Implementation of Retrieval Practice After Learning the Immune System in High School: Students' Perceptions and Self-Efficacy

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Abstract

Retrieval practice is a learning strategy that has been shown to be effective in improving student learning. However, more research needs to be done on a classroom scale that examines students' perceptions of retrieval practice and its relationship to self-efficacy. The purpose of this study was to examine students' perceptions of retrieval practice and its influence on self-efficacy in the context of immune system learning. The research was conducted with 128 high school students from four 11th-grade science classes who were divided into two groups: two classes as the experimental group and two classes as the control group. Students in both groups underwent classroom learning about the immune system using Discovery Learning. Three days after the classroom learning, students in the experimental group received additional learning in the form of retrieval practice followed by feedback. Meanwhile, two classes of the control group were spent re-reading. Data on self-efficacy and students' perceptions of retrieval practice were collected after three weeks of learning. Differences in self-efficacy data between the experimental and control groups were analyzed using the Independent Samples t-test. The Spearman Rho test was used to determine the relationship between self-efficacy and students' perceptions in the experimental group. Research has shown that retrieval practice has a positive effect on self-efficacy. However, students' perceptions of retrieval practice vary widely, although most students have shown positive perceptions. These perceptions have a significant positive relationship with self-efficacy. Students who perceive retrieval practice positively generally have high self-efficacy. Therefore, students who use retrieval practice tend to have higher self-efficacy than those who do not. The difference was significant. It suggests that students' perceptions of retrieval practice play an essential role in determining the effect of retrieval practice on self-efficacy.

Keywords: Retrieval Practice, Perception, Self-efficacy

INTRODUCTION

The current education system increasingly emphasizes the implementation of effective learning to help students understand the learning material. In order to improve the effectiveness of learning, teachers are required to introduce effective learning strategies that involve active student participation. However, effective learning strategies are still underutilised (Carpenter et al., 2022). The use of ineffective learning strategies can reduce students' potential to achieve optimal learning outcomes (Blasiman et al., 2017). Some ineffective learning strategies that teachers often use include re-reading, re-studying, and highlighting (Blasiman et al., 2017; Palmer et al., 2019; Rea et al., 2022). These learning strategies are still commonly used because they are easier to do, take less time, and require less effort (Hui et al., 2022). The low effort invested in using these strategies is apparently insufficient to create a more profound and more lasting impact on learning. However, more effort is necessary to achieve long-term learning benefits and outcomes (Yang et al., 2018).

Retrieval practice is one of the empirically proven effective learning strategies for improving students' learning performance is retrieval practice (Agarwal et al., 2021; Moreira

et al., 2019). Retrieval practice represents an additional learning strategy that occurs outside classroom learning through repeated practice questions or quizzes. By doing repeated practice, students' cognition is stimulated to retrieve information actively from memory. Retrieval practice works in the student's cognitive system by retrieving information that has been stored in long-term memory to be restructured in working memory and consolidated back into long-term memory (Biwer et al., 2020; McDermott et al., 2014). The process that occurs during retrieval practice involves more active cognitive processes so that it can increase retention and better long-term memory (Agarwal, 2019). In addition, retrieval practice facilitates the transfer of knowledge to new contexts so that students can understand similar knowledge that may not be tested during retrieval practice (Fiorella & Mayer, 2016). Retrieval practice indirectly through feedback can also motivate students to learn more, increase metacognitive awareness, and improve the conceptual organization of material (Yang et al., 2021).

Retrieval practice has been widely researched as an additional strategy that can be applied to various subjects, both students and college students. Some studies reveal that retrieval practice

effectively improves students' learning performance in anatomy (Dobson et al., 2017), language (Bertilsson et al., 2021), history (Agarwal, 2019), and psychology (Batsell et al., 2017). Despite the many studies that reveal the effectiveness of retrieval practice, the application of retrieval practice in biology learning, especially on immune system material at the high school level class scale, still needs to be improved. Meanwhile, the immune system is one of the important materials that students must learn so that students can recognize and maintain the immune system in their bodies. Immune system material is also listed as material that must be studied in the current curriculum in Indonesia.

