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Correlation Analysis of Mental Workload on Academic Performance of Boarding Students During Biology Learning

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Abstract: This study examines the correlation between mental workload and academic performance of boarding students at Ihsanul Fikri Islamic Boarding High School Mungkid during biology learning. Mental workload was measured using the Mental Effort Rating Scale, while academic performance was measured using the Students' Academic Performance Scale. Employing quantitative correlation design, the study involved 49 randomly selected twelfth-grade science students. Results revealed a strong negative correlation between mental workload on students' academic performance (- 0.647). Students' mental workload was categorized as moderate with indicators of work performance and mental work effort has an average of "considerable effort" (98.16 and 91.43). Academic performance was also in the moderate category (92.63). These findings highlight the importance of managing academic demands through effective learning strategies and a supportive school environment to reduce mental workload and optimize students' academic performance, especially in boarding school.

Keywords: Mental Workload; Academic Performance; RSME; SAPS; Boarding Students; Biology Learning;

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Introduction

The goal of Indonesia's national education is stated in Article 4 of the 2003 National Education Law: "National education aims to develop the potential of students to become human beings of faith and devotion to God, almighty, noble, virtuous, healthy, knowledgeable, competent, skilled, creative, independent, aesthetic, democratic and have a sense of community and nationality." If examined closely, religious boarding schools have a strategic role to play in achieving this goal by balancing the development of general and religious knowledge holistically. Students can develop rational thinking through the nature of reason and the nature of religion so that the pillars of goodness are embedded in them (Minarti, 2022).

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One of the religious boarding schools is an Islamic boarding school that combines complex aspects of the general curriculum and Islamic religion so that students are expected to become individuals with character (Saputra, 2024). Boarding students have an additional burden of duties in the form of religious activities such as community service, dormitory pickets, quran recitation review, and so on that must be observed. Students must be able to divide their time and thoughts so that they can take part in class learning optimally and complete all assigned academic tasks.

Learning in boarding Islamic schools emphasizes mastery of general and Islamic knowledge that is done and internalized so that it functions as a science content applied in life by students (Izaryani, 2023). One of the fields of science studied is biology. Subjects such as biology are taught with regard to Islamic values. For example, boarding students must be able to analyze and integrate information related to a hadith related to circulatory system material and build a deep understanding in order to understand biology subjects with Islamic values.

Biology is one of the most important subjects. Biology learning requires students to understand, analyze, and apply procedural concepts to solve problems (Aqil, 2017). Biology learning focuses on scientific process skills such as observation, classification, experimental design, prediction, interpretation, and application (Mahmudah, et al., 2019). Boarding students must be able to process information and build knowledge related to pure and Islamic knowledge during learning in religious boarding schools. Boarding students must optimize their cognitive functions to learn, remember, think, receive, process, understand and use information to perform academic tasks optimally (Dania & Novziransyah, 2021; Didin, et al., 2020).

Boarding students have a lot of task load to do during learning at school and in dormitories. Existing academic demands can cause stress and anxiety among students which has an impact on optimizing the learning process (Putri, 2023). Academic demands can motivate within reasonable limits, but often transform into a heavy psychological burden (Budiman, 2024). High task load, task demands, and academic pressure can cause academic stress and adversely affect the physical and mental health of students (Islaha, et al., 2024).

Mental workload is an important issue in education because students spend more time on their minds. Mental workload is a task load that involves psychological activities such as concentration, confusion, and alertness (Longo, et al., 2022). Cognitively, mental workload is a multidimensional construct in processing major tasks over time mediated by external and internal factors to cope with task demands (Tao, et al., 2019). Thus, mental workload is the condition of a person experiencing high pressure mentally while performing a task by involving various cognitive aspects such as concentration, alertness, and information processing ability.

