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Improving Learning Outcomes on the Musculoskeletal System through Direct Instruction with Biology Magazines

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Abstract: The students of class XI IPA 2 at MAN 1 Kubu Raya demonstrated low understanding of the musculoskeletal system, which resulted in poor learning outcomes. This issue stemmed from the dominance of a teacher-centered approach, where learning relied heavily on lectures guided by textbooks. A potential solution is the implementation of a structured learning model, such as direct instruction, which has the capacity to enhance student learning outcomes. Furthermore, integrating the direct instruction model with biology magazines can stimulate students' interest, attention, and comprehension of the topic. This research aimed to examine the improvement of student learning outcomes on the musculoskeletal system through the application of the direct instruction model assisted by biology magazines in class XI IPA 2 at MAN 1 Kubu Raya. The research employed Classroom Action Research, conducted in two cycles, each consisting of two meetings following the stages of planning, implementation, observation, and reflection. The research subjects were 33 students of XI IPA 2, with instruments comprising observation sheets and learning outcome test sheets, both validated and confirmed reliable. Data analysis involved calculating the percentage of implementation based on observation results, followed by determining the percentage of classical achievement of learning outcomes. The findings revealed an increase in learning outcomes, from 78.18% in Cycle I to 84.40% in Cycle II, with learning implementation reaching 100% in both cycles. These results indicate that the use of the direct instruction model assisted by biology magazines can significantly improve student learning outcomes on the musculoskeletal system. This implies that integrating the direct instruction model with an innovative learning media (such as magazines) can provide structured, engaging, and comprehensive biology learning experiences that effectively enhance students' learning outcomes.

Keywords: Biology Magazine; Direct Instruction; Learning Outcomes; Musculoskeletal System.

Introduction

Learning becomes a process that involves a reciprocal relationship between teachers and students in carrying out mutually supportive educational activities [1]. The role of the teacher determines the success of the teacher in achieving these objectives. A teacher is not only responsible for delivering the material, but also acts as a mentor who supports students in their growth and development emotionally, physically, and psychologically. Therefore, in the teaching and learning process, teachers are required to create a conducive and enjoyable learning environment that encourages active learning strategies, student participation, and intensive interaction between teachers and students [2], [3]. Within the design of the learning process, the learning model constitutes a vital foundation.

A learning model refers to a structured pattern comprising systematic steps designed to be implemented in the learning process [4]. The use of engaging learning models can be an effective way to improve the quality of instruction. Biology learning relies heavily on the application of appropriate learning models, as it becomes a key factor in fostering student engagement, both intellectually and emotionally [5]. The right learning model increases the opportunity for students to interact with each other to obtain the optimal learning achievement [6]. Therefore, teachers are required not only to master the topic but also to possess the competence and readiness to design effective learning processes that integrate innovative learning models that enhance student participation and learning outcomes [7]. One learning model that can help students understand the topic concepts more effectively is the direct instruction model.

The direct instruction is a learning model that emphasizes concept mastery and behavioral change through a deductive approach, beginning with general explanations followed by more specific examples [8]. This approach helps students better understand the topic being taught. The direct instruction model is characterized by clearly defined learning objectives and a measurable impact on students, including systematic assessment procedures. In addition, this model features a structured syntax or learning pattern, a clear sequence of activities, and a classroom management system and learning environment that are specifically designed to ensure the effectiveness of instruction [7]. According to Sitompul and Hayati [9], the direct instruction model consists of five phases: (1) orientation or stating the learning objectives, (2) presentation or demonstration, (3) guided practice, (4) checking for understanding and providing feedback, and (5) providing opportunities for extended practice and application.

Based on observations and interviews, it was found that the learning process has been predominantly teacher-centered. Teachers use the lecture method guided by

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textbooks, as it is considered practical in terms of both preparation and implementation. However, this method has limitations, particularly in activating students during the learning process. Students generally only listen and take notes on the material delivered by the teacher, without active engagement in learning activities. This condition has resulted in students' low understanding of the topic, which in turn affects their learning outcomes. Teachers' efforts to encourage active student participation have not been fully successful, as only a small number of students tend to participate actively. The lack of student involvement in the learning process negatively impacts learning outcomes. Based on the results of daily biology assessments for class XI at MAN 1 Kubu Raya in the 2023/2024 academic year, the lowest average classical achievement percentage was found in the topic of the musculoskeletal system in classes XI IPA 1 and 2, with an average of 42.84%. Among the two classes, the lowest classical achievement percentage was recorded in class XI IPA 2, at only 35.68%. The low scores in the musculoskeletal system topic were largely due to the continuous use of the lecture method by teachers. This is in line with the findings of Haqqi et al. [10], who stated that a lecture-based approach tends to bore students and hinder their understanding of the information presented. The results of the observation and interviews become the basis for implementing the direct instruction model.

