Biosfer: Jurnal Pendidikan Biologi

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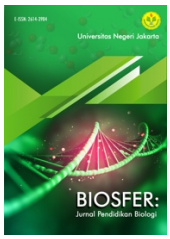

Using the ibsr technique as a psychological intervention to alleviate student stress in biology learning: Impacts on motivation, knowledge construction, and cognitive anxiety

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ARTICLE INFO

Article history
Received: 20 May 2024
Revised: 12 June 2024
Accepted: 12 September 2024

Keywords:
Cognitive anxiety
GCL
IBSR technique
Learning difficulties
Motivation

ABSTRACT

Learning difficulties are a common issue faced by students, with stress being a significant contributing factor. One psychological treatment that has been shown to effectively reduce stress is Inquiry-Based Stress Reduction (IBSR). The objective of this study is to integrate IBSR into a discovery learning strategy in Biology in the classroom, with the aim of increasing students' learning motivation and knowledge construction while reducing their learning difficulties and cognitive anxiety. This is quasi-experimental research that used a post-test non-equivalent control group design. The study involved 72 11th-grade science students from two different classes at one of the public high schools in Bandung City. One class, consisting of 36 students, received IBSR treatment, while the other class, also consisting of 36 students, did not. Both classes used a discovery learning framework for teaching. Data on motivation, learning difficulties, and cognitive anxiety were collected using a rating scale questionnaire with eight scales. Students' ability to construct knowledge was measured using the German Cognitive Load (GCL) instrument in the form of a written test with indicators taken from Mayer's cognitive taxonomy (2002) in the realm of understanding. The study found that incorporating IBSR techniques into learning strategies for the immune system material can reduce student stress and improve learning performance, motivation, and knowledge construction (GCL), while also decreasing learning difficulties and cognitive anxiety.

INTRODUCTION

Learning is the primary activity that students must undertake to achieve their goals. It plays a crucial role in shaping a student's behaviour towards a positive direction. Through learning, students acquire knowledge that can be useful in their lives (Cahyono, 2019). Additionally, learning provides students with opportunities to apply concepts, develop skills, and construct knowledge. To achieve the desired results, it is important to carry out learning activities effectively. However, the implementation of learning is not always successful. Learning difficulties can lead to failure in achieving the desired results, as stated by Utami (2020). This statement is in line with the findings of Amaliyah (2021) which suggest that low learning outcomes can be attributed to learning difficulties experienced by students.

Learning difficulties in students can be caused by stress, which is the body's response to pressure, change, emotional tension, and other factors. Stress is a common disorder that occurs when the body adjusts to the environment and responds to any disturbed body needs. The stress experienced by students can have a significant impact on their physical, psychological, intellectual, social, and spiritual well-being. Academic stress, which is caused by the inability to adapt to academic demands, can interfere with cognitive function and self-control, leading to poor decision-making. Academic stress is stress caused by academic stressors in the learning process related to student learning activities at school. This can result in distortions in students' minds and affect their physical, emotional, and behavioural well-being. The physical and emotional effects of academic stress can have both positive and negative impacts on students (Ambarwati et al., 2019).

The results of preliminary studies conducted in three high schools in Bandung indicate that academic stress is influenced by a multitude of causal factors, including motivation (>75%), cognitive anxiety (<50%), the education system (>70%), self-confidence (>89%), and teachers (>80%) In the context of learning biology, students tend to perceive learning difficulties as being caused by the perceived burden of learning each new biology topic. This assumption arises because students perceive biology as a subject requiring extensive memorization. Based on the results of an interview with one of the teachers at SMA Bandung, it was revealed that certain biological concepts were challenging to comprehend due to their abstract nature, resulting in the lowest scores among other biological materials, namely the material on the immune system. The lowest score obtained indicates that students have learning difficulties in the material on the immune system, as they are unable to master the learning material provided by the teacher. This is consistent with the findings of research by Yudistira et al (2021), which indicates that the human immune system is a challenging topic for students to understand due to the presence of numerous confusing and memorized terms. The difficulty of this material is also due to its abstract nature, which makes it challenging to understand and imagine. Additionally, the numerous complex mechanisms are difficult to visualize. In the study of biology, students are not only expected to memorize information, but also to apply it in everyday life, making the knowledge gained more meaningful. For instance, when studying the immune system, students must comprehend the concepts and analyze its role in bodily processes. It is not enough to simply learn about the immune system's functions; students must also be able to apply this knowledge to prevent diseases and solve problems related to the immune system. All these problems arise due to the fullness of students' working memory because it is filled with stressful thoughts. In this way, students are not simply memorizing material, which can cause stress due to the limited capacity of their working memory (Isnaeni, 2022).

When students experience a high cognitive load, meaning their working memory is occupied with additional cognitive processes, they may encounter difficulties in processing and constructing knowledge. The task of constructing students' cognitive schemes is a significant burden in the learning process, commonly known as germane cognitive load (GCL). The emergence of germane cognitive load can occur due to the mental effort students put into cognitive processes related to studying the material. This includes inferring, distinguishing, giving examples, interpreting, organizing, and classifying information to construct knowledge schemes (Mayer, 2002). During the learning process, if students are unable to process the information or knowledge provided by the teacher due to a lack of free capacity in working memory, it can cause an extra burden on them. This can lead to improper construction of knowledge and result in cognitive anxiety (Derakshan & Eysenck, 2009).