Students and teachers also feel the challenges in learning and teaching the immune system material. Students often face difficulties when asked to explain concepts related to the immune system (Ristanto et al., 2020). The difficulties that students face may be due to the abstract and complex nature of the immune system material, which requires much memorization (Cahyati et al., 2022). Students also struggle and lose interest because of the extensive use of technical terms in the subject and a lack of good active-learning exercises to highlight the key concepts (Raimondi, 2016). As a result, students are left with no choice but to re-study and re-read the material that the teacher has covered in class. Based on these problems, retrieval practice becomes a solution that can be used to help students improve their learning performance in immune system learning, especially in comprehension, analytical, and problem-solving skills.

Despite the effectiveness of retrieval practice for training students' cognitive processes, there are still few studies that investigate the extent to which retrieval practice affects students' non-cognitive mechanisms, such as self-efficacy. Self-efficacy is an individual's belief in their ability to complete a challenging or newly assigned task (Bandura, 1978). Self-efficacy serves as a predictor of an individual's success in learning (Alyami et al., 2017). Increased self-efficacy is associated with increased effort and persistence, leading to better performance (Bandura, 1997). Therefore, it is crucial to build self-efficacy in the learning process. Bandura (1997) states that self-efficacy is based on four major sources of information, which include mastery experience, vicarious experience, verbal persuasion, and physiological and affective states. Retrieval practice has the potential to act as a mastery experience. In mastery experiences, students are directly involved in the completion of a task, which provides a sense that the goal or task can be accomplished (Bandura,

1978). Feedback given to students after retrieval practice also has the potential to build self-efficacy through verbal persuasion.

Improving students' learning performance through retrieval practice can occur in two ways, namely directly and indirectly (Bjork et al., 2013). Directly, retrieval practice trains students to retrieve information that has been stored in their long-term memory. Indirectly, retrieval practice helps focus students' attention on what they do not yet know, thereby enhancing metacognitive awareness of the knowledge being learned. With this metacognitive ability, students are able to make informed decisions about what material they still need to learn and how much time and effort they should invest (Arnold & McDermott, 2013). This can occur because feedback provided in retrieval practice not only reports the results of the exercises but also indicates which parts have not been achieved and which parts have been accomplished. Those encourage students to exert better learning efforts to correct their mistakes (Yang et al., 2018). When students successfully correct their mistakes, they gain experience in how to overcome those errors. This experience becomes the basis for building self-efficacy when facing similar situations in the future (Endres et al., 2020). In addition,

feedback allows students to monitor their learning progress (Abel & Bäuml, 2020), enabling them to build belief in their abilities. However, further research on how retrieval practice can enhance students' self-efficacy is highly necessary.

Although retrieval practice has been shown to be effective in improving students' learning outcomes, as outlined above, research indicates that many students perceive it as a strategy demanding high mental effort, causing them to prefer restudy strategy over retrieval practice (Carpenter et al., 2020; Hui et al., 2022). However, those studies gathered perception data only based on students' learning preferences and did not consider perceptions from other aspects, such as congruency and experiences that students perceive from retrieval practice. Perception is a fundamental factor that can impact students' learning process. When students have a positive perception of learning, the learning process becomes more accessible, and they will learn more. Conversely, if students perceive learning negatively, they may put little effort into learning (Marzano et al., 1997). Misunderstandings regarding learning strategies can lead to less favourable perceptions and hinder the implementation of effective strategies (Hui et al., 2022). In order to ensure that

students can experience the benefits of retrieval practice comprehensively, students' perceptions of retrieval practice become a crucial aspect that needs attention.

Based on the above description, this study aims to fill the gap of knowledge by exploring how students' self-efficacy and perceptions of retrieval practice in the context of immune system learning. Three research questions that this study aims to answer are:

1. How does the implementation of retrieval practice strategy influence students' self-efficacy in immune system learning?

2. What are students' perceptions regarding the implementation of retrieval practice in immune system learning?

3. What is the relationship between perceptions and students' self-efficacy in immune system learning?

Learning Procedure

METHOD

This study used a quasi-experimental research design, which included both control and experimental groups using non-probability sampling. The study was conducted at a public high school in Bandung City.

