



Academic Stress Level of High School Students in Biology Learning

Nova Vivi Clara Saputri ¹, Azura Salsabila ¹, Tina Rizqiyati Rohimah ¹ and Adi Rahmat ^{1*}

¹ Master of Biology Education Study Program, Faculty of Mathematics and Natural Sciences Education, Indonesian University of Education, Jl. Dr. Setiabudhi No. 229 Bandung, Jawa Barat, Indonesia, 40154

* Correspondence: adirahmat@upi.edu

Abstract

Background: Learning biology has material and concepts that students must understand; besides that, there is abstract material that makes it difficult to understand. This can cause students academic stress during the biology learning process. Students who experience stress will undoubtedly feel a loss in the field of learning if they cannot manage stress quickly and adequately. This research was conducted by analyzing the level of academic stress caused by five factors: motivation, self-confidence, anxiety, the education system, and teachers. Academic stress experienced by students is then categorized into three categories: mild stress, moderate stress, and severe stress. **Methods:** The research method used was a survey (ex-post facto) with instruments in the form of a questionnaire with nine choice scales and interviews. The population in this study were teenage students aged 16-18 years, with a sample of 54 students from 3 schools with specific characteristics. **Results:** The results showed that students experienced academic stress caused by five factors but with different categories. Motivation, self-confidence, the education system, and teachers generally cause students to experience severe academic stress. **Conclusion:** The anxiety factor only causes academic stress in the mild and moderate categories.

Keywords: Academic stress level; Anxiety; Education system; Motivation; Self-efficacy; Teacher



Article history

Received: 20 Nov 2023

Accepted: 19 Apr 2025

Published: 31 Dec 2024

Publisher's Note:

BIOEDUSCIENCE stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Citation: Saputri, N.V.C., Salsabila, A., Rohimah, T.R., and Rahmat A. (2024). Academic Stress Level of High School Students in Biology Learning. *BIOEDUSCIENCE*, 8(3), 385-393. doi: [10.22236/jbes/13214](https://doi.org/10.22236/jbes/13214)



©2024 by authors. Licensee Bioeduscience, UHAMKA, Jakarta. This article is open-access distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license.

Introduction

Learning is an interaction process between teachers, students, and learning resources. During the learning process, disturbances often can harm the desired results (Yohanes & Lusbiantoro, 2019). Stress in students can be caused by their inability to deal with academic disturbances. High school students generally experience stress at varying levels. Students who experience stress during learning will feel a loss if the student is unable to manage stress quickly and adequately. Insufficient ability to deal with stress and excessive demands will increase stress continuously. This can affect the physical and psychological health of students. Thus, students' awareness of handling stress independently can prevent students from harmful stress. Students must be able to adjust to conditions at school, especially during learning. If students cannot adapt to school conditions or environments, especially during learning, the students are in a stressful condition, namely academic stress (Nilma, 2022).

In high school students, the level of stress experienced can increase because students have to adjust to physical and emotional changes in themselves and overcome conflicts in their lives. Academic stressors cause academic stress. Academic stressors are causes of stress that originate from the learning process, such as pressure to get good grades, long study time, lots of assignments, low grades/achievements, and anxiety in facing exams; in addition, students who experience academic stress tend to be influenced by skills in time management between studying and other activities (Harahap et al., 2020).

One of the causes of academic stress in students is changes in the curriculum. This is because students are asked to be able to adjust themselves to these changes. In addition, specific learning that students feel is very difficult to learn, either from too much material or feared teachers, the media used can also cause academic stress. Academic stress can include students' perceptions of the amount of knowledge that must be mastered and insufficient time to master that knowledge (Barseli et al., 2018). Some stress that occurs in students apart from the learning process comes from the students' daily lives themselves (Fauziyyah et al., 2021).

In biology learning, students often assume that biology is a learning that involves more memorization, which creates a burden in learning it (Fitriani et al., 2022). What must be instilled in students is meaningful biology learning, not just knowing and understanding concepts but being able to apply them in everyday life. For example, in the digestive system material, students not only memorize and know the function of the digestive organs but must also be able to apply it to avoid digestive disorders. To achieve meaningful learning, high-level cognitive abilities need to be trained. Training cognitive abilities will be disrupted if students' working memory is filled with more extraneous thoughts (extra processing), such as what happens when students experience stress. Stress causes negative emotions in students, affecting working memory by narrowing cognitive resources (Saputri et al., 2024).