Cognitive anxiety is a response that students have to learning-related problems. It can occur when students try to understand learning materials and worry about the difficulties they encounter. This type of anxiety is particularly common when students are preparing for school exams that require

good grades, as they may feel insecure about their ability to perform well. Cognitive anxiety can have both positive and negative effects on students. Moderate levels of anxiety can provide strength and build confidence, ultimately reducing anxiety. However, high levels of anxiety can result in physical symptoms and lower student learning outcomes. Student motivation in learning is related to low learning outcomes, which may be caused by students' inability to manage anxiety and stress (Karaman et al., 2019).

Student motivation is crucial for learning difficult material, including biology. Low motivation or willingness to learn can hinder students' understanding of the subject matter. Therefore, it is important for students to be motivated to know the direction to go or achieve. Student motivation is essential for successful learning outcomes. According to Tokan & Imakulata (2019), students who have a desire to learn are more likely to remain active and persevere in their studies, resulting in better final results. Motivated students tend to engage more actively in the learning process, directing their cognitive resources towards constructing important knowledge schemes. Additionally, motivated students experience less academic stress (Minkley et al., 2021).

To address student learning difficulties caused by stress, a learning strategy is necessary that not only considers the delivery of teaching material, but also includes strategies to reduce stress and encourage active student participation in the learning process. Learning strategies refer to the methods, steps, or patterns used by teachers to ensure proper and effective achievement of learning objectives and aspects. The appropriate learning strategy can facilitate students and promote development in affective, cognitive, and psychomotor domains (Lubis et al., 2020). Therefore, the researcher conducted this study to find out how the effect of applying IBSR in biology learning strategies to intervene stress on students so that it has an impact on learning difficulties, cognitive anxiety, motivation, students' ability to construct knowledge (germane cognitive load).

METHODS

Research Design

This research is a descriptive study using quasi-experimental methods consisting of experimental classes using Inquiry Based Stress Reduction (IBSR) techniques and control classes without using Inquiry Based Stress Reduction (IBSR) techniques. The detailed research design is presented in Figure 1.

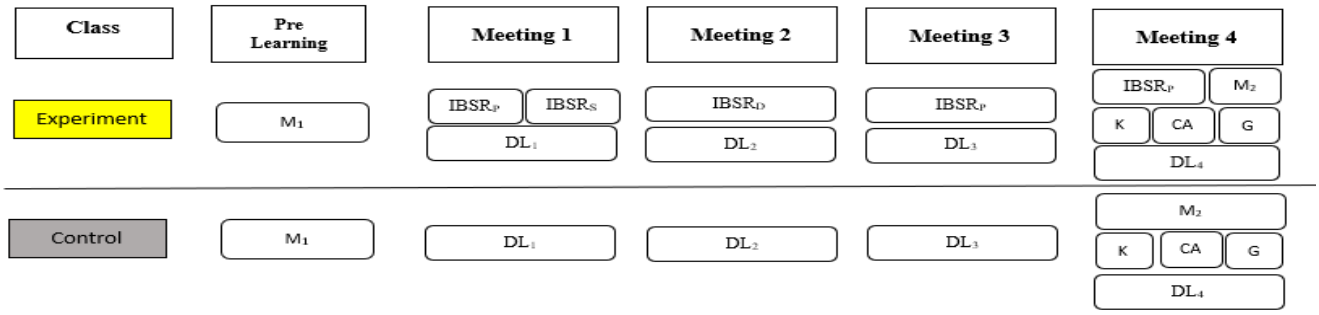


Figure 1. Research design. M1: Initial motivation questionnaire data collection; DL1,DL2,DL3,DL4: Learning using discovery learning model; IBSRP : IBSR questions inserted in the introduction activity; IBSRS: IBSR questions inserted in the stimulation syntax; IBSRD : IBSR questions inserted in the data collection syntax; K : Learning difficulty questionnaire data collection; CA : Cognitive anxiety questionnaire data collection; G : Knowledge construction test (GCL); M2 : Final motivation questionnaire data collection

Population and Samples

The population under investigation in this study is comprised of students attending one of the high schools in Bandung City. The sample for this study consisted of 72 11th grade science students, aged 16 to 18 years, who were divided into two classes. The first class was a treatment group comprising 36 students (23 female and 13 male) who received IBSR treatment. The second class was a control group comprising 36 students (19 female and 17 male) who did not receive IBSR treatment.

Instrument

The study utilized various instruments, including IBSR questions, questionnaires, and test questions. The IBSR instrument is integrated into a learning strategy with a discovery learning model.

This model is based on the following six stages: (1) syntax stimulation, (2) problem statement, (3) data collection, (4) data processing, (5) verification, and (6) generalization. The IBSR instrument consists of thirteen questions adopted from Katie (2019) developed by Zadok-gurman (2021). The questions (Table 1) are integrated into the introduction activity (prior to the commencement of the core activity), stimulation syntax, and data collection.

Table 1
Integration of the IBSR Technique in the Discovery Learning Model

Meeting	Syntax	IBSR Question
First Meeting	Introductory activities	a. Do you have any thoughts that are bothering you, such as anger, upset, disappointment or other things that will interfere with your learning now? Express the thoughts that are bothering you
		b. Are these thoughts important and can they be bad for you?
		c. Can you forget these thoughts? Let's forget those thoughts and focus on studying for the future
Second Meeting	Stimulation	a. Can you infer what exactly was shown in the video?
		b. Are you still distracted by your thoughts when summarizing the video? If you are still disturbed, try to express your thoughts again through writing and try to see how important it is that the thought stays in your head? Can you forget it?
	Data collection	a. Were you able to collect the required information and data?
		b. Do you still have other thoughts that interfere with finding and gathering information? If you do, try to express your thoughts in writing and see how important it is that it stays in your head? Can you forget about it?
Third Meeting	Introductory activities	a. Are you ready to present the results of the group discussion?
		b. Do you have thoughts that distract you from preparing for the presentation, making it difficult to concentrate on the presentation?
		c. If there is a disturbing thought, please write it down and then forget it. Can you forget it? Let's try to forget so that you can concentrate.
Fourth Meeting	Introductory activities	a. Do you still have thoughts that are bothering you right now that make your mind not focus on studying? Try to express the thoughts that bother you.
		b. Think back to whether these thoughts are important for you to think about right now?
		c. Can you forget about it and start focusing on studying?