Participants

Participants were 128 high school students from four 11th-grade science classes who were studying the immune system material. In total, 61 students (two classes) were included as the control group and 67 students (two classes) as the experimental group. No specific criteria were used to assign the control and experimental groups. Each class in both the control and experimental groups was selected based on their relatively similar average Biology learning achievements, ensuring there was no knowledge gap among students across classes.
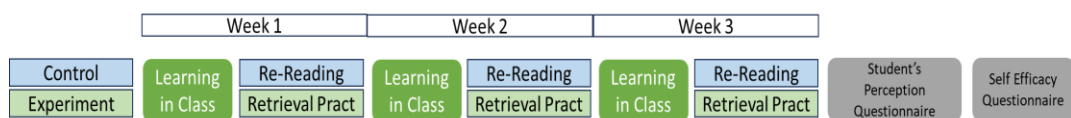

Figure 1. Research Design of Implementation of Retrieval Practice in Immune System Learning

Classroom learning of the immune system material was conducted for three weeks. In both control and experimental groups, immune system learning was carried out using the Discovery Learning

model with the following stages (Khasinah, 2021): 1) Stimulation, 2) Problem statement, 3) Data collection, 4) Data processing, 5) Verification, 6) Generalization. For each week, learning

occurs twice (two meetings), with two learning hours (45 minutes) each. As shown in Figure 1, three days after classroom learning, students in the experimental group were assigned to participate in a retrieval practice activity by answering questions asynchronously using Google Forms. Meanwhile, students in the control group were assigned to re-read materials provided by the teacher and review and complete worksheets that had been worked on in class. The questions in retrieval practice were arranged based on The New Taxonomy by Marzano and Kendall (2008). One day after the implementation of the retrieval practice, students were given feedback on the questions they had answered. Feedback contains explanations that guide students to the correct answer, enabling them to realize what needs to be done and obtain the correct answers. Meanwhile, the control group was asked to ensure that the material had been mastered.

Data Collection Tools

After three weeks of learning and three sessions of retrieval practice, students' self-efficacy was measured in both the experimental and control groups. Students' self-efficacy was measured using a 15-item questionnaire designed according to Bandura (2006) self-efficacy guidelines. The self-efficacy questionnaire was adjusted to the immune system learning material being studied by students. The framework of the self-efficacy questionnaire can be seen in Table 1.

Table 1. The Framework of Self-efficacy Questionnaire in Immune System Learning

No	Framework	Item Number	Total Item
1	Belief in their ability to explain concepts in immune system material	1,2,3,5	4
2	Belief in their ability to classify concepts in immune system materials	4,9	2
3	Belief in their ability to identify concepts in immune system materials	6,7,8,13	4
4	Belief in their ability to analyze concepts in immune system materials	10,11	2
5	Belief in their ability to apply concepts in the immune system	12,14,15	3
	Total		15

For the experimental group, in addition to measuring self-efficacy, students' perceptions of the implementation of retrieval practice were also collected. Students' perceptions of retrieval practice were measured using a 10-item questionnaire with a scale of 1 (strongly disagree) to 9 (strongly agree) and a 3-item open-ended essay. The statements and open-ended essays in the

perception questionnaire cover the congruency aspect of retrieval practice based on the student's experiences during retrieval practice. The questionnaire framework for perceptions can be seen in Table 2.

Table 2. The Framework of Perception Questionnaire of Retrieval Practice in Immune System Learning

No	Aspect	Indicator	Item Number +	Item Number -	Total Item
1	Congruency	Relate to material learned in the previous classroom meeting	2	-	1
2		Provide out-of-class activities to help students review immune system material	3,4	-	2
3		Application of retrieval practice in other material or subject	10	-	1
4	Experience	Retrieval practice is exciting and arouses enthusiasm	1,7	-	2
5		Retrieval practice is effective in helping to remember and understand the immune system material	6	8,9	3
6		Retrieval practice helps in taking the immune system final exam	-	5	1
	Total				10