This study analyzes the causes of students' academic stress in biology learning based on five aspects, namely motivation, self-confidence, anxiety, education system, and teachers. The results of this study are expected to provide an overview of the academic stress experienced by high school students so that teachers can design appropriate learning strategies. Stress is one factor that can interfere with students' cognitive processes during learning, so the student learning process in class becomes less than optimal. It can even be an obstacle to learning.

Method

This descriptive study uses a survey method (ex post facto). The study was conducted by analyzing the level of academic stress caused by several factors that occur in students during biology learning by categorizing the level of stress obtained from a scale of mild anxiety to severe stress.

Sample or Participant

The population in this study were adolescent students aged 16-18 years, with a sample of 54 students from 3 schools. Participants in School 1 consisted of 7 females and 12 males, and school two consisted of 7 females and nine males, school 3 consisted of 8 females and 11 males. The sampling technique used was purposive sampling with sample characteristics in the form of students who are active in the learning process, students who are not active in the learning process, students who have problems with assignments, students who do not have problems with assignments, students who are often absent from biology learning.

Instrument

The instrument used was a questionnaire consisting of 20 statement points with a scale of 1-9 and interviews. The questionnaire was developed by considering the coverage of aspects that cause students' academic stress. These aspects are motivation, self-confidence, anxiety, the education system, and teachers. Interviews were conducted individually using an interview format that covered all factors that cause academic stress in students. Interview questions adapted from Cassady & Johnson (2002) can be seen in Table 1.

Table 1. Interview Questions Based on Five Aspects of Academic Stress Triggers

Aspect	Question
General	Do you like learning biology? Give reasons?
Motivation	Do you feel forced to study biology? Give reasons?
	Do you have the motivation to study biology? Give reasons?

Self-Confidence	Do you always try to study biology material until you understand it? Give reasons?
	Are you confident in your ability to learn biology? Give reasons?
	Are you confident in your ability to overcome obstacles and the difficulties of the tasks you are facing? Give reasons?
	Are you confident in getting good grades in learning biology? Give reasons?
	Are you confident in communicating well with friends during the discussion process? Give reasons?
Anxiety	Do you feel anxious while studying biology in class? Give reasons?
	Do you feel your memory decreases when the teacher asks during biology lessons? Give reasons?
	Do you feel it is better not to ask even though you do not understand the material being taught? Give reasons?
	Do you feel unable to study biology according to the demands of the curriculum (KD/CP/Learning Objectives)? Give reasons?
	Do you feel pressured by the length of time you spend studying biology? Give reasons?
Education System	Do you feel anxious about certain biology materials? Give reasons?
	Do you feel pressured by the demands of the current curriculum? Give reasons?
Teachers	Do you feel pressured by the demands of the KKM value for biology? Give reasons?
	Do you like the learning method used by the biology teacher? Give reasons?
	Do you feel uncomfortable with the attitude of the biology teacher? Give reasons?
	Do you feel pressured when the biology teacher asks you to answer questions or re-explain material that the teacher has explained? Give reasons?
	Do you feel burdened when the biology teacher gives you homework? Give reasons?
	Do you find it difficult to understand the teacher's explanation of biology material? Give reasons?

Data collection & Data analysis

Data was obtained from collecting questionnaires and interview results, and then the data obtained through questionnaires and interviews were analyzed using a Likert scale and will be discussed descriptively.

Result

Level of Student Preference for Biology Subject

The percentage of student preference for biology subjects in the three schools is presented in Table 2. In the three schools, the results showed that only one school was in the high category regarding their preference for biology learning. This means that many students dislike biology subjects because they are abstract and require memorization.

Table 2. Percentage of Students at Each Level of Biology Subject Preference in Three Schools

School	Category	
	Medium	High
School 1	42.10%	57.89%
School 2	68.75%	31.25%
School 3	68.42%	31.57%

Students' Academic Stress During Biology Learning

The results of the statistical data on academic stress obtained are presented in Table 3.

