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Evaluation of Students' Learning Outcomes on the Human Digestive System Topic through the Discovery Learning Method in Grade VIII of Nurul Iman Middle School, Palembang

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Abstract: The surge in diverse teaching methods necessitates systematic evaluation of their effectiveness. This study evaluated student learning outcomes in three domains (cognitive, psychomotor, and affective) following the discovery learning implementation on the human digestive system material in Grade VIII at Nurul Iman Middle School Palembang. Using a mixed-method approach, 36 students were assessed through: (1) a 20-item multiple-choice posttest including literacy questions, (2) poster creation evaluated by three observers using five aspect rubrics, and (3) self-evaluation questionnaires covering communication, discipline, teamwork, and character. Results revealed suboptimal cognitive achievement, with only 47% meeting the minimum completion criteria (≥70), though students demonstrated strong performance on literacy questions (61-83% correct). Psychomotor skills averaged 74 (sufficient category), showing varied creative abilities in applying digestive health knowledge. Affective outcomes averaged 80 (good category), indicating positive attitude development. The discovery learning method effectively fostered literacy skills and affective development but requires instructional refinement to optimize conceptual understanding and application in the cognitive domain.

Keywords: Discovery learning; Learning outcome evaluation

Introduction

The learning process is a complex and dynamic system that involves interactions between educators, students, and the learning environment to achieve predetermined educational goals (Suryani et al., 2020; Huda et al., 2023). In the context of modern education, the learning process is no longer seen as a one-way transfer of knowledge from teacher to student, but rather as an active construction of knowledge where students become learning subjects who play an active role in building their own understanding (Murni, 2021; Widiastuti & Santosa, 2021). An effective learning process must pay attention to various aspects, starting from planning, implementation, and continuous evaluation to ensure that learning objectives are achieved optimally (Fauziah et al., 2020; Astuti et al., 2023).

In the effort to create meaningful and effective learning, the role of learning evaluation is crucial as an integral part of the education system (Warsah, 2022; Gultom et al., 2024). Learning evaluation serves not only as a tool for measuring student learning outcomes but also as a feedback mechanism that allows educators to

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reflect on and improve the learning process that has been implemented (Harjono et al; Jufrida et al., 2019; Asrial et al., 2020). Bloom's Taxonomy is divided into three domains, namely cognitive, affective, and psychomotor, which provide a comprehensive framework for designing and evaluating learning holistically (Kurniawan et al., 2019; Magdalena et al., 2021). Through systematic and structured evaluation, educators can identify strengths and weaknesses in the learning process, so that they can take the necessary corrective steps to improve the quality of learning in the future (Pathoni et al., 2020; Gunawan et al., 2021).

At Nurul Iman Junior High School in Palembang, implementing quality learning is a top priority in efforts to improve the quality of education. The school is strongly committed to implementing innovative learning methods that can optimize student potential in various aspects (Deta et al., 2020; Azizah et al., 2021). In the context of science learning, specifically the human digestive system, the challenge is how to present this complex and abstract material in a way that students can understand deeply and meaningfully (Syavira, 2021; Ardiyani et al., 2021). The human digestive system has characteristics that require a strong conceptual understanding, the ability to analyze biological processes, and the skills to apply this knowledge in everyday life (Doyan et al., 2020; Hikmawati & Sutrio, 2020; Samsudin et al., 2021).

The application of the discovery learning method to the human digestive system at Nurul Iman Middle School, Palembang, is a strategic step in improving the quality of science learning (Saputra et al., 2019; Annisa & Sholehha, 2021). The discovery/inquiry learning model is centered on understanding concepts, meanings, and relationships through an intuitive process to ultimately arrive at a conclusion (Prayogi et al., 2019; Januarti et al., 2024; Verawati et al., 2021). The discovery learning method allows students to be actively involved in the process of discovering digestive system concepts through structured investigations, experiments and explorations (Sinaga, 2021; Kosim et al., 2021). Through this approach, students do not only receive information passively, but actively build their understanding of the structure and function of the digestive organs, the chemical and mechanical digestion processes, and disorders that can occur in the digestive system (Rokhmat et al., 2019; Hikmawati & Sutrio, 2020).