Data Analysis

Students' self-efficacy data were analyzed using an Independent Sample t-test on the SPSS program to examine the significance of differences between control and experimental groups. The effect size of retrieval practice on self-efficacy was determined based on Glass's Delta effect size by Cohen et al. (2017) (Table 3). Students' self-efficacy data were grouped based on their level of self-efficacy by dividing students into three groups according to Cassady and Johnson's (2002) categorization (Table 4). Before being analyzed, students' perception data was sorted into two parts. The first part is data derived from the rating scale questionnaire, and the second part is data derived from the open-ended questionnaire. Data derived from the rating scale questionnaire are quantitative responses from students that were qualitatively analyzed by grouping and categorizing based on the total score obtained by each student. Grouping and categorization were conducted based on a frequency distribution table created by considering the minimum and maximum scores from the rating scale questionnaire (Table 5). Data from the open-ended questionnaire were analyzed by categorizing students' responses based on the tendency of positive or negative responses to the implementation of retrieval practice strategies. The Spearman correlation test was conducted

on SPSS to examine the relationship between perception and self-efficacy. Perception scores obtained from the perception rating scale questionnaire were correlated with scores from the self-efficacy rating scale questionnaire.

Table 3. Interpretation of Glass's Delta (Effect Size) (Cohen et al., 2017)

Effect Size	Interpretation
0–0.20	Strongly Weak
0.21–0.50	Weak
0.51–1.00	Medium
>1.00	Very Strong

Table 4. Grouping and Categorization of Students' Self-Efficacy (Cassady & Johnson, 2002)

Score of Self-Efficacy	Category
0-33%	Low
34%-66%	Medium
67%-100%	High

Table 5. Grouping and Categorization of Students' Perceptions

Perception Score	Interpretation
10-20	Strongly Negative
>20-30	Negative
>30-40	Moderately Negative
>40-50	Slightly Negative
>50-60	Slightly Positive
>60-70	Moderately Positive
>70-80	Positive
>80-90	Strongly Positive

RESULTS AND DISCUSSION

The results of the mean difference test for the self-efficacy scores between the experimental and control groups show a highly significant difference ($p = .002$), with the experimental group students having a higher mean score than the control group students (Table 6). These findings suggest that retrieval practice has an impact on the development of students' self-efficacy.

Based on the calculation of Glass's Delta effect size, $d = 0.58$ was obtained, indicating that the effect of retrieval practice is in the medium category. The effect of retrieval practice is supported by the data, which shows that the number of students with high self-efficacy is predominantly from the experimental group, while the number of students with low self-efficacy is predominantly from the control group (Figure 2).

Table 6. Student's Self-efficacy of both Experiment and Control Groups

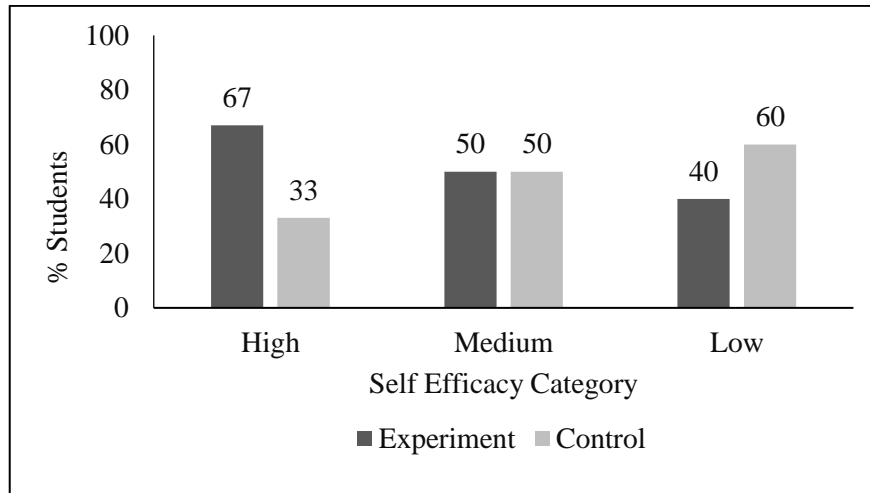| Research Group	N	Mean	SD	Std. Error	Sig (2 tailed)
Experiment	67	86.98	19.92	2.44	.002
Control	61	76.46	17.99	2.30	