The next instrument is a questionnaire of learning difficulties, learning motivation, and cognitive anxiety. These questionnaires consist of positive and negative statements with a rating scale ranging from 1 to 8. The Learning Difficulty Instrument is a questionnaire that has been adapted from Harris & Kirk (1993). The questionnaire comprises 15 statements, which can be grouped into five categories: students slow to follow lessons, inability in certain areas, academic difficulties in relation to uncontrolled behavior, problems related to learning motivation and problems related to learning difficulties due to teachers. The motivation questionnaire consists of 21 statements derived from several indicators, including attention, relevance, confidence, and satisfaction. This learning motivation indicator is adapted from Keller (1987) work and focuses on the immune system material. The cognitive anxiety questionnaire consists of 14 statements derived from 7 indicators, including difficulty concentrating, fear of inability to overcome problems, worrying, feeling threatened by people or events, mixed up or confused thoughts, feeling disturbed by fear, and worrying about being left alone. The Cognitive Anxiety Instrument used in this study was adapted from the Cognitive Test Anxiety Scale (CTAS) developed by Cassady & Johnson (2002). Additionally, the General Constructive Learning (GCL) instrument was used to measure students' ability to construct knowledge. This instrument consists of 15 multiple-choice questions related to the components involved, the types of body immunity, the types of immunity, the mechanism of the immune system, and the kinds of immune system. The GCL instrument has demonstrated high reliability with a Cronbach's α of 0.79. The instrument was developed based on Mayer (2002) knowledge scheme, which includes interpreting, giving examples, classifying, inferring, and differentiating.

Procedure

The immune system material in the experimental and control classes was divided into 4 meetings. One week before learning, students in experimental and control classes were asked to fill out a motivation questionnaire. At the first meeting in the experimental class, students were given IBSR before entering the core learning. Then stimulation was given by showing a video about how the immune system works and giving IBSR again to eliminate disturbing thoughts that still exist in students, after which a problem statement was made related to the video that had been presented. The second meeting, data collection and information related to identifying questions from various sources and giving IBSR after that data processing is carried out. The third meeting, given IBSR in the introduction and verification activities by presenting the results of group discussions. The fourth meeting, given IBSR in the introduction and verification and generalization activities. In addition, at the fifth meeting, a cognitive anxiety questionnaire was also given followed by a posttest and a questionnaire of motivation and learning difficulties. While in the control class, the learning steps carried out are the same as the experimental class only not given IBSR.

Data Analysis Techniques

The data obtained is subjected to analysis using a Likert scale, ANATES, and SPSS. Following this, the results will be discussed descriptively. The use of ANATES is employed to determine the validity, reliability, distinguishing power, and level of difficulty on germane cognitive load questions. While the use of SPSS is employed to ascertain normality via the Kolmogorov-Smirnov test, homogeneity via the Levene test, and the mean difference test, as well as the correlation test with the Pearson product moment correlation technique.

RESULTS AND DISCUSSION

Integration of IBSR (Inquiry-Based Stress Reduction) in Learning Strategies for Immune System Materials

The study integrated the IBSR technique by incorporating IBSR questions into the lesson plan (RPP) and the syntax of the Discovery Learning model used. The IBSR technique for releasing students' stress and transforming negative thoughts into positive ones involves. The results of teaching this IBSR technique are that students are able to identify the stressful thoughts that are interfering and to write down their stressful thoughts. In addition, students can explore their thoughts by structurally asking themselves about the stressful thoughts they have using questions given by the teacher (Table 1). At this stage, students were able to identify their own answers to the given questions and explore and feel the impact, benefits and functions of their stress cognition. The result of students using this IBSR technique is that they are able to reverse the stressful thoughts they have. For example, if a student's initial thought is, "My parents' demand that I get the best grades is very stressful. This stressful thought could be reversed to "My parents want the best for me in the future, so they are supporting me to get the best grades. The purpose of reversing these thoughts is to change the direction of negative thinking into positive thinking so that students find new interpretations in their minds. Changing the direction of this thought can provide an opportunity for students to experience a new perspective, so that students realize that they should not automatically believe the stressful thoughts. With the knowledge of this thought structure, students can better understand themselves and the causes and consequences of negative thoughts.

The purpose of incorporating the IBSR technique in this learning strategy is to assist students in detaching themselves from distracting thoughts that can cause pressure and stress. Pre-learning stress can affect students' memory performance in receiving information, so the IBSR technique should be utilized to overcome this stress and prevent it from impacting learning objectives and results. The IBSR technique assists students in observing the thoughts that underlie their emotions. By questioning these thoughts, students can recognize that their thoughts, emotions, and pressures are not beneficial to them (Landau et al., 2016). This awareness allows students to release these disturbing thoughts and be free from negative emotions (Leufke et al., 2013). Thus, due to the student's awareness, the working memory of the student is not filled with stressful thoughts which can certainly have a positive impact to be used in processing information during learning.