Aside from the problems regarding the teaching method, another problem encountered is that the learning process still relies on textbooks and student worksheets. The use of learning media has not yet been optimized, making the process less engaging for students. This condition affects their learning outcomes. Learning media are tools used to assist the teaching and learning process by clarifying or reinforcing the topic studied [11]. According to Fadilah et al. [12], the benefits of learning media in the teaching process include: clarifying the presentation of messages to reduce verbalism, overcoming the limitations of space, time, and sensory perception, and addressing student passivity through appropriate and varied media use. In addition, Tafonao [11] emphasizes that learning media help teachers create a more dynamic, engaging, and less monotonous learning atmosphere, enabling them to design diverse classroom situations for students. One form of innovative learning media is a magazine.

Unlike textbooks, magazines use a lighter and more informative language style and typically contain more images [13]. Their relaxed design, which combines text, images, and attractive colors, makes them more appealing to readers [14]. In the field of education, magazines also serve as a tool that can stimulate students' creativity and help create a conducive learning environment [15]. Biology magazines hold great potential for use in classroom learning, as they contain various components that support the creation of meaningful learning experiences. In addition to presenting material summaries, biology magazines often include discussion activities. According to Munna and Kalam [16], discussion activities foster a two-way learning environment and serve as a strategy to help students deepen their understanding of the topic through peer interaction, in addition to learning from the teacher. This approach encourages a more interactive and enjoyable atmosphere, enhancing students' understanding through active participation. Furthermore, biology magazines are designed with visually appealing layouts and colorful illustrations that aim to stimulate students' interest and facilitate their understanding of biological concepts.

Simply put, the problems encountered from the results of the observation and interviews within the scope of teaching strategies and resources can be addressed by using the direct instructional model and biology magazines. The use of the direct instruction model to improve learning outcomes has also been implemented by other researchers, such as Candrawati [17], who concludes that the direct instruction model can improve students' learning outcomes, as evidenced by the increase in average scores during biology lessons. In the first cycle, the average score was 68.64 with a mastery level of 56%. In the second cycle, the average increased to 85.91, with mastery rising to 81%. In correlation with the use of biology magazines, the study by Dani et al. [18] found that students' average learning outcomes were higher when using biology magazines compared to those who did not. Students who used the magazines achieved an average score of 85.64, while those who did not obtained an average score of 71.79.

Based on the aforementioned background, this research was conducted to determine the improvement in students' learning outcomes on the topic of the musculoskeletal system through the implementation of the direct instruction model assisted by biology magazines in class XI IPA 2 at MAN 1 Kubu Raya. The novelty presented in this research is the use of biology magazines to accompany the implementation of the direct instruction model. This becomes important as the amount of research examining the impact of the direct instruction model assisted by biology magazines in improving learning outcomes is limited. Furthermore, this research is implemented in class XI IPA 2 at MAN 1 Kubu Raya. The combination of direct instruction and biology magazines has the potential to create a more engaging and interactive learning environment, while also enhancing students' understanding and learning outcomes. Therefore, this study is expected to make a meaningful contribution to enrich biology teaching strategies and serve as an alternative solution for teachers to improve the quality of classroom instruction.

Research Methods

Research Design

This research was conducted at MAN 1 Kubu Raya. The subjects of the research were 33 students from Class XI IPA 2 in the 2024/2025 academic year. The method utilized in this research is Classroom Action Research (CAR). The procedural design of the CAR adopts the cyclical model developed by Kurt Lewin, which includes four stages: planning, implementation, observation, and reflection [19]. The CAR implemented was carried out in two learning cycles. Each cycle consists of two meetings and ends with an evaluation test at the end of each session. Implemented in November 2024, Cycle I was held on 6 and 7 November, while Cycle II took place on 13 and 14 November. This research was conducted up to the second cycle because the targeted quantitative parameters had been achieved. This is consistent with the statement of Syaifudin [20] and Rahmawati et al. [21], who emphasize that the number of cycles in CAR is not predetermined, but rather continues

only until the research objectives are accomplished.