Figure 2. Percentage of Students in Both Experiment and Control Group Based on Self-Efficacy Category

The difference in students' self-efficacy between the experimental and control groups illustrates that providing retrieval practice as an additional learning strategy outside the classroom for the immune system material can foster students' self-efficacy. Through the questions worked on during retrieval practice, students strengthen their memory of the immune system material covered in class. This process stimulates students to retrieve information that has been stored in long-term memory to be processed again in working memory (Biwer et al., 2020). Repetitive practice, such as retrieval practice, also solidifies neural pathways, transforming unstable memory representations into stable ones, ultimately leading to improved performance and mastery (Bellafard et al., 2024). With those processes, retrieval practice provides students with an experience to train their memory and

understanding of the immune system material more robustly.

Referring to Bandura's (1997) social cognitive theory which states that there are four major sources of information that can build self-efficacy, namely 1) mastery experience, 2) vicarious experience, 3) verbal persuasion, 4) and physiological and affective states, retrieval practice at least acts as mastery experience and verbal persuasion. As a mastery experience, retrieval practice directly involves students in recalling previously learned information. In this case, retrieval practice provides valuable experience for students. The success of students in answering retrieval practice questions is a crucial source of information for the formation of self-efficacy in students.

Retrieval practice continues beyond students answering questions. In retrieval practice, the teacher remains

present beside the students by providing feedback on students' answers. The feedback given one day after working on the questions is a form of encouragement or motivation provided by the teacher to the students, allowing them to build a belief in their abilities. This occurs because the feedback provided by the teacher includes praise or words that encourage students to continue improving their learning spirit. Praise given when students answer questions correctly and words of encouragement given when students make mistakes increase students' self-efficacy and prompt them to exert better effort on future occasions (Bandura, 1997). Feedback encourages students to exert better learning efforts to correct their mistakes (Yang et al., 2018). The experience gained when successfully correcting mistakes can build self-efficacy for dealing with similar situations in the future (Endres et al., 2020). Thus, the feedback provided by the teacher in retrieval practice can act as verbal persuasion that can increase students' self-efficacy (Bandura, 1997). However, it is crucial to note that feedback should be delivered carefully. Feedback that is delivered with a negative mechanism can reduce students' self-efficacy, leading to a decrease in students' effort and learning outcomes (Frankenstein et al., 2022). Delivering

feedback in a positive mechanism can increase students' self-efficacy and motivation (Sun & Yeh, 2017).

Retrieval practice and positive feedback form a strong unity in increasing students' self-efficacy. Increased self-efficacy can affect one's attitude when facing challenges, resilience when encountering obstacles, and effort to complete a task (Frankenstein et al., 2022). Students with high self-efficacy tend to have a strong belief in their abilities, do not give up quickly, and view difficulty as a challenge, resulting in better performance (Bandura, 1997). Therefore, it is essential for teachers and students to consistently build self-efficacy, both during and after the learning process in class.

The self-efficacy built by students through the implementation of retrieval practice is significantly positively correlated with students' perceptions of retrieval practice ($p < .001$; $r = 0.452$). The relationship between perception and self-efficacy, along with its line fit plot, can be seen in Figure 3. The line fit plot of perception to self-efficacy is formed by the equation $Y = 0.837X + 25.62$, where Y is the amount of self-efficacy, and X is the amount of perception. This line-fit plot illustrates that the higher the students' perception scores on retrieval practice, the higher their self-efficacy