The Effect of IBSR on Student Learning Difficulties

Academic stress that students have can make students experience difficulties in learning at school. This stress can interfere with brain performance in the learning process so that students have difficulty processing information. In the experimental class and control class, the learning difficulty questionnaire was given at the end of the learning process after conducting four meetings. The results of statistical analysis showed that learning difficulties in the experimental class were lower (M=43.24, SD=.331) compared to the control class (M=52.27, SD=.349). Learning difficulties in these two classes were significantly different (p = .000). The percentage of learning difficulty questionnaire acquisition in each aspect in the experimental and control classes can be seen in Figure 2.

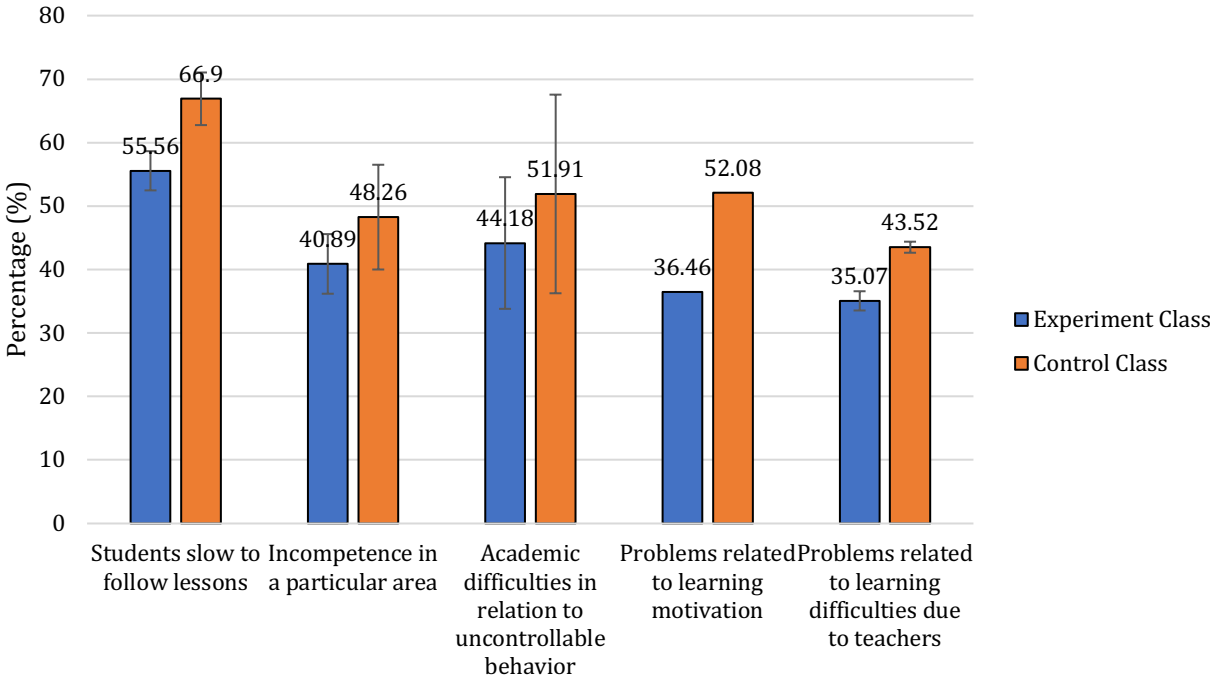


Figure 2. Results of Student Learning Difficulty Questionnaire

According to Figure 2, students who received the IBSR technique experienced fewer learning difficulties in all aspects compared to those who did not receive it. These results provide evidence that IBSR can reduce students' learning difficulties. The technique has helped students identify negative emotions or thoughts that interfere with their emotional responses. Remind students of the importance of recognizing negative thoughts and transforming them into positive ones to alleviate stress (Hook et al., 2021). The IBSR technique aims to modify problematic thoughts and help students understand their unhelpful nature. By recognizing the insignificance of these thoughts, students can release them and reduce their stress levels (Luff & Ledingham, 2017). Reducing or eliminating negative thoughts can have a significant impact on students' working memory capacity (Friehs & Frings, 2020).

Students have a limited working memory capacity with a short duration. If this capacity is filled with stressful thoughts, it can hinder their performance and ability to receive and process information from the teacher. Changes in content must be avoided. If this capacity is filled with stressful thoughts, it can hinder their performance and ability to receive and process information from the teacher. Objective and concise language is necessary to ensure comprehension and logical structure. It is important to avoid biased or emotional language and to use precise subject-specific vocabulary when appropriate. Adherence to conventional structure and formatting is also necessary. According to Plass & Kalyuga (2019), stress can have a negative impact on student cognition by causing negative emotions that affect working memory. Li et al (2021) also found that stress can impact working memory performance in processing information. Therefore, it is important to empty working memory of negative thoughts that cause stress in students. When students do not have extraneous thoughts, they can better focus on the learning provided, and their working memory can more effectively receive and process information. This is because, during the learning process, they do not feel stressed by distracting thoughts outside the context of the material and learning (Lukasik et al., 2019). Therefore, reduced stress levels can

enhance students' ability to comprehend and reduce learning difficulties.

The Impact of IBSR on Students' Cognitive Anxiety

Anxiety in the cognitive aspect is a problem that must be considered in the field of education. High levels of cognitive anxiety among students can interfere with achieving goals (Safithry, 2022). Therefore, cognitive anxiety must be considered as a variable. Statistical analysis revealed a significant difference in cognitive anxiety between students in the experimental and control classes (p = .000). The experimental class exhibited lower levels of cognitive anxiety (M=53.89, SD=.364) compared to the control class (M=68.55, SD=.481), as evidenced by the results of the cognitive anxiety questionnaire (Figure 3).