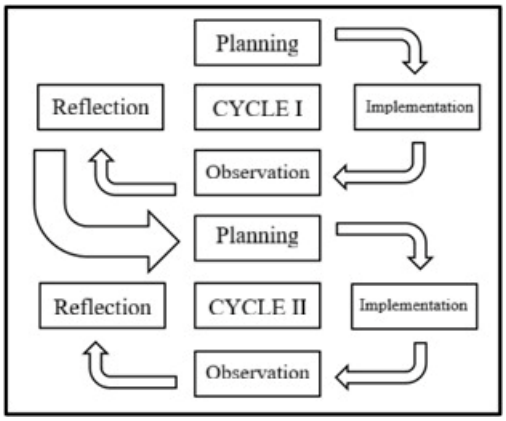

Figure 1. The research procedure is based on Kurt Lewin's CAR model [19]

Research Instruments

The instruments used in this research consisted of lesson implementation plans, biology magazines, evaluation questions, and observation sheets. The researcher developed the three former instruments, while the observation sheets were modified from Sulistiyowati [22]. Prior to the implementation of the research, the content validity of the three instruments was assessed by five expert validators. The content validation results were then analyzed using Aiken's validity index using Formula 1 [23]. According to Aiken [23], the threshold for the validity index at a 95% confidence level, with five validators and a maximum score of 4, is 0.87. An Aiken's validity index below this threshold is categorized as invalid, while an index at or above 0.87 is categorized as valid.

$$V = \frac{\Sigma s}{n(c-1)}$$

Description:
V : Aiken's validity index
s : $r-l_o$
r : Score given by the validator
l_o : Lowest validation score (1)
n : Number of validators
c : Highest validation score (4)

Furthermore, the item validity of the evaluation questions was assessed by conducting a trial test with students who had already studied the topic being evaluated. In this research, the trial test was administered to class XII IPA 1 at MAN 1 Kubu Raya. The item validity was then analyzed using the Pearson Product-Moment correlation coefficient formula (Formula 2, [19]). The testing criteria state that if $r_{calculated}$ is greater than r_{table}, the item is considered valid, whereas if $r_{calculated}$ is less than r_{table}, the item is considered invalid.

$$r = \frac{N\Sigma XY - \Sigma X\Sigma Y}{\sqrt{((N\Sigma X^2 - (\Sigma X)^2)(N\Sigma Y^2 - (\Sigma Y)^2))}}$$

r : Correlation coefficient
$\sum X$: Total item score
$\sum Y$: Total score
N : Number of respondents

The reliability of the lesson implementation plans and biology magazines was assessed through interrater reliability analysis using the Intraclass Correlation Coefficient (ICC) in the Statistical Package for the Social Sciences. A two-way mixed model with absolute agreement type at a 95% confidence level was applied (Formula 3, [24]). Referring to Koo and Li [24]An ICC value of less than 0.5 is categorized as poor, between 0.5 and 0.75 as fair, between 0.75 and 0.9 as good, and greater than 0.9 as very good.

$$ICC = \frac{MS_R - MS_E}{MS_R + \frac{MS_C - MS_E}{n}}$$

Description:
ICC : Intraclass Correlation Coefficient
MS_R : Mean square for rows
MS_E : Mean square for error
MS_C : Mean square for columns
N : Number of subjects

The internal reliability of the evaluation question items was analyzed using the Kuder-Richardson 20 (KR-20, Formula 4, [25]). The test reliability coefficient is then categorized into five criteria: between 0.80 and 1.00 is categorized as very high, between 0.60 and 0.80 as high, between 0.40 and 0.60 as moderate, between 0.20 and 0.40 as low, and between 0.00 and 0.20 as very low [26].

$$r_i = \frac{k}{(k-1)}\left\{\frac{s_t^2 - \Sigma p_i q_i}{s_t^2}\right\}$$

Description:
r_i : Internal reliability of the instrument
K : Number of items in the instrument
p_i : Proportion of subjects who answered each item
q_i : $1-p_i$
s_t^2 : Total variance

The content validity results using Aiken's validity index confirmed that the lesson implementation plans, biology magazines, and evaluation questions were valid, with values of 0.93, 0.91, and 0.92, respectively. Item validity for all evaluation questions was also confirmed, as indicated by $r_{calculated} > r_{table}$. Interrater reliability was tested using the ICC, showing values of 0.814 for the lesson implementation plans and 0.826 for the biology magazines, both categorized as good. The reliability of the evaluation questions analyzed using KR-20 was categorized as high across all meetings. Therefore, the instruments are declared valid and reliable.