(Figure 3). This correlation is supported by data indicating that students with positive and strongly positive perceptions of retrieval practice have high average self-efficacy scores of 86.54 and 99.72, respectively. These scores are higher compared to students with moderately positive, slightly positive, and even slightly negative perceptions (Table 7).
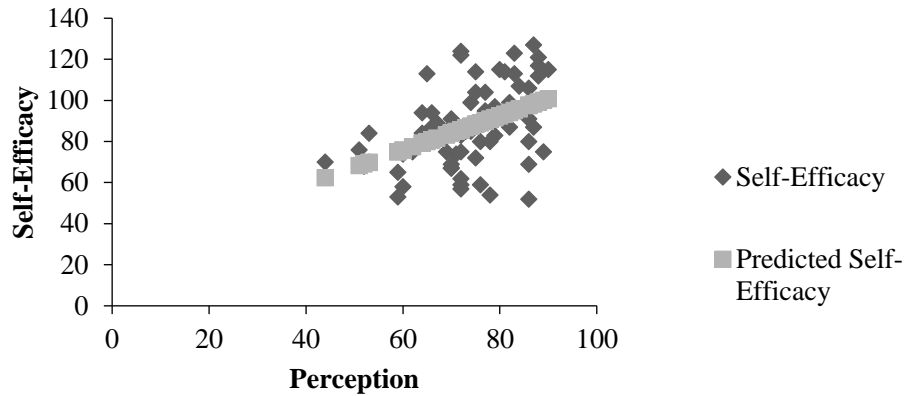

Figure 3. Perception Line Fit Plot in Relation to Self-Efficacy

Table 7. Average Self-efficacy Score Based on Students' Perceptions of Retrieval Practice

Students' Perception	% Students	Mean of Self-Efficacy Score
Strongly Negative	0	0
Negative	0	0
Moderately Negative	0	0
Slightly Negative	1	70.00
Slightly Positive	9	69.33
Moderately Positive	24	81.06
Positive	39	86.54
Strongly Positive	27	99.72

The correlation test results indicate that students' positive perceptions of retrieval practice contribute to building high self-efficacy in learning the immune system. In other words, the perception of retrieval practice is related to the formation of students' self-efficacy in learning the immune system. The findings of Wei and Chou (2020) revealed that students' perceptions of learning affect their self-efficacy and subsequently impact their learning performance and motivation. Students with positive perceptions engaged in retrieval practice sessions with enthusiasm and seriousness because they have a favourable view that retrieval practice will benefit their learning. In this context, positive perception builds a good learning environment and creates enthusiasm for students during retrieval practice. These results illustrate that students' moods or emotional states play a crucial role in building self-efficacy.

Students can learn faster when the things they learn are aligned with their mood, and they will remember things better, leading to an increase in self-efficacy (Bandura, 1997).

Students with a less favourable perception engaged in retrieval practice sessions with reluctance and felt forced because they viewed retrieval practice as an additional learning task. This condition makes students feel that they lack the ability to complete the task. This may be due to a lack of relevance between the students' emotional thoughts and the learning task to be performed during retrieval practice. Learning tasks that are not relevant to students' thoughts can deplete cognitive resources, while tasks related to positive emotions can maintain cognitive resources (Meinhardt & Pekrun, 2003). As a result, students with slightly positive or even slightly negative perceptions tend to feel burdened when answering retrieval practice questions, which ultimately leads them to lower self-efficacy. This finding implies that building students' positive perceptions of learning tasks is fundamental because the feeling of pleasure and joy in completing a task will lead students to interpret it as a sign of their ability to achieve success, thereby enhancing their self-efficacy (Bandura, 1995). This finding is consistent with what Hayat et al. (2020) suggested that in

order to reduce students' stress regarding given learning tasks, teachers should create a positive environment that is supportive and calm for students, as negative emotional states such as stress can affect students' self-efficacy. Creating a learning environment where students feel comfortable and accessible will make them enjoy learning. A comfortable feeling can enhance student engagement during learning, even if the learning task is an additional learning strategy outside the classroom, such as retrieval practice. A positive perception of the learning strategy, in this case, retrieval practice, allows students to feel the overall benefits of retrieval practice. This situation allows students to believe in their ability to complete learning tasks, especially in the context of immune system learning.

In this study, over 60% of students have positive or strongly positive perceptions of retrieval practice, while only 10% have slightly positive or slightly negative perceptions (Table 7). The data presented in Table 7 indicate that the majority of students have a positive perception of the implementation of retrieval practice strategies in immune system learning, ranging from moderately positive to strongly positive categories. These results suggest that the majority of the students can accept the implementation

of retrieval practice in learning well. The emergence of positive perceptions in the majority of students is a result of the perceived benefits of retrieval practice itself by students, in addition to the teacher's efforts in building initial perceptions. Long before the implementation of retrieval practice, teachers explained what retrieval practice is and its benefits. This was done in order to build the students' trust, as retrieval practice was positioned in this study as an additional learning strategy to be implemented outside of the classroom learning (outside of the schedule set by the school). Building students' trust is essential when implementing learning strategies so that students can understand the relationship between the strategies they use and the outcomes they will achieve (Putwain & Aveyard, 2018). Therefore, students will develop perceptions that are in line with their understanding. Misunderstandings regarding learning strategies can lead to less favourable perceptions and hinder the implementation of effective strategies (Hui et al., 2022).