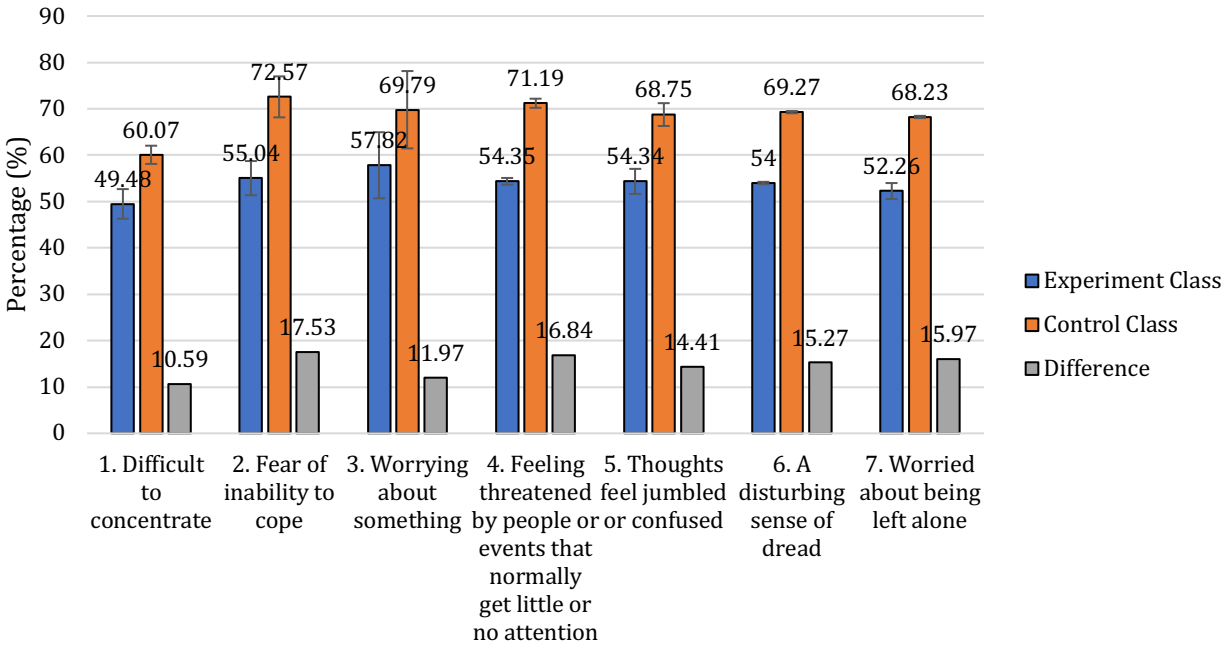


Figure 3. Results of Students' Cognitive Anxiety Questionnaire

Figure 3 shows that the experimental class has a significantly lower percentage of cognitive anxiety in each aspect compared to the control class. Cognitive anxiety is a negative and prospective emotion experienced by students when they have concerns about failing to obtain good results. Although cognitive anxiety is generally considered a negative emotion, moderate or sufficient anxiety can enhance student performance in learning. Some studies suggest that high anxiety levels can hinder learning performance, while moderate or sufficient anxiety levels can improve it (England et al., 2019).

Based on the results obtained in the experimental class, each aspect of cognitive anxiety falls into the medium or sufficient category. This indicates that the results are effective in activating and improving student performance in learning. In contrast, the control class showed high levels of cognitive anxiety in each aspect, which can inhibit student performance in learning. Figure 3 shows that the significant percentage difference is due to aspect 2, specifically the fear of inability to face problems, which is 17.53%. This fear arises when students are about to take an exam due to the fear of failure. Additionally, individuals may experience external pressure from family, teachers, or other sources if they are unable to achieve satisfactory exam scores (Putwain & Daly, 2014).

The high percentage of aspect 2 in the control class was due to students' unpreparedness during the exam and their inability to achieve the learning objectives. This unpreparedness is a result of the information received by students not being transferred into long-term memory or not being received and processed properly due to the working memory being filled with stressful thoughts that interfere with the learning process. Students must be aware of the importance of eliminating negative thoughts (stress) that can hinder their ability to process information. Failure to eliminate these thoughts before beginning the learning process can result in difficulty obtaining and retaining information, which is crucial for success on exams. Excessive cognitive anxiety during exams can be caused by insufficient preparation and provision, which can negatively impact students.

In contrast to the control class, the experimental class exhibits significantly lower cognitive anxiety levels. Students in this class are able to process their stressful thoughts, either by reducing or eliminating them, resulting in increased availability of free capacity in working memory. As a result, the student's brain is able to receive and process more information. According to Krispenz & Dickhäuser (2018), releasing stressful thoughts through the IBSR technique teaches students to systematically identify stress-inducing thoughts, which can reduce cognitive anxiety. This can help students process information more effectively and reduce excessive fear when facing school exams, as they are better prepared. During the exam, previously obtained and properly managed information stored in long-term memory can be used to construct knowledge.