Table 3. Results of Student Academic Stress Statistics

Variable	N	Min	Max	Mean	SD
Academic Stress	54	42	68	57	5.28428

The category of academic stress levels of students originating from five causal factors is presented in Table 4. The results show that severe stress occurs due to 4 of the 5 factors that cause student stress: motivation, self-confidence, education system, and teachers.

Table 4. Percentage of Academic Stress Levels

School/Academic Stress Factors	Category		
	Mild Stress	Moderate Stress	Heavy Stress
Percentage of Students in School 1			
Motivation	36.84		78.95
Self-Confidence			94.74
Anxiety			
Education System			84.21
Teachers			100
Percentage of Students in School 2			
Motivation	50		75
Self-Confidence			93.75
Anxiety			
Education System			87.50
Teachers			87.50
Percentage of Students in School 3			
Motivation	57.89		89.47
Self-Confidence			89.47
Anxiety			
Education System			73.68
Teachers			89.47

Discussion

Level of Student Preference for Biology Subjects

Based on the results of the data analysis in Table 2. shows that the percentage of students who like biology learning in school 1 is 42.1% with a medium category and 57.89% with a high category. In school 2, the percentage of students' preference for biology subjects is 68.75% with a medium category and 31.25% with a high category. Meanwhile, in school 3, students' preference for biology subjects obtained a percentage of 68.42% with a medium category and 31.57% with a high category. These data show that in school 1, more students like biology learning, so it is more dominant in the high category than the low category, in contrast to schools 2 and 3, which show that students' preference for biology subjects is higher in the medium category, which means that in schools 2 and 3, the preference for biology learning is lower than in school 1. The interview results showed that students prefer biology learning more because biology follows the life they live. This condition follows the findings of Rahmat (2010) that many high school students like learning biology because biological material is very close to human life. The statement of Harefa et al. (2022) reinforces this that biology is not a complex science to learn; learning biology means learning about yourself and your environment.

In biology learning, several materials are based on the life they experience or feel, such as studying plants, animals, organ systems, and other materials, as well as their liking for biology since junior high school. The interviews conducted at school 1 show that students' liking for biology learning is very high because students at school 1 like to learn a lot about living things and the surrounding environment. However, their liking is not facilitated well at school because no practicums and activities support biology learning. Meanwhile, the results of interviews at schools 2 and 3 regarding liking for biology learning are that most of these students feel that in biology learning, there is a lot of material that must be memorized so that sometimes it makes students bored and sleepy, besides that, abstract materials also make them have difficulty understanding them. Therefore, in this case, a good teaching strategy is needed for a teacher to help students understand abstract materials such as metabolism, photosynthesis, and others. In the learning process, teachers should be more creative and innovative in creating an interesting and enjoyable learning environment so students can easily understand the learning delivered (Fitriani et al., 2022).

In the learning process that occurs in the classroom, students are still not encouraged or facilitated enough to improve their thinking skills. The learning process is directed at students' ability to memorize information the brain receives. Students are forced to remember and collect various information that they must remember. This causes students to be less able to connect what they learn with how that knowledge will be used or applied in new situations, so students will lose their motivation to be active in learning, which can lead to decreased interest in the teaching and decreased learning outcomes (Lestari & Irawati, 2020). Interest in learning can motivate students to socialize with anyone, be confident open, and have a high sense of curiosity. Meanwhile, someone with low interest tends to be withdrawn, self-confident, and anti-social (Yohana et al., 2022).

Students' Academic Stress During Biology Learning

Table 4. shows that the five academic stress factors contribute to the percentage of stress caused by students in the three schools. In the first school, the highest rate of students' academic stress factors came from the teacher factor; in the second school, it was self-confidence. In the third school, the highest percentage of academic stress came from three factors, namely motivation, self-confidence, and teachers. However, when viewed from the categorization of students' academic stress, the three schools have almost the same category of academic stress caused by motivation, self-confidence, anxiety, education system, and teachers. In line with these results, Kurnia (2021) said that academic stress can occur because academic stressors cause it. Academic stressors are triggers for mental stress that start from the teaching and learning process. This stressor is a kind of pressure to get good and satisfactory results or grades, the length of learning activities, the many and varied assignments given, low and unsatisfactory grades obtained, and fear of facing tests or exams.