The implementation of the discovery learning method in learning about the human digestive system has great potential to develop students' abilities (Wahyudi et al., 2018; Istidah et al., 2022). However, the implementation of the discovery learning method needs to be systematically evaluated to ensure its effectiveness in achieving the established learning objectives (Lazonder & Harmsen, 2016; Istiyono et al., 2020). A comprehensive evaluation should include measuring learning outcomes in all three domains: cognitive, affective, and psychomotor (Misbah et al., 2018; Rita et al., 2021). This is important because effective learning must develop students holistically, not only in terms of knowledge but also in attitudes and skills (Fitriani et al., 2019; Dewi et al., 2020). Bloom's taxonomy is a hierarchical structure that identifies thinking skills from lower to higher levels (Astuti et al., 2020; Rahayu et al., 2022).

Despite extensive research on discovery learning effectiveness, a critical gap remains in comprehensive multi-domain evaluation of this method in specific biological content areas within Indonesian middle school contexts. Previous studies have predominantly focused on single-domain assessments or general learning outcomes, while overlooking the nuanced interplay between cognitive mastery, psychomotor application, and affective development in complex biological topics such as the human digestive system. This research addresses this gap by providing a holistic three-domain evaluation framework that simultaneously examines cognitive achievement (including literacy competencies), psychomotor skills through authentic creative tasks, and affective development through self-evaluation mechanisms. The novelty of this study lies in its integrated assessment approach that captures not only whether students can recall digestive system concepts, but how effectively they can apply this knowledge creatively, communicate it visually, and develop positive learning attitudes—aspects that are crucial for 21st-century science education but rarely evaluated concurrently in Indonesian educational research. Furthermore, this study provides critical empirical evidence for educators and curriculum developers in Palembang and similar contexts about the actual effectiveness and limitations of discovery learning when systematically evaluated across all learning domains, thereby informing evidence-based instructional decisions and policy recommendations for improving science education quality in Indonesian middle schools.

Based on the description above, this research is very relevant and important to implement. The evaluation of student learning outcomes on the human digestive system material through the application of the discovery learning method at Nurul Iman Middle School Palembang will provide an empirical picture of the method's effectiveness in developing students' abilities in depth. Therefore, the purpose of this study is to evaluate student learning outcomes from the cognitive, psychomotor, and affective domains on the human digestive system material through the application of the discovery learning method in class VIII Nurul Iman Middle School Palembang.

Method

Time and Location of Research

This study was conducted at Nurul Iman Junior High School in Palembang for eighth-grade students. The research took place from April to May 2025. The primary focus was to evaluate student learning outcomes on the human digestive system through the application of discovery learning methods, focusing on the cognitive, psychomotor, and affective domains.

Type of Research

This research approach uses a mixed method, combining quantitative and qualitative methods in an integrated manner within a single study. Quantitative methods focus on collecting numerical data that are analyzed statistically to objectively measure variables, while qualitative methods explore meaning, context, or in-depth narrative analysis (Love et al., 2022).

Population and Sample

The population in this study was eighth-grade students at Nurul Iman Junior High School Palembang. The sampling technique used was snowball sampling, assuming that a larger sample size results in richer research results and closer to data saturation (Ting et al., 2025). This study involved 36 students as research subjects.

Data Collection Instruments

Data collection in this study covered three domains: cognitive, psychomotor, and affective, each measured using appropriate instruments. Cognitive data were obtained through a 20-item multiple-choice test structured according to a grid, covering indicators of conceptual understanding, application, and reasoning. Several literacy questions focused on the human digestive system were included in questions numbers 1, 6, 14, and 18. Psychomotor data were collected using a poster assessment questionnaire, in which three independent observers assessed students' work as a form of creative and structured application of knowledge. The posters were themed "An Invitation to Maintain a Healthy Human Digestive System" and evaluated based on five aspects: design creativity, information accuracy, neatness and visual techniques, originality of work, and clarity of message delivery. Affective data were obtained through self-evaluation sheets completed by students, covering indicators of communication attitudes, discipline, organizational skills, and personal character throughout the learning process.