Data Analysis

The analysis of the percentage score from the observation results of the learning process using the direct instruction model assisted by a biology magazine, as recorded on the observation sheet, was conducted using Formula 5. The results were then interpreted based on the assessment criteria proposed by Pantas and Surbakti [27], as shown in Table 1. To minimize potential observer bias during data collection, structured observation sheets were used, and observers were briefed beforehand to ensure consistency in interpreting and recording students' activities.

$$\text{Implementation percentage} = \frac{\Sigma \text{Observation score results}}{\text{Total score}} \times 100$$

Table 1. Learning implementation process criteria

Range	Criterion
81-100%	Very good
61-80%	Good
41-60%	Fair
21-40%	Poor
0-20%	Very poor

The data on individual student learning outcomes were analyzed using Formula 6 [28]. Subsequently, the percentage of classical achievement was determined with Formula 7 [28], taking into account a minimum completeness criterion of 76. Furthermore, the analysis and comparison of the individual learning outcomes and classical achievement at the end of each cycle were employed to draw conclusions. For this action research to be deemed successful, the learning process was required to achieve at least 75% implementation of the stages outlined in the observation sheets, accompanied by an increase in student learning outcome achievement, with a minimum of 60% in Cycle I and 75% in Cycle II.

$$\text{Student's score} = \frac{\text{Score obtained}}{\text{Maximum score}} \times 100$$

$$\text{Classical achievement} = \frac{\text{Students who passed}}{\text{Total number of students}} \times 100$$

Ethical Considerations

Ethical considerations in this research involved getting permission from the school and the class teacher. Students were informed about the purpose and procedures. Activities were conducted as part of regular learning, ensuring that no participant was disadvantaged. Student data remained confidential by anonymizing responses and reporting only in groups. Care was taken to avoid stigmatization. The interventions aimed to support learning and fit with the curriculum. They followed the principles of respect, fairness, and kindness to protect participants' rights and well-being.

Results and Discussion

Based on the research conducted, the results were obtained in terms of the learning implementation process and student learning outcomes across cycles I and II, and the summary of these findings is presented in the following sections.

Planning

The first stage of the action research process consists of identifying the topic, reviewing related literature, and developing a research plan [29]. The planning stage was undertaken to design and prepare the learning instruments that would later be employed during the action phase in both Cycle I and Cycle II. These instruments consisted of lesson implementation plans, biology magazines, and evaluation questions, each tailored to the learning objectives. In Cycle I, the first meeting focused on the structure and function of bones, followed by a second meeting that addressed the concept of joints. In Cycle II, the instructional focus shifted to human muscles in the first meeting and to disorders of the locomotor system in the second.

To ensure the quality and suitability of these instruments, five experts carried out a validation process. This group included two lecturers from the Biology Education Study Program at Tanjungpura University and three skilled biology teachers, two from MAN 1 Kubu Raya and one from SMA Negeri 2 Kubu. Following expert validation, the instruments underwent analysis to check their validity and reliability. The validation results confirmed that all instruments met the required standards. Reliability testing showed their consistency in measuring the constructs. Since these instruments were proven valid and reliable, they were then used in the implementation stage. This provided a strong foundation for conducting the CAR and ensured that both the teaching process and the evaluation of student outcomes were supported by reliable tools.

Implementation

The action stage was implemented systematically in alignment with the steps outlined in the lesson implementation plans, beginning with introductory activities, continuing through the core learning activities, and concluding with closing reflections. The teaching and learning process consistently employed the direct instruction model supported by biology magazines throughout both Cycle I and Cycle II. All stages specified in the lesson implementation observation sheet were executed as planned, with no steps omitted or overlooked. The implementation process was closely monitored to ensure fidelity to the designed procedures. The students' learning outcomes obtained from the learning process are presented in Table 2

Table 2. Learning outcomes obtained

Cycle	Meeting	Average Score per Meeting	Average Score per Cycle
I	M1	77.27	78.18
	M2	79.09	
II	M1	81.21	84.40
	M2	87.58	

The data in Table 2 show a clear improvement in student learning outcomes from Cycle I to Cycle II of 6.22 points. This upward trend indicates that implementing the direct instruction model supported by biology magazines was increasingly effective over time. The learning process became more structured and familiar to students, which allowed them to engage more actively and achieve better results. The consistent progress across the cycles suggests that the teaching approach can enhance students' comprehension and contribute to a more positive and productive classroom learning environment. Furthermore, the classical achievement obtained from the learning process is shown in Table 3.

