimizing the learning process effectively.

Conclusion

Implementing the problem-based learning model using the practicum method, students experience changes in how they learn; they are more enthusiastic and more active in learning and cognitive learning outcomes are also 100 per cent complete. Getting used to good practices and continuing to strive to make changes by implementing innovative and learning-centred for students must continue to be done so that students' motivation and learning outcomes increase. Implementing the Problem-Based Learning model can improve learning outcomes for plant and animal cell structures.

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