Research Procedure

This research was conducted systematically through five stages. First, the preliminary stage involved obtaining permissions and preparing learning materials aligned with the human digestive system curriculum. Second, the implementation stage consisted of four-week discovery learning-based instruction (April-May 2025), where 36 students engaged in guided inquiry activities, group discussions, and structured investigations. Third, cognitive assessment was executed through a 20-item multiple-choice posttest covering conceptual understanding, application, and reasoning, with emphasis on literacy questions (items 1, 6, 14, and 18). Fourth, psychomotor assessment required students to create posters themed "An Invitation to Maintain a Healthy Human Digestive System," evaluated by three independent observers using a five-aspect rubric. Fifth, affective assessment involved self-evaluation questionnaires containing 12 statements related to communication attitudes, discipline, organizational skills, and character development. All collected data were analyzed quantitatively for cognitive and psychomotor domains using scoring formulas and qualitative categorization, while affective data were converted into categorical descriptions to provide a holistic evaluation across the three learning domains.

Data Analysis

The analysis of student learning outcomes in this study was conducted in an integrated manner across three learning domains: cognitive, psychomotor, and affective. The cognitive domain was analyzed through posttest scores of 20 multiple-choice questions, which were converted and compared to the Minimum Competency Criteria of 70 (required by SMP Nurul Iman Palembang), with particular attention to literacy questions in numbers 1, 6, 14, and 18. The psychomotor assessment was based on students' posters about encouraging digestive health, using a five-aspect rubric categorized by achievement level. The affective domain was analyzed from the scores of the self-evaluation questionnaire containing 12 statements, which were then converted into qualitative categories to describe the development of students' attitudes and characters. Assessment of the psychomotor and affective domains used the following formula:

$$Final\ score = \frac{Total\ score\ obtained}{Maksimum\ score}\ x\ 100 \quad (1)$$

Then described qualitatively in the following criteria.

Table 1. Categorization of Students' Psychomotor and Affective Values (Sugiyono et al., 2024)

Value Range	Category
86 – 100	Very good
76 – 85	Good
60 – 75	Enough
<60	Less

Result and Discussion

Overview of Research Implementation

This research was conducted to assess the effectiveness of the discovery learning method in biology instruction, specifically on the human digestive system. This activity was conducted at Nurul Iman Junior High School in Palembang, involving 36 eighth-grade students as research subjects. The evaluation was comprehensive, focusing on three main domains of learning outcomes: cognitive, psychomotor, and affective. The cognitive domain evaluation involved 20 multiple-choice questions covering the entire topic of the human digestive system, which were completed by students after participating in the discovery learning approach. These questions were designed to measure students' understanding of the concepts, processes, and functions of the digestive system as a whole, aligned with the learning competency achievement indicators.

The psychomotor domain evaluation involved assigning students to create posters inviting them to maintain a healthy digestive system. The posters were assessed by three independent observers who assessed them based on predetermined criteria, including creativity, accuracy, neatness, originality, and message delivery. This triangulation of assessment aimed to increase objectivity and accuracy in assessing students' psychomotor skills. The affective domain employed an evaluative approach by providing students with self-evaluation sheets, which they filled out honestly and reflectively. These sheets contained statements reflecting students' communication, discipline, organizational skills, and character during the discovery learning process. The results of the cognitive, psychomotor, and affective domain evaluations are presented in the following tables.

Cognitive Domain Learning Outcomes

The cognitive domain learning outcomes of students in this evaluation illustrate the extent to which eighth-grade students of Nurul Iman Middle School, Palembang, understood the human digestive system after participating in discovery learning-based instruction. The assessment was conducted through a post-test consisting of 20 multiple-choice questions, with material covering an introduction to nutrition, the structure and function of digestive organs, digestive disorders, and efforts to maintain digestive health. The recapitulation results presented in Table 2 reveal that of the total 36 students who participated in the cognitive domain learning outcomes evaluation, 17 students (47%) achieved scores that met the minimum passing criteria (KKM), while 19 students (53%) were still below the established passing threshold.