Table 3. Classical achievement obtained

Cycle	Meeting	Average Classical Achievement per Meeting	Average Classical Achievement per Cycle
I	M1	75.76%	77.28%
	M2	78.79%	
II	M1	81.81%	84.85%
	M2	87.88%	

The results presented in Table 3 demonstrate a consistent increase in classical achievement from Cycle I to Cycle II of 7.57%. This indicates that a greater proportion of students were able to reach the mastery criteria as the learning process progressed. The improvement suggests that the direct instruction model, when supported with biology magazines, not only enhanced individual performance but also elevated overall class achievement. Through the application of this model, students were guided with clear, step-by-step explanations provided by the teacher, allowing them to grasp the topic more effectively and systematically. The integration of biology magazines as a supporting medium further enhanced the learning process by presenting content in a visually engaging and contextually relevant way. The inclusion of topic-related images and illustrations captured students' attention, also supporting them in understanding abstract biological concepts more easily. This combination of structured instruction and visually enriched materials contributed to sustaining student interest and promoting deeper comprehension of the topic [30]. Simply put, the increase in classical achievements obtained reflects the success of the instructional strategy in fostering collective learning success, ensuring that learning objectives were met at the group level, not just individually.

The improvement in students' learning outcomes was also reflected in the achievement of specific learning objectives, as indicated by the percentage of correct answers on the evaluation questions. In Cycle I, during the first meeting, students achieved an average mastery of 77.52%. The highest achievement was recorded for the learning objective of identifying the function of the human skeletal system, reaching 80.81%. In the second meeting, the average increased slightly to 79.09%, with the highest result obtained for the objective of describing the types of joints (81.82%). In Cycle II, the results showed a more substantial increase. In the first meeting, students achieved an average mastery of 80.30%, with the highest performance on the objective of analyzing the types of human muscles (84.85%). In the second meeting, the average rose further to 87.88%, with the highest mastery obtained for the objective of describing various disorders of the human locomotor system, which reached 93.94%.

These results were strongly supported by the implementation of the direct instruction model assisted with biology magazines. The evaluation questions related to these objectives were explained clearly and systematically in the magazine, which also included a student worksheet with a "discussion area". Through this activity—carried out as part of the guided practice phase—students worked collaboratively to answer questions similar in concept to those on the evaluation, enabling them to discuss, practice, and strengthen their understanding before the assessment (Figure 2). These findings indicate that the integration of direct instruction with biology magazines not only facilitated conceptual clarity but also significantly enhanced students' achievement of the intended learning objectives.

The direct instruction model emphasizes conceptual mastery and behavioral change through a deductive approach, where learning begins with general explanations and gradually narrows down to specific examples [7]. Such a structured approach enables students to systematically understand and internalize the material, thereby improving their overall learning outcomes. Complementing this model, the use of biology magazines as instructional media provides additional support for an effective and engaging learning process. The magazines present information in simple and comprehensible language, enriched with relevant visuals that reinforce key concepts. This combination not only allows students to access the content directly and flexibly but also increases their interest and motivation to learn. In turn, heightened interest can foster deeper comprehension and positively influence learning achievements [31].

Figure 2. Students completing the student worksheet

The findings of this research align with and are reinforced by previous research. The application of the direct instruction model significantly enhanced the learning outcomes of Grade X Science students at SMA Negeri 1 Jalaksana [17]. Similarly, Dani et al. [18] found a notable improvement in the learning outcomes of Grade X students at MAN 2 Mataram, showing that those who utilized biology magazines during the learning process achieved better results compared to students who did not use them. Analyses of large-scale and integrated educational approaches across schools, districts, states, and nations were done by Darling-Hammond et al. [32] reveal that with thorough preparation, well-structured curriculum systems, and equitable resources, educators can establish supportive environments that promote healthy development and meaningful learning for children and youth.