Stress can happen to anyone, and the stress level for each individual is undoubtedly different. The stress experienced by students will inevitably harm their learning activities if it is not managed quickly and adequately. If many disturbances come and the ability to deal with these disturbances is very minimal, then this can result in severe stress. What needs to be considered is that if the ability to deal with stress is inadequate and demands are excessive, stress will continue to increase. As a result, stress contributes negatively to students' physical, intellectual, social and psychological health (Nursolehah & Rahmiati, 2022). Therefore, awareness of stress and its symptoms must be considered to avoid the consequences of this stress. Students' responsibilities in the academic field at school are regarded as demands and burdens that must be met. Students who are unable to adjust to circumstances or adapt to the school environment are students who are experiencing academic stress. Symptoms of academic stress can be physical, behavioral, mental, and emotional factors (Abdollahi et al., 2020). Stressful conditions cannot be ignored because they can hinder students from achieving achievement and interfere with their productive period. The role of each individual's behavior, physical, and emotions when experiencing stress is different. This includes the human nervous system and the human immune system itself (Nilma, 2022).

Academic stress due to motivational factors occurs because of the laziness experienced by students in learning biology. This was revealed when interviews were conducted with students. Students said that biology is a tedious and challenging subject for some students because a lot of material must be memorized. Many scientific words are challenging to learn. As a result, the biology learning outcomes for some students are relatively low. This condition contradicts the student interest in biology in the medium and high categories. According to Rangkuti & Ulfa (2022), the low scores are not caused by the difficulty of biology, but many things cause it, including low motivation to learn biology. The high percentage in this motivational aspect occurs because students do not have the motivation or desire to learn biology because of the assumption that biology is a less enjoyable subject. After all, it isn't easy to understand (Azizi & Irwansah, 2020). Motivation is one of the essential factors that students must have. Motivation will provide enthusiasm for students so

that they will know the direction of their learning. Learning motivation can arise when students desire to learn and will increase their activities and maintain perseverance in learning to improve their learning outcomes (Aina et al., 2021). Someone with a clear goal can make them more motivated to achieve that goal, so students with high motivation will be serious about learning (Lianto & Jufri, 2018). The reason for the low motivation in these three schools is also because the ideals or majors that students are interested in after graduating from high school have nothing to do with biology learning, so they already have the idea that biology learning is not a subject that they must master so that in the learning process many students are not serious about understanding each material given. So, it can be concluded that students who do not have self-motivation in learning tend to have difficulty concentrating; besides that, learning is considered a failure if students do not have the enthusiasm to learn and do not know something being learned (Lestari & Irawati, 2020).

The next factor that can cause academic stress is self-confidence (self-efficacy). Self-efficacy possessed by individuals can enable them to face various situations. Individuals with high self-efficacy believe that they can do something to change the events around them. Meanwhile, individuals with low self-efficacy will assume they are unable to do everything around them. In difficult situations, individuals with low self-efficacy tend to give up easily. Meanwhile, individuals with high self-efficacy will try harder to overcome existing challenges (Siregar & Putri, 2020). Table 2 shows that students' self-confidence in the three schools falls into severe stress. This happens because students are not confident in completing academic tasks to achieve goals, which becomes an obstacle to achieving good results.

The next factor that causes academic stress is student anxiety. Anxiety arises because of a response or conflict that occurs when someone experiences a change in their life situation and is required to be able to adapt. The anxiety that students face during the learning process is normal when they try to understand a learning material because cognitively, someone who feels anxious will continue to worry about all kinds of problems that might occur so that it will be difficult for them to concentrate or make decisions, confused, and difficult to remember (Habibullah et al., 2019). Academic anxiety usually occurs when students face an exam that requires them to get good grades. The exam is either in the form of a written exam or a practical exam. In biology learning, students do not only take written exams but also take practical exams on certain materials. Biology materials that are abstract and complex and the many sub-chapters in the material, such as metabolism, circulatory system, and photosynthesis, make students anxious to study them. This is in line with the opinion of Firmansyah & Ardi (2022) that in Biology lessons, there are materials that are difficult for students to understand because of their complexity or the abstractness of the material. A student experiences anxiety also because they do not have confidence in their abilities and are unable to receive learning well due to physical conditions or health conditions, which causes anxiety in them. This causes students to have thoughts that will shape their behavior (Azyz et al., 2022).