Table 2. Recapitulation of Student Posttest Results

Student	Total Score	Mark	Information
AA	14	70	Complete
BB	16	80	Complete
CC	12	60	Incomplete
DD	16	80	Complete
EE	15	75	Complete
FF	13	65	Incomplete
GG	12	60	Incomplete
HH	17	85	Complete
II	9	45	Incomplete
JJ	11	55	Incomplete
KK	11	55	Incomplete
LL	9	45	Incomplete
MM	14	70	Complete
NN	20	100	Complete
OO	11	55	Incomplete
PP	11	55	Incomplete
QQ	10	50	Incomplete
RR	16	80	Complete
SS	12	60	Incomplete
TT	13	65	Incomplete
UU	12	60	Incomplete
VV	11	55	Incomplete
WW	18	90	Complete
XX	15	75	Complete
YY	13	65	Incomplete
ZZ	19	95	Complete
Aa	10	50	Incomplete
Bb	14	70	Complete
Cc	14	70	Complete
Dd	16	80	Complete
Ee	13	65	Incomplete
Ff	14	70	Complete
Gg	15	75	Complete
Hh	13	65	Incomplete
Ii	15	75	Complete
Jj	13	65	Incomplete

Some students demonstrated sufficient understanding of the material, but there were still many areas for improvement, especially in the application of concepts and analysis, as reflected in questions in categories C3 and C4 in Bloom's Taxonomy. These findings indicate that the majority of students have not succeeded in achieving the expected learning targets, so further efforts are needed in the form of remedial classes, concept reinforcement, or adjustments to learning strategies to improve students' overall cognitive achievement. This finding contrasts with research by

Sari et al. (2024), who reported that the discovery learning model significantly improved concept mastery among biology students. The difference in outcomes may be attributed to variations in implementation duration, student readiness, and teaching support mechanisms.

Analysis of Literacy Questions Performance

The focus of the results on questions in the form of literacy resulted in the following diagram.

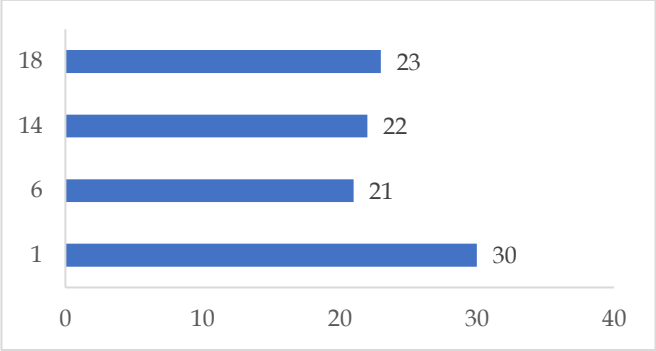

Figure 1. Diagram of students' cognitive results on literacy questions

Figure 1 shows the number of students who answered correctly on literacy questions numbers 1, 6, 14, and 18 out of a total of 36 students in the evaluation of learning the Human Digestive System material using the Discovery Learning method in class VIII SMP Nurul Iman Palembang. Question number 1 was answered correctly by 30 students, making it the question with the highest success rate. Question number 6 was answered correctly by 22 students, number 14 by 24 students, and number 18 by 25 students. These data indicate that the majority of students were able to understand and answer questions related to cognitive literacy skills well.

This high success is due to the discovery learning approach that allows students to build knowledge through active exploration, group discussions, and direct observation of human digestive phenomena, so that basic concepts of a literary nature are easier to understand. This finding aligns with research by Na (2023) and Sari et al. (2024), who demonstrated that discovery learning enhances students' ability to comprehend contextual information. Literacy questions generally require understanding the context and drawing logical conclusions from text or visual information, which is in accordance with the characteristics of activities in discovery-based learning. Martinah et al. (2022) and Berliana et al. (2023) support this observation, noting that discovery learning methods facilitate the development of scientific literacy through active engagement with learning materials.

Psychomotor Domain Learning Outcomes

Student learning outcomes in the psychomotor domain show interesting variations and illustrate the diversity of students' practical skills in expressing biological understanding in visual form. Assessment was carried out through a poster creation assignment with the theme "An Invitation to Maintain a Healthy Human Digestive System." Each poster was assessed based on five main indicators: design creativity, information accuracy, neatness and visual techniques, originality of work, and clarity of message delivery.