The results of the grouping of student statements collected through the open-ended questionnaire strengthen and clarify the data collected through the rating scale questionnaire (Table 8). Students who express positive or strongly positive perceptions on the rating scale questionnaire also provide positive statements regarding retrieval practice on the open-ended questionnaire. Similarly, students with moderately positive, slightly positive, and slightly negative perceptions provide statements that align with the perceptions expressed through the rating scale questionnaire. Students who believe that retrieval practice will be beneficial for their learning strive to optimize their performance to do the tasks in retrieval practice. Whereas students who view retrieval practice as an added burden may not perform as well when completing learning tasks during retrieval practice. Diverse statements from students show the variety of perceptions students have regarding retrieval practice.

Table 8. Experimental Group Student Statement About Retrieval Practice

Perception	Statements
Positive (Strongly Positive and Positive Perception)	In order to understand the material, retrieval practice is beneficial.
	Retrieval practice is an excellent tool for self-study.
	The retrieval practice can help me remember the material I have already learned.
	Working on the retrieval practice is an exciting experience and adds excitement to learning.
	The feedback from the retrieval practice is an aid to comprehension of the material.

Perception	Statements
	The learned material is reactivated through retrieval practice.
	Retrieval practice is quite influential in the learning process.
Moderately Positive	Retrieval practice is a valuable tool for comprehending learning material, although limited by time constraints.
	Using retrieval practice aids in understanding the material, but occasionally, it can be unproductive.
	Assessing our understanding of the taught material is enabled by retrieval practice, although managing time outside of school becomes challenging.
	Retrieval practice helps when taking the final exam on the immune system because it helps in reviewing previously learned material.
	The problem-solving questions provided during retrieval practice need help comprehending.
Slightly Positive	Retrieval practice is less effective; I prefer to summarize the material.
	Retrieval practice is very good, but I am lazy in reading and answering retrieval practice questions.
Slightly Negative	I think it is better to explain the material directly and summarize it because it can be understood immediately.

The group of students with positive and strongly positive perceptions (66%) understands the role of retrieval practice. They stated that it not only helped them remember and understand the material taught by the teacher but also assisted in their learning process of understanding the immune system material (Table 8). In this group, students have an average self-efficacy score above 86 (Table 7). The group of students with high self-efficacy scores seemed to have used their metacognition in responding to the retrieval practice, which was provided as an additional learning strategy outside of the classroom. Therefore, the perceptions expressed in their written statements included their thoughts about the benefits they would get in the future. This result is in line with the view that perception can impact metacognition. According to this perspective, when students are faced with a new strategy, it raises several questions, such as how to act, whether something is learnable, whether to continue or quite studying and what expectations they have about their performance in future exams (Finn & Tauber, 2015). Students express that the benefits of retrieval practice are enhanced by the feedback given after the retrieval practice session (Table 8). Feedback allows students to identify recall and conceptual errors, providing opportunities for them to engage in elaborative (re)encoding of these concepts. By doing so, students can improve their understanding and ability to recall, gain a better understanding of the concepts, and be able to correct those errors on subsequent tests (Agarwal et al.,

2017). Feedback can also provide a more challenging activity for students, making them enthusiastic during retrieval practice and when receiving feedback (Abel & Bäuml, 2020). This encourages a more challenging and exciting learning experience while also reducing monotony.