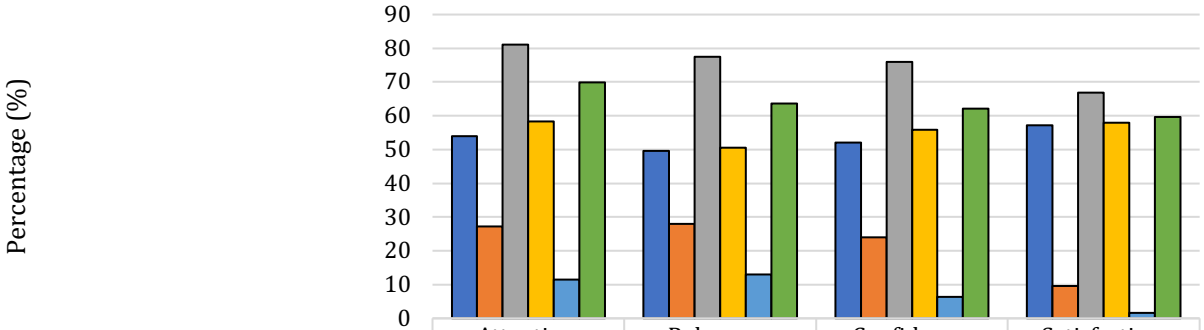
The Impact of IBSR on Student Motivation

The data on learning motivation results were obtained from questionnaires given to students before and after the learning process in both experimental and control classes. Statistical tests were then conducted to analyze the data.

Table 3
Statistical Test Results of Student Learning Motivation

Class	Beginning				End			
	M	SD	Sig.	Description	M	SD	Sig.	Description
Experiment	53.37	.313	.010	Significant	74.97	.258	.000	Very significant
Control	55.82	.331			63.63	.251		

Table 3 indicates a significant difference in the initial learning motivation of students and a highly significant difference in their final motivation. The control class had higher initial motivation than the experimental class. However, at the end of the learning process, the experimental class students experienced a significant increase in their final motivation compared to the control class. This is illustrated in Figure 4.



	Attention	Relevance	Confidence	Satisfaction
Experiment Class (Initial Motivation)	53.89	49.58	52.01	57.24
Difference Experiment	27.29	28	23.97	9.54
Experimental Class (Final Motivation)	81.18	77.58	75.98	66.78
Control Class (Initial Motivation)	58.33	50.63	55.83	58.04
Control Difference	11.51	12.99	6.27	1.69
Control Class (Final Motivation)	69.84	63.62	62.1	59.73

Figure 4. Results of Student Learning Motivation Questionnaire

According to Figure 4, the experimental class showed a greater increase in all indicators of learning motivation compared to the control class. However, the experimental class experienced a significant increase in learning motivation specifically in the attention and relevance indicators. Attention, which is a selection mechanism closely related to student cognition, was found to be particularly affected. The experimental class showed an increase in motivation due to the implementation of IBSR techniques. These techniques assist students in releasing or intervening in stressful thoughts prior to the learning process. Students are directed to focus on their stressful

thoughts and then transform them into positive thoughts (Landau et al., 2021). Stressful thoughts can impact students' working memory capacity. Working memory and attention are two crucial cognitive abilities that are closely related in the learning process. Attention plays a vital role in controlling activities, working memory representation, and information retention. The acquisition of information involves the five senses, including sight, hearing, and touch. The human body has five senses that make up the sensory memory. These senses receive impulses or stimuli and forward them to the working memory. Due to the limited capacity of working memory in students, it is important to selectively attend to information during the learning process. Students who pay close attention to what they learn can process the knowledge in their working memory. If the knowledge is learned more deeply, it will be stored in long-term memory and remembered for a longer period of time. Attention is crucial for both receiving and accepting information. It reduces the burden and stress that can disrupt students' learning, creating a more enjoyable experience that helps them concentrate. Therefore, it can be concluded that attention plays a significant role in the learning process.

The next indicator that experienced a significant increase was relevance. This increase in the percentage of indicators in the experimental class is due to their awareness of the importance of the material they learn (Nur & Kurniawan, 2022) and their efforts to reduce stress on students who have to fulfill working memory (Brown et al., 2013). When the attention indicator is present, students are able to concentrate and focus their attention on what they are learning. This can lead to an awareness of the benefits of understanding the immune system, making students more interested in learning about it because they feel that the material has direct benefits in everyday life. Additionally, immune system material is closely related to students' daily lives (Tepriandy & Rochadi, 2021). Recently, Indonesia and other countries have experienced an outbreak of the Covid-19 virus, which is being studied in relation to the immune system. This presents an opportunity for students to engage in meaningful learning (Mayer, 2002), which involves connecting new information to relevant concepts in their cognitive structures. These structures include concepts, facts, and generalizations that students have learned and remembered. Vergara et al (2019) define meaningful learning as the process by which students fully understand the knowledge they acquire, allowing them to connect it with previously acquired knowledge.

Overall, the increase in motivation in the experimental class occurred because when students do not have extra thoughts, they will be more focused on receiving the learning provided, because during the learning process they do not feel stressed over disturbing thoughts outside the context of material and learning. Students begin to have an awareness of the importance of learning and are able to process stress that should be removed from their minds. This is also supported by previous research conducted by Epel et al (2018) that the process students go through when exploring their thoughts meditatively to be interpreted and then compared with the reality they experience, can result in increased motivation, increased self-capacity and strengthen students' mindset because they consciously know the importance or not of these negative thoughts. Meanwhile, the increase in the control class could occur due to other factors not examined by the researcher, such as the use of learning models, teaching styles, and other factors because according to Ramadan et al (2021) and Siak et al (2023) learning strategies, both models, methods and others, can provide increased learning motivation for students.