Table 3. Student Poster Score Recapitulation

Student	Total Score	Mark	Information
AA	10	50	Not enough
BB	10	50	Not enough
CC	10	50	Not enough
DD	10	50	Not enough
EE	20	100	Very good
FF	13	65	Enough
GG	20	100	Enough
HH	14	70	Enough
II	14	70	Enough
JJ	18	90	Very good
KK	14	70	Enough
LL	17	85	Good
MM	15	75	Enough
NN	18	90	Very good
OO	13	65	Enough
PP	20	100	Very good
QQ	15	75	Enough
RR	15	75	Enough
SS	16	80	Good
TT	15	75	Enough
UU	14	70	Enough
VV	14	70	Enough
WW	14	70	Enough
XX	16	80	Good
YY	15	75	Enough
ZZ	16	80	Good
Aa	15	75	Enough
Bb	16	80	Good
Cc	14	70	Enough
Dd	15	75	Enough
Ee	15	75	Enough
Ff	15	75	Enough
Gg	15	75	Enough
Hh	14	70	Enough
Ii	15	75	Enough
Jj	15	75	Enough
Average		74	Enough

The recapitulation results show that the highest scores were achieved by several students such as EE, GG, and PP who obtained a perfect score (100) in the very good category. Their posters displayed aesthetic designs, accurate and relevant information, and messages that were conveyed very clearly and

persuasively. Students in this category demonstrated excellent psychomotor abilities in presenting biological material creatively and communicatively. The majority of students were in the sufficient category with scores ranging from 65 to 75. They were able to present information in a fairly attractive visual form, although there were still some shortcomings such as unbalanced image composition, limited color variations, and less strong message delivery.

Several students in the good category, such as LL, SS, XX, and ZZ, obtained scores between 80 and 85, reflecting stable and neat psychomotor achievements, but not yet reaching the maximum level of creativity. Students with the lowest scores, such as AA, BB, CC, and DD, obtained a score of 50, which is included in the poor category. The posters they created tended to be simple, less attractive visually and content-wise, and still needed guidance in organizing information logically and communicatively. This observation is important because it demonstrates that in the discovery learning approach, active student involvement is not always directly proportional to technical ability. Ketaren et al. (2024) noted similar findings, suggesting that training in visual skills and scientific communication needs to be improved alongside discovery learning implementation. The average psychomotor domain score of 74 indicates that most students have achieved sufficient psychomotor skills, and the discovery learning method provides space for students to apply knowledge to real-world work that can be evaluated authentically.

Affective Domain Learning Outcomes

The recapitulation of students' self-evaluations in the affective domain, collected through a questionnaire on a scale of 1–4 on 12 statements, provides a comprehensive picture of students' attitudes during the discovery learning method on the human digestive system (Table 4). The average student affective score reached 80, which is categorized as "Good." This indicates that most students demonstrated a positive attitude and a high level of responsibility during the learning process.

Communication Attitudes

The aspect of communicative attitudes (asking questions, answering questions, and expressing opinions) showed high performance among the majority of students, indicating that discovery-based learning is able to encourage students to actively participate verbally in class discussions. The large number of students who scored between 3 and 4 on these three indicators demonstrates that the courage to ask questions and express opinions has developed well. This finding is consistent with research by Ketaren & Waruwu (2024), who found that discovery learning models enhance communication skills among students.