The education system that applies in schools is one of the factors that causes academic stress. Generally, learning in schools is more emphasized on achieving curriculum demands. Teachers emphasize more on achieving Basic Competencies or Learning Outcomes, which emphasize cognitive aspects. Learning in schools pays less attention to the overall development of students. As a result, students are less actively involved in learning. In other words, student involvement in learning is not optimal, resulting in suboptimal student learning outcomes (Sarumaha et al., 2022). These learning outcomes can occur because the student continues trying to study hard (Ula et al., 2021).

Another factor that causes stress in students is the teacher. This can happen because, in classroom learning, they have a significant role. In the learning process, student involvement is substantial to have a learning experience so that there is a change in their knowledge. However, if the teacher only uses a learning method where students only get information without being involved in the learning, students will feel bored and busy with their own affairs or with their friends. To avoid this, teachers must have extensive instructional

knowledge and skills. The knowledge and instructional skills teachers possess can positively or negatively influence student learning outcomes. Teachers with high knowledge and instructional skills can create an interesting and enjoyable learning atmosphere. In addition, teachers who can build optimal interactions between teachers and students will have a good and significant effect on student motivation in learning (Fitriani et al., 2022). This will give rise to positive emotions in students. Conversely, learning will be monotonous and teacher-centered if teachers do not want to develop their instructional knowledge and skills. As a result, many students feel bored and stressed when they have to participate in biology learning like that (Simatupang & Sitompul, 2018).

Of the five factors causing academic stress studied in the three sample schools, motivation, self-confidence, education system, and teachers are the four factors causing stress in the severe category. Meanwhile, anxiety in school 1 is included in the low category of stress, while in schools 2 and 3, it is a factor causing stress in the moderate category. The four factors causing academic stress in students in the severe category in the three sample schools hurt the process and results students want to achieve. Stress in the severe category can affect students' memory systems, starting from receiving information in sensory memory, processing data in working memory, storing information in long-term memory, and retrieving information stored in long-term memory. Thus, stress significantly interferes with brain performance. If this happens during classroom learning, students cannot follow the learning even and adequately tend to try to run away from the teaching (Adams et al., 2018).

Increased stress has been shown to interfere with working memory capacity, which causes a narrowing of free space working memory; this limited working memory causes students to be unable to receive so much learning simultaneously. Learning will be disrupted if the working memory capacity exceeds the limit (Sayed, 2021). This is in line with the fact that the higher the academic stress in students, the lower the achievement that students will get and vice versa. If the level of academic stress in students is in the low category, the achievement that students will get will be higher (Sudarsana, 2019).

Conclusion

Students in the three sample schools prefer biology subjects in the medium and high categories. However, in biology learning, students also have academic stress, which reaches the severe category in some students. Factors causing severe academic stress in biology learning are motivation, self-confidence, the education system, and teachers. Student anxiety about learning and learning outcomes are not included in the factors causing severe stress in biology learning.

Acknowledgments

The researcher would like to thank three Bandung schools for permitting this research.

Declaration statement

The authors report no potential conflict of interest.

References

- Abdollahi, A., Panahipour, S., Tafti, M. A., & Allen, K. A. (2020). Academic Hardiness As a Mediator for the Relationship Between School Belonging and Academic Stress. *Psychol Schs*, 1–10. <https://doi.org/10.1002/pits.22339>
- Adams, E. J., Nguyen, A. T., & Cowan, N. (2018). Theories of Working Memory: Differences in Definition, Degree of Modularity, Role of Attention, and Purpose. *Language, Speech, and Hearing Services in Schools*, 49(3), 340–355. https://doi.org/10.1044/2018_LSHSS-17-0114
- Aina, M., Budiarti, R. S., Muthia, G. A., & Putri, D. A. (2021). Motivasi Belajar Biologi Peserta Didik SMA pada Pembelajaran Daring Selama Masa Pandemi Covid-19. *Al Jahiz: Journal of Biology Education Research*, 2(1), 1. <https://doi.org/10.32332/al-jahiz.v2i1.3379>
- Azizi, A., & Irwansah, I. (2020). Pengaruh Penggunaan Model PBL Terhadap Motivasi Belajar Biologi Siswa Kelas X Mia. *Jurnal Ilmiah Global Education*, 1(2), 186–192. <https://doi.org/10.55681/jige.v1i2.52>