Effect of IBSR on Germane Cognitive Load (GCL)

The cognitive load data obtained is relevant to the questions used to measure student construction results following the biology learning process on the immune system. The same question on immune system material was given to both the experimental and control classes after completing the learning process. Statistical analysis of the acquisition of student post-test scores showed significant differences between the experimental and control classes ($p = .001$). The experimental class ($M = 86.47$, $SD = 9.858$) demonstrated a higher value of student knowledge construction (GCL) compared to the control class ($M = 78.33$, $SD = 10.359$), as shown in Figure 5.

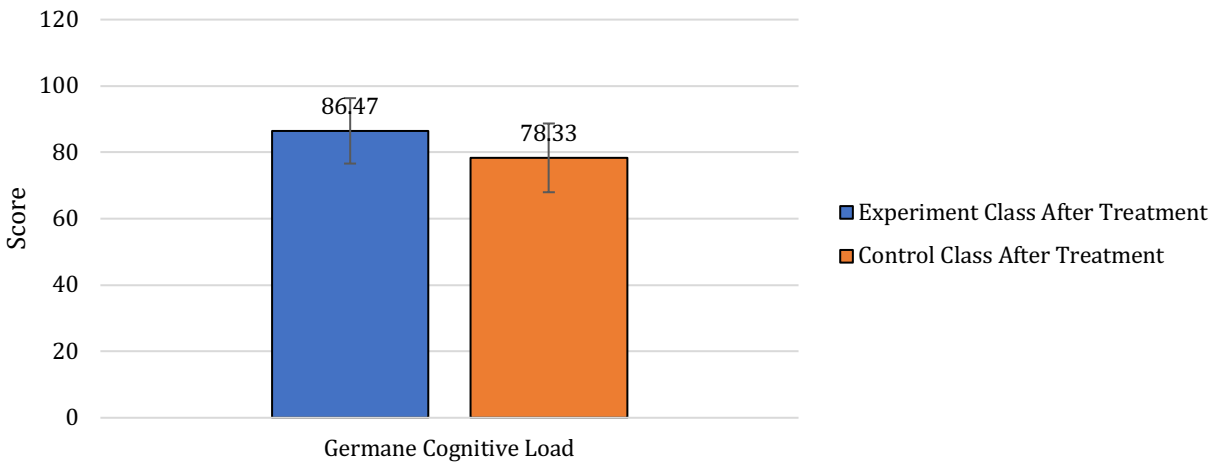


Figure 5. Results of Students' Knowledge Construction (GCL)

The data in Figure 5 shows that the acquisition of values obtained from the construction of student knowledge on the material of the immune system after the provision of the IBSR technique is 86.47 in the experimental class and 78.33 in the control class. The results obtained from both classes have reached the KKM value that must be obtained by students in learning biology, which is 78, but the acquisition of values in the experimental class is much higher than the value in the control class. GCL questions were taken after the learning process (post-test) and not taken at the beginning of learning (pretest), this is because at the beginning of learning students do not have a cognitive load and do not have new information in their working memory to be used in constructing their knowledge. Germane cognitive load is one component in cognitive load whose percentage must be much higher than intrinsic cognitive load (ICL) and extrinsic cognitive load (ECL). GCL itself is a mental effort devoted to storing information and producing knowledge schemes for what has been learned. According to Bottini & Doeller (2020), the resulting GCL illustrates the formation of knowledge that students learn so that it forms a complete scheme. The results of knowledge construction obtained from working on problems or tasks indicate that there is a thinking process in students. This thinking process is closely related to students' working memory. The capacity of students' cognitive processes during the learning process can be directly measured using working memory, but if there are things that interfere with the cognitive system during the learning process, it can cause excessive cognitive load on students (Rahmat & Hindriana, 2014). To optimize the learning process, the amount of load in students' working memory should not exceed the limit, so that if there is excess capacity in working memory, it must be reduced or eliminated so as not to affect the results to be achieved.

The control group did not receive the IBSR technique to eliminate stress-inducing thoughts, resulting in stress before and during the learning process. This stress had a negative impact on the learning process and student memory, leading to poor knowledge construction results. Furthermore, stress can cause test anxiety, which can result in low academic performance. Stress before the learning process can negatively impact information processing and memory consolidation. This can result in inadequate processing of information, leading to its inability to be stored in long-term memory (Zhao & Hu, 2021). The storage of information in long-term memory is crucial for students, as it allows knowledge to persist and not be lost even when new information is introduced.

Sandi (2013) suggests that stress can greatly affect cognitive function by interfering with information processing and memory. Working memory, responsible for organizing and giving meaning to information, is a complex cognitive task that requires temporary storage. Its capacity is limited, and information is only retained for a short period of time. Therefore, during the learning process, it is important to avoid filling working memory with stressful thoughts that may exceed its capacity. If students experience cognitive overload due to stress before the learning process, the information obtained during the learning process may not be fully processed by working memory and transferred to long-term memory, thus inhibiting the learning process (Sweller, 2011).

Therefore, the scores in the experimental class were much higher than the control class because the provision of IBSR in the experimental class helped students in relieving stress (disturbing thoughts) in their working memory when started learning. This makes students able to receive and process

information in working memory as well as possible, so that memory consolidation occurs in the form of transferring information from short-term memory to long-term memory which causes information obtained by students to be maintained for a long time, so that they are able to construct their knowledge at the end of the learning process. The high GCL in students in the experimental class can also be interpreted as a sign that meaningful learning occurs for students during the learning process (Koć-Januchta et al., 2022).

Correlation Between Variables

The results of the correlation test between variables can be seen in Table 4.