Observation

Observation was carried out simultaneously with the implementation of the learning process, beginning from the introduction until the closing stages of each lesson. The observations were conducted by the Biology teacher at MAN 1 Kubu Raya, who acted as a collaborator, with the aim of ensuring that the instructional process designed by the researcher was implemented according to plan. To strengthen the validity and reliability of the findings, three additional observers were also involved, providing multiple perspectives in monitoring the overall learning process. The results of these observations are presented in Table 4.

Table 4. Implementation percentage obtained

Cycle	Meeting	Average Implementation Percentage per Meeting	Average Implementation Percentage per Cycle
I	M1	100%	100%
	M2	100%	
II	M1	100%	100%
	M2	100%	

The observation results indicated that the implementation of the direct instruction model, supported by

the use of biology magazines, was successfully carried out. All stages outlined in the lesson implementation were fully implemented without any significant deviations [33]. These results consistently demonstrate that the instructional design could be translated into classroom practice with high fidelity. The consistent success across both cycles underscores the practicality and feasibility of integrating the direct instruction model with biology magazines as learning media. The structured and sequential nature of the model allowed lessons to be delivered in a clear, systematic manner, while the magazines provided a supportive resource that enriched the material and ensured alignment between teacher instruction and student access to content. The presence of multiple observers further strengthens the conclusion that the implementation was not only faithful to the plan but also replicable in similar classroom contexts.

From a broader perspective, these findings highlight the importance of validating and monitoring the implementation of instructional models in CAR. The 100% achievement rate on both cycles confirms that the designed instructional steps were realistic and manageable within the given classroom context. It also suggests that careful planning, supported by appropriate learning media, can minimize instructional barriers and ensure that all aspects of the learning process can be executed as intended.

Reflection

The purpose of the reflection stage was to analyze the level of success in the learning process, evaluate the activities that had been carried out, identify the factors contributing to both successes and shortcomings, and design strategies to optimize learning outcomes while continuously improving instructional practices [34]. The students' learning outcomes demonstrated consistent improvement across meetings, a progress that was strongly influenced by the reflections conducted after each session (Figure 3), which served as the basis for targeted enhancements.

Figure 3. Reflection process

The syntax of the direct instruction model, supported by the use of biology magazines, was successfully implemented in every meeting. Nevertheless, several aspects still require further refinement, particularly in classroom management, time allocation, and the organization of the learning environment, to ensure that the instructional process can be carried out more effectively. To address the weaknesses identified in Cycle I, several corrective measures were planned and implemented (Table 5). The reflection stage of Cycle I led to improvements, ensuring that the shortcomings and weaknesses identified in Cycle I did not recur in Cycle II.

Table 5. Corrective measures obtained from the reflection stage in Cycle I

Issue	Corrective Measure
Student readiness	A conducive classroom environment was created to ensure that students were ready to engage in the learning process. To address issues of student readiness, the researcher provided clear and structured instructions at the beginning of each lesson, reminding students to prepare for the topic, sit attentively, and make use of the biology magazines distributed by opening and reading them prior to the main activities.
Distractions	Students were guided and managed to maintain focus during the delivery of the topic, thereby minimizing distractions and unrelated activities. The biology magazine was strategically employed as a supporting medium to capture and sustain students' attention. During the lesson, students were instructed to open the relevant pages of the magazine that corresponded to the explanation being given and were directed to read and observe the illustrations and content presented, which helped anchor their focus on the topic studied.
Student comprehension	The delivery of the topic was carried out in a slow and careful manner to facilitate better student comprehension. The researcher deliberately adopted a measured pace to ensure clarity and understanding while also providing opportunities for students to actively engage by asking questions after the explanation. This practice not only reinforced comprehension but also encouraged interactive participation in the learning process.

The first issue concerned student readiness. Many students were not adequately prepared to engage in the learning process, which negatively influenced their participation and achievement. In a broad sense, student readiness refers to the capacity of individuals to absorb knowledge and engage in behavioral changes that contribute to effective and successful learning outcomes [35]. To address this, the researcher created a more conducive classroom environment and provided structured guidance at the start of each lesson. Clear instructions were given to remind students to prepare their learning materials, sit attentively, and use the biology magazines provided. By doing so, students were gradually conditioned to approach lessons with greater focus and discipline. This step also aligns with the principles of scaffolding, where structured guidance helps students transition into independent engagement. Furthermore, by integrating scaffolds with authentic sources of information, students were gradually able to establish deeper connections with the topic, which in turn enhanced their overall involvement in the learning process [36].