- Azyz, A. N. M., Huda, M. Q., & Luthfi Atmasari. (2022). School Well-Being dan Kecemasan Akademik pada Mahasiswa. *Happiness, Journal of Psychology and Islamic Science*, 3(1), 18–35. <https://doi.org/10.30762/happiness.v3i1.350>
- Barseli, M., Ahmad, R., & Ifdil, I. (2018). Hubungan Stres Akademik Siswa dengan Hasil Belajar. *Jurnal EDUCATIO: Jurnal Pendidikan Indonesia*, 4(1), 40. <https://doi.org/10.29210/120182136>
- Cassady, J. C., & Johnson, R. E. (2002). Cognitive Test Anxiety and Academic Performance. *Contemporary Educational Psychology*, 27(2), 270–295. <https://doi.org/10.1006/ceps.2001.1094>
- Fauziyyah, R., Awinda, R. C., & Besral, B. (2021). Dampak Pembelajaran Jarak Jauh terhadap Tingkat Stres dan Kecemasan Mahasiswa selama Pandemi COVID-19. *Jurnal Biostatistik, Kependudukan, Dan Informatika Kesehatan*, 1(2), 113. <https://doi.org/10.51181/bikfokes.v1i2.4656>
- Firmansyah, I., & Ardi. (2022). Analisis Kebutuhan Multimedia Interaktif Berbasis Aplikasi Android Tentang Materi Virus Untuk Peserta Didik Kelas X Di SMAN 13 Padang. *Jurnal Biodidaktika*, 17(2), 113–119.
- Fitriani, Delima Harahap, R., & Safitri, I. (2022). Analisis Hambatan Proses Pembelajaran Biologi Secara Daring Selama Pandemi Covid-19 Di Sma Negeri. *Jurnal Biolokus: Jurnal Penelitian Pendidikan Biologi Dan Biologi*, 5(1), 81–89. <http://dx.doi.org/10.30821/biolokus.v5i1.1328>
- Habibullah, M., Hastiana, Y., & Hidayat, S. (2019). Kecemasan Mahasiswa Dalam Menghadapi Seminar Hasil Skripsi Di Lingkungan FKIP Universitas Muhammadiyah Palembang. *BIOEDUKASI: Jurnal Pendidikan Biologi*, 10(1), 36–44. <http://dx.doi.org/10.24127/bioedukasi.v10i1.2015>
- Harahap, A. C. P., Harahap, D. P., & Harahap, S. R. (2020). Analisis Tingkat Stres Akademik pada Mahasiswa Selama Pembelajaran Jarak Jauh Dimasa Covid-19. *Biblio Couns: Jurnal Kajian Konseling Dan Pendidikan*, 3(1), 10–14. <https://doi.org/10.30596/bibliocouns.v3i1.4804>
- Harefa, M., Lase, N. K., & Zega, N. A. (2022). Deskripsi Minat dan Motivasi Belajar Siswa pada Pembelajaran Biologi. *Jurnal Pendidikan*, 1(2), 381–389. <https://doi.org/10.56248/educativo.v1i2.65>
- Kurnia, R. W. (2021). Stres Akademik Siswa Dalam Melaksanakan Pembelajaran Daring Selama Masa Pandemi Covid-19 Di MAN 1 Jember. *TARBIYA ISLAMIA: Jurnal Pendidikan dan Keislaman*, 11(2), 57–64.
- Lestari, D. G., & Irawati, H. (2020). Literature Review: Peningkatan Hasil Belajar Kognitif dan Motivasi Siswa pada Materi Biologi melalui Model Pembelajaran Guided Inquiry. *Bioma: Jurnal Biologi dan Pembelajarannya*, 2(2), 51–59.
- Lianto, Jufri, W. M. (2018). Pemanfaatan Model Jurnal Belajar Kotak Berhias untuk Meningkatkan Motivasi dan Hasil Belajar. *Pendidikan Biologi*, 8(2012), 711–716.
- Nilma, N. (2022). Sistem Pakar Untuk Analisa Tingkat Stres Belajar Siswa SMK Dengan Algoritma Inferensi Forward Chaining. *JRKT (Jurnal Rekayasa Komputasi Terapan)*, 2(02), 88–95. <https://doi.org/10.30998/jrkt.v2i02.6729>
- Nursolehah, R., & Rahmiati, R. (2022). Pengaruh Expressive Writing terhadap Penurunan Stres Akademik Mahasiswa. *Jurnal Basicedu*, 6(4), 6703–6712. <https://doi.org/10.31004/basicedu.v6i4.3348>
- Rahmat, A. (2010). Kajian Terhadap Metode dan Pendekatan Pembelajaran Biologi di SMA: Kesenjangan dalam Pembelajaran di Kelas. *Jurnal Pengajaran MIPA*, 15(1), 25–34. <https://doi.org/10.18269/jpmipa.v15i1.35985>
- Rangkuti, A. S., & Ulfa, S. W. (2022). Analysis of the Attitude and Learning Interest of Senior High School Students Towards Biology Lesson. *Jurnal Pembelajaran dan Biologi Nukleus*, 8(2), 409–418. <https://doi.org/10.36987/jpbn.v8i2.2927>
- Saputri, N. V. C., Rahmat, A., & Hamdiyati, Y. (2024). Using the Ibsr Technique as a Psychological Intervention to Alleviate Student Stress in Biology Learning: Impacts on Motivation, Knowledge Construction, and Cognitive Anxiety. *Biosfer: Jurnal Pendidikan Biologi*, 17(2), 508–522. <https://doi.org/10.21009/biosferjpb.45086>
- Sarumaha, M., Harefa, D., Ziraluo, Y. P. B., Fau, A., Venty Fau, Y. T., Bago, A. S., Telambanua, T., Hulu, F., Telaumbanua, K., Lase, I. P. S., Laia, B., Ndraha, L. D. M., & Novialdi, A. (2022). Penggunaan Model Pembelajaran Artikulasi Terhadap Hasil Belajar Siswa Pada Mata Pelajaran IPA Terpadu. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, 8(3), 2045. <https://doi.org/10.37905/aksara.8.3.2045-2052.2022>
- Sayed, A. A. (2021). The Relationships Between Cognitive Load and Affective Strategies used in Learning Situations among General Diploma Students in Faculty of Education. *Egyptian Journal of Educational Sciences*, 1(2), 69–101. <https://doi.org/10.21608/ejes.2021.227241>
- Simatupang, A. C., & Sitompul, A. F. (2018). Analisis Sarana dan Prasarana Laboratorium Biologi dan Pelaksanaan Kegiatan Praktikum Biologi Dalam Mendukung Pembelajaran Biologi Kelas Xi. *Jurnal Pelita Pendidikan*, 6(2), 109–115. <https://doi.org/10.24114/jpp.v6i2.10148>