Table 4
Correlation between Variables

Correlation	R	Sig	Description
Learning Difficulties-Cognitive Anxiety	.380*	.022	* Significant
Cognitive Anxiety-Learning motivation	-.474**	.004	** Very Significant
GCL- Learning motivation	.567**	.000	** Very Significant
GCL- Cognitive Anxiety	-.349*	.037	* Significant

*Correlation is significant at the .05 level (2-tailed)
**Correlation is significant at the .01 level (2-tailed)

Based on the results in Table 4 above, there is a correlation between the variables. The first correlation is learning difficulties with cognitive anxiety, which has a correlation value of .380 with a positive relationship direction. This means that when students have high learning difficulties, it can increase cognitive anxiety in students and vice versa. The existence of this correlation can be seen in Figure 2 that students in experimental class have lower learning difficulties, which allows students to be better able to understand learning well because there are no extra thoughts that interfere and fill working memory, so students can focus more on the learning process and process information well. The low learning difficulty of students in the experimental class affects the percentage of cognitive anxiety. It can be seen in Figure 3 that the cognitive anxiety of the students in the experimental class is lower than that of the control class, which means that this cognitive anxiety occurs because the students have learning difficulties in the learning process, so the information cannot be processed properly by the students. So it can be said that there is a positive correlation between learning difficulties and cognitive anxiety in students. This is also consistent with the research of Utami & Warmi (2019), which states that students who have difficulties in understanding the learning material will have an impact on students' understanding is low, so students feel worried or anxious about working on exam questions.

Next is the correlation between cognitive anxiety with learning motivation. Table 4 shows that there is a correlation of .474 with a negative correlation direction between cognitive anxiety and learning motivation in students. This means that when students have high anxiety, it can reduce learning motivation and vice versa. It can be seen in Figure 3, the percentage of cognitive anxiety in the experimental class is lower than the control class and falls into the moderate category. This can activate or bring out the maximum effort that students can do in learning to face school exams. Maximum effort made by students who have cognitive anxiety in this moderate category also affects the percentage of learning motivation. So it can be seen in Figure 4, student learning motivation in the experimental class has increased very significantly which means that students already have full awareness of the importance of learning, controlling activities and representing working memory. This is certainly different from the control class which has a high percentage of cognitive anxiety (Figure 3) which can make students much more stressed and inhibit performance in learning so that it has an impact on student learning motivation which becomes low. Students who have high anxiety on the eve of an exam can affect certain motivations that result in avoidance tendencies (Krispenz et al., 2019).

The next correlation is between GCL and student learning motivation. In Table 4, it shows that GCL has a very significant effect on student learning motivation and vice versa with a positive relationship direction. This means that when students have high motivation, it can affect students' GCL. It can be seen in Figure 4 that the percentage of student learning motivation in the experimental class is higher than the control class, which means that students in the experimental class have more enthusiasm for learning than the control class. Students' enthusiasm and awareness in learning and

good information processing in working memory also have an impact on the results obtained by students. This can be seen in Figure 5 which shows the results that the score on the exam of the experimental class immune system material is much higher than the control class. This result is in accordance with the statement of Minkley et al (2021) that students who have high motivation are more involved during the learning process, so that their cognitive resources are more likely to be directed to the construction of schemes that are important for acquiring knowledge. Likewise, according to Costley (2021), students who have high motivation make a greater contribution so that they get greater learning outcomes compared to students who have low motivation. This is also in line with the research of Sapitri & Fauziah (2022) which states that learning motivation contributes greatly to student learning outcomes (GCL) and shows that there is a strong relationship between motivation and the learning success of a student.

Finally, the correlation between GCL and students' cognitive anxiety. Based on Table 4 shows that GCL significantly affects students' cognitive anxiety and vice versa with a negative correlation direction. This means that when students have excessive or high cognitive anxiety, it can reduce students' knowledge construction ability (GCL). It can be seen in Figure 5 that the results of high knowledge construction in this experimental class are influenced by students' cognitive anxiety which is in the moderate category (Figure 3) which can activate maximum performance in learning when facing school exams. The acquisition of high scores in this experimental class occurred because during the learning process students were able to process information well because it was not disrupted by working memory by stressful thoughts, so that this well-processed information could be transferred into long-term memory which could be recalled at any time to be constructed during the exam. The storage of information in long-term memory can be an asset for students when facing exams because all information stored in long-term memory can be stored for a very long time and it is difficult to fade away. This can certainly help students to be more confident and calmer in facing the exam so that students can face the exam well and get a good score too. Because of this, the cognitive anxiety of students in the experimental class will not be excessive when approaching the exam. So it can be said that GCL is negatively correlated with students' cognitive anxiety. This is in accordance with the results of research conducted by Von der Embse et al (2018) that students' GCL (knowledge construction) has a negative correlation with students' cognitive anxiety, when students have high cognitive anxiety it will affect students' low academic achievement. as well as the results of research conducted by Pascoe et al (2020) which say that students who have higher stress will experience high cognitive anxiety as well when facing exams because high stress is related to poorer academic performance. Poor academic performance certainly affects the academic achievement that will be obtained by students. Research conducted by Fteiha & Awwad (2020) and Nuraeni & Ratnaya (2023) shows that students who have high stress tend to have lower academic achievement because it is influenced by students' cognitive anxiety when taking exams.

CONCLUSION

The study's findings indicate that incorporating the IBSR technique into the learning strategy for the immune system material can help alleviate student stress. Research has shown that reversing negative thoughts into positive ones can reduce learning difficulties and cognitive anxiety, while also increasing motivation and knowledge construction. The IBSR technique can be incorporated not only into the Discovery Learning model but also into other learning models and biology materials to alleviate student stress during the learning process.

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