The second issue identified was distractions. During the delivery of material in Cycle I, many students were easily distracted or engaged in unrelated activities, which disrupted

the learning process. Managing distractions is a common challenge in secondary school classrooms, particularly when dealing with content that requires sustained attention [37]. The corrective measure involved actively guiding and managing students to maintain focus throughout the lesson. The biology magazine was strategically employed as a supporting medium to anchor students' attention. Students were directed to open the relevant pages of the magazine corresponding to the lesson and were asked to observe illustrations or read content that supported the teacher's explanation. This approach not only minimized off-task behavior but also reinforced the multimodal presentation of the material.

The third issue pertained to student comprehension. In Cycle I, the fast pace of content delivery limited students' ability to fully grasp the topic's essence. Comprehension is central to learning, as it determines how well students internalize and apply knowledge. To address this, the researcher deliberately slowed down the topic delivery, explaining concepts carefully and systematically. After presenting the lesson, opportunities were provided for students to ask questions, ensuring that misunderstandings could be clarified immediately. This approach reflects the principles of cognitive load theory, which emphasize the need to present information in a manageable way to avoid overwhelming students [38]. Furthermore, encouraging students to engage in questioning promoted active participation, thereby reinforcing both understanding and retention.

Overview of the Research

The consistent implementation of the direct instruction model supported by biology magazines across four meetings brought about notable improvements in student activity. Over time, students became increasingly accustomed to the structure of the learning process, which allowed them to participate more actively. The integration of the direct instruction model with biology magazines as a learning medium created a more organized and systematic classroom environment. The magazines served a vital role in supporting learning by providing relevant biological information, structured learning materials, and discussion prompts that encouraged active engagement. Moreover, the explicit and systematic delivery of content by the teacher, as emphasized in the direct instruction model, combined with the visual features of the magazines, enabled students to grasp concepts in a more engaging and accessible manner. The inclusion of meaningful visual elements not only aided comprehension but also captured students' attention, thereby enhancing their motivation and interest in learning. This is consistent with the findings of Besare [39], who emphasized that interest plays a critical role in shaping students' abilities and their success in developing potential within the classroom. In this context, a heightened level of interest in learning contributed directly to the observed improvements in student learning outcomes.

These findings have important implications for biology teachers and curriculum designers. For teachers, the results indicate that the direct instruction model, when combined with well-designed and visually engaging instructional media like biology magazines, can effectively improve student learning outcomes. Teachers can use similar approaches by adding structured instructional steps along with supplementary media that encourage active engagement, improve understanding, and keep students interested in learning. For curriculum designers, using instructional media such as magazines shows the need to offer resources that match learning objectives and are accessible and appealing to students. Curriculum developers should think about including visual and interactive elements in learning materials to make abstract biological concepts clearer. This way, teachers and curriculum designers can create a more supportive and engaging learning environment that helps students master concepts and retain biological knowledge over the long term.

This CAR focuses on students' cognitive learning outcomes as shown by their ability to meet the learning objectives. The results show clear improvements in these outcomes through the use of the direct instruction model and biology magazines. However, this research does not cover other areas of learning outcomes. Specifically, it does not measure affective outcomes or psychomotor outcomes related to skills and practical performance. These areas are also important for understanding students' overall learning development. Therefore, future research should include assessments of affective and psychomotor domains to get a fuller view of how instructional models and materials affect student learning.

Conclusion

This research shows a clear improvement in student learning outcomes in the cognitive domain. There was an increase of 6.22 points from Cycle I to Cycle II, along with a 7.57% rise in classical achievement. The direct instruction model, supported by biology magazines, effectively improved individual performance and overall class achievement. Observations confirmed that the implementation went smoothly, achieving a 100% implementation rate. However, refinements were made in each meeting to enhance classroom management, time management, and overall class organization. These findings have practical implications for classroom practice. Teachers are encouraged to use the direct instruction model with biology magazines in other topics or schools to improve learning outcomes. For future research, it is recommended to conduct comparative research with different instructional media, assess the long-term sustainability of learning improvements, and broaden the assessment to include affective and psychomotor learning outcomes to capture a complete view of student development.

Author's Contribution

Nuruliza Nabila: Conceptualization, data curation, formal analysis, investigation, methodology, visualization, and writing-original draft. Titin: Conceptualization, methodology, supervision, and writing-review & editing. Eko Sri Wahyuni: Formal analysis, methodology, supervision, and writing – review & editing.

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