- Siregar, I. K., & Putri, S. R. (2020). Hubungan Self-Efficacy dan Stres Akademik Mahasiswa. *Consilium: Berkala Kajian Konseling Dan Ilmu Keagamaan*, 6(2), 91. <https://doi.org/10.37064/consilium.v6i2.6386>
- Sudarsana, D. (2019). Pengaruh Antara Stres Akademik dengan Prestasi Belajar Siswa Kelas Ix Smpn 2 Kemalang (the Influence Beetween Academic Stress and Learning. *Jurnal Riset Mahasiswa Bimbingan Dan Konseling*, 5(2), 204–207.
- Ula, S., Afifa, A. N., & Azizah, S. A. (2021). Pengaruh Penggunaan Teknologi di Masa Pandemi Covid-19 terhadap Hasil Belajar pada Mata Pelajaran Biologi di MAN 2 Jember. *ALVEOLI: Jurnal Pendidikan Biologi*, 2(1), 54–66. <https://doi.org/10.35719/alveoli.v2i1.35>
- Yohana, Y., Gresinta, E., & Zakiah Fithah A'ini, Z. (2022). Analisis Minat Belajar Biologi Siswa SMA Kasih Depok di Tengah Pandemi Covid-19. *EduBiologia: Biological Science and Education Journal*, 2(2), 115. <https://doi.org/10.30998/edubiologia.v2i2.13527>
- Yohanes, B., & Lusbiantoro, R. (2019). Teori Beban Kognitif: Elemen Interaktivitas dalam Pembelajaran Matematika. *Inspiramatika*, 5(1), 1–8. <https://doi.org/10.52166/inspiramatika.v5i1.1477>