Table 4. Recapitulation of Student Self-Evaluation Scores

Student	Total Score	Mark	Information
AA	41	85	Good
BB	38	79	Good
CC	44	92	Very good
DD	43	90	Very good
EE	36	75	Enough
FF	39	81	Good
GG	37	77	Good
HH	44	92	Very good
II	39	81	Good
JJ	39	81	Good
KK	40	83	Good
LL	46	96	Very good
MM	35	73	Enough
NN	39	81	Good
OO	35	73	Enough
PP	23	48	Not enough
QQ	33	69	Enough
RR	40	83	Good
SS	41	85	Good
TT	33	69	Enough
UU	40	83	Good
VV	42	88	Good
WW	30	63	Enough
XX	32	67	Enough
YY	42	88	Good
ZZ	42	88	Good
Aa	48	100	Very good
Bb	41	85	Good
Cc	38	79	Good
Dd	43	90	Very good
Ee	33	69	Enough
Ff	43	90	Very good
Gg	36	75	Enough
Hh	35	73	Enough
Ii	41	85	Good
Jj	29	60	Enough
Average		80	Good

Discipline and Independence

The aspect of discipline, which is measured through indicators such as doing assignments well, submitting them on time, and independence, also showed quite good results. However, several students scored low (1-2), especially on the indicator of working on assignments independently. This indicates that although the discovery learning method can increase activeness, it is not yet fully able to encourage all students to take individual responsibility in completing assignments. This observation suggests the need for additional scaffolding to support independent work habits.

Organizational Skills and Teamwork

The organizational aspects of learning (group communication, accepting responsibility, and understanding roles) showed relatively stable results. Many students scored 3–4, indicating that they were able to work in teams and understand their responsibilities within the group. This aligns with one of the characteristics of the discovery learning method, which emphasizes group work and collaboration. Slight variations in scores indicate unequal participation in group dynamics, suggesting that teachers need to monitor group interactions more closely to ensure equitable participation.

Character Development

The final aspect, characterization, which encompasses adherence to rules, politeness, and personal responsibility, showed relatively high results. Many students scored above 80 in this section, with some even reaching the maximum score (100). This indicates that the discovery-based learning environment provides sufficient space for character development, particularly in terms of ethics and social responsibility in the classroom. The positive character development observed in this study supports the notion that active learning approaches foster not only academic skills but also personal values.

Overall Affective Domain Analysis

The results of this affective evaluation indicate that the discovery learning method contributes positively to the development of students' attitudes in biology learning. Although some students still showed low scores in certain aspects, the majority of students achieved good and excellent categories. This provides evidence that active learning approaches such as discovery learning can be an effective tool not only in strengthening knowledge but also in developing positive attitudes and constructive learning behaviors. Akbar et al. (2023) emphasized that evaluation of the affective domain is crucial as a basis for teachers to strengthen character and develop more personalized attitudes for students who are still in the sufficient and less than adequate categories.

Conclusion

This evaluation of student learning outcomes on the human digestive system material through the application of the discovery learning method in class VIII of Nurul Iman Middle School, Palembang, reveals both achievements and challenges across the three learning domains. The cognitive domain results show that only 47% of students achieved the minimum completion criteria, indicating suboptimal conceptual understanding, particularly in application and analysis levels (C3 and C4 of Bloom's Taxonomy), although students demonstrated strong performance on literacy questions with success rates ranging from 61% to 83%. The psychomotor domain, assessed through poster creation, yielded an average score of 74 (sufficient category), with notable variation in students' creative expression and visual communication skills. The affective domain showed the most positive outcomes, with an average score of 80 (good category), demonstrating that discovery learning effectively fosters communication attitudes, discipline, teamwork, and character development. These findings suggest that while discovery learning successfully promotes literacy skills and affective development, its implementation requires refinement to optimize cognitive achievement, particularly through enhanced scaffolding, concept reinforcement, and targeted remedial interventions. This study has several limitations, including the use of snowball sampling, which may not fully represent the broader student population, the relatively short implementation period (one month) which may be insufficient to capture the full impact of discovery learning, and reliance on self-evaluation for affective assessment, which could introduce bias. Future research should investigate the long-term effects of discovery learning on retention and transfer of knowledge, explore optimal implementation strategies with adequate teacher training and support, examine the integration of technology-enhanced discovery learning to address cognitive challenges, and conduct comparative studies across different school contexts and student demographics. The broader scientific implications of this study highlight the need for multi-dimensional evaluation frameworks that balance cognitive rigor with affective and psychomotor development, the importance of differentiated instruction within discovery learning to accommodate diverse student abilities, and the critical role of teacher facilitation in scaffolding student-centered learning approaches to achieve optimal outcomes across all learning domains.

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