Meanwhile, the group of students with moderately positive perceptions (24%) have an average self-efficacy score of about 81, which is below the average self-efficacy score of students with positive and strongly positive perceptions (Table 7). Students in this group acknowledge that retrieval practice is a strategy that helps them learn, but only to the extent of remembering, understanding, and reviewing the material that has been taught. Some of them feel that retrieval practice is a less productive learning strategy. Those perspectives are based solely on the immediate benefits they perceive, not yet extending into their metacognitive thinking, especially regarding the indirect effects they will experience in the future. The role of retrieval practice in helping students remember the material that has been taught has been revealed by Biwer et al. (2020) and Agarwal (2019). Retrieval practice stimulates students to retrieve information stored in long-term memory and process it again in working memory.

Consequently, engaging in retrieval practice after studying material can enhance retention and improve long-term memory. Some students in this group feel assisted in taking the final exam because retrieval practice helped them review previously learned material (Table 8). Those students' perspectives provide evidence that retrieval practice not only improves the retention of learned concepts but also enhances the transfer of knowledge to new contexts (Fiorella & Mayer, 2016). When students encounter problems with similar concepts but with different contexts during daily tests, they can solve them more easily.

Additionally, apart from students with positive perceptions, as mentioned above, there is a group of students who hold slightly positive and slightly negative perceptions of the implementation of the retrieval practice strategy. Both groups of students have relatively similar self-efficacy scores (Table 7). Students with slightly negative perceptions feel that retrieval practice is an ineffective and inappropriate strategy for them. They preferred direct explanations from the teacher rather than participating in retrieval practice activities. Meanwhile, some students with slightly positive perceptions consider retrieval practice as a good learning strategy but perceive it as less effective (Table 8). The ineffectiveness

of retrieval practice, according to these students, is related to their learning preferences. Students in this group are less inclined toward learning, which requires more effort in reading and answering questions. They prefer other ways, such as summarizing or listening to direct explanations from the teacher (Table 8). Students tend to view retrieval practice as an additional task rather than a learning strategy that will help them in their learning process, which makes them feel lazy and forced to do retrieval practice. This perception prevents students from experiencing the full benefits of retrieval practice. This situation is suspected because the students still need to understand the positive relationship between higher effort and the learning outcomes to be achieved. Students tend to view retrieval practice as an ineffective strategy because it requires high mental effort, so they refrain from using the strategy (Carpenter et al., 2020; Hui et al., 2022). In fact, high effort in learning will benefit long-term learning outcomes (Yang et al., 2018). The feeling of laziness felt by students makes them not fully utilize the learning opportunities through retrieval practice, and students tend to avoid retrieval practice activities.

The findings in this study provide evidence that retrieval practice plays a role in building students' self-efficacy.

However, the development of students' self-efficacy is inseparable from their perceptions of retrieval practice itself. Students who perceive retrieval practice as beneficial to the learning process and outcomes have higher self-efficacy compared to students who perceive retrieval practice as a learning strategy that gives additional burden or task. This finding implies the importance of building good perceptions before using retrieval practice as an additional learning strategy outside the classroom (Hui et al., 2022). In order to build better student perceptions of retrieval practice, a modification of perspectives that emphasizes goals and outcomes is needed to promote students' effective use of the strategies. Teachers are encouraged to communicate the benefits and goals of each strategy to students beforehand, allowing them to evaluate the meaning of each learning strategy used and then experience the optimal results. The ultimate goal is for students to discover practical strategies that will support them to become lifelong learners.

CONCLUSION

The implementation of retrieval practice in teaching the immune system to high school students has yielded positive results in terms of student self-efficacy. Students who underwent retrieval practice demonstrated higher self-efficacy than those who did not. The

retrieval practice group had a higher percentage of students in the high self-efficacy category. In comparison, the group without retrieval practice had a higher percentage of students in the low self-efficacy category. Regarding congruency and experience, most students in the retrieval practice group have positive perceptions with varying degrees, ranging from slightly positive to strongly positive. Only a small number of students have a slightly negative perception. This level of perception was significantly positively correlated with the magnitude of students' self-efficacy. This finding suggests that implementing retrieval practice in learning the immune system can enhance students' self-efficacy. However, students' perceptions of the retrieval practice itself are crucial. Therefore, it is essential to provide complete information about retrieval practice before implementing it in the classroom to foster positive perceptions among students.

ACKNOWLEDGMENT

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