Excessive task load capacity results in mental workload that makes it difficult to process new information, which can cause the absorption of student material during the learning process to be less than optimal (Kunasegaran, et al., 2023; Aini, et al., 2023). Excessive mental workload can also result in stress, fatigue, and anxiety, which has an impact on the less-than optimal academic performance of students during the learning process (Syafira, 2024). Task load that is in line with the capacity of students is very important to avoid excessive mental workload in order to maximize the learning process.

A maximized learning process can be seen in students' academic performance. Comprehensive academic performance is not only related to academic grades, but includes the completion of academic tasks during the classroom learning process such as listening, writing, reading, and

collaboration skills (Jabir and Farooq, 2022). Optimizing academic performance will assist students in attaining their learning goals. However, in reality, students are not fully optimal in carrying out these tasks. This can be caused by factors such as lack of motivation, difficulty in understanding the material, to lack of support from the surrounding (Alani & Hawas, 2021).

Every year 5-10% of boarding students experience problems with the adjustment process of adjusting to the boarding learning system, which is different from other public schools (Bau, Kadir & Abudi, 2022). The three highest problems experienced by boarding school students are in the areas of social relationships 34.08%, personal-self 35.8% and physical-health 30.77% (Kusaini, 2021). These problems often occur in boarding schools due to of different forms of rules that are very different from those in general. The density of dormitory activities requires students to balance their time studying school materials, religious materials, and other dormitory activities.

One biology teacher revealed that the demands of biology learning tasks for boarding students are quite a lot, because of the large coverage of material and biological concepts that require in-depth analysis and understanding. The most demanding tasks are felt especially by twelfth grade. The twelfth-grade students have additional responsibilities such as tutoring, preparation for graduation exams, and college entrance exams. In addition, the different backgrounds and characteristics of students, as well as limited access to the outside environment and technology, are also one of the difficulties in delivering material for teachers during the biology learning process. At the same time, students consider biology as a subject that requires a lot of memorizing. In fact, to learn biology material, students must not only memorize, but also understand the concepts (Kurnianingsih, 2023).

Systematic studies analyzing the correlation between mental workload on boarding students' academic performance need to be conducted. Issues related to mental workload have a significant impact on academic performance. This is supported by research by Mehta (2020), showing that mental workload has a significant effect on student performance. Furthermore, research conducted by Parray & Khan (2024), shows that as the complexity of mental workload increases, individual performance will decrease. Identifying, analyzing, and understanding the underlying source of the problem will help students, teachers, and researchers as material for evaluating the teaching and learning process as well as data for future research.

The absence of efforts made by schools to analyze mental workload related to the academic performance of boarding students during biology learning especially at Islamic Boarding High School Ihsanul Fikri and the lack of research that discusses mental workload on the academic performance of boarding students encourage research with the title “Correlation Analysis of Mental Workload on Academic Performance of Boarding Students During Biology Learning at Islamic Boarding High School Ihsanul Fikri Mungkid” to analyze the correlation between mental workload on the academic performance of students in boarding schools.

Based on the background that has been presented, this study aims to analyze the correlation of mental workload on the academic performance of boarding students at Islamic Boarding High School Ihsanul Fikri Mungkid, Magelang Regency. The hypotheses are considered in the study:

H0. There is no correlation between mental workload and the academic performance of boarding students at Islamic Boarding High School Ihsanul Fikri Mungkid

H1. There is a correlation between mental workload on the academic performance of boarding students at Islamic Boarding High School Ihsanul Fikri Mungkid

Method

This study used a correlational quantitative research design. This study uses two variables, namely mental workload and academic performance. The sample used in this study was comprised of 49 boarding students who had completed at least four semesters of biology learning. The mental workload variable is measured using the Rating Scale Mental Effort (RSME), which focuses on one dimension, namely mental effort, using a single scale with reference points from 0-150 by Zijlstra et al (Zijlstra & Van Doorn, 1985), which has been adapted by Widyanti, et al (2013), with a Pearson correlation coefficients between scale scores in test & retest phase of .96. The results of the RSME scale assessment can be interpreted in the following groups: (a) Absolutely no effort (if the score is between 0-16); (b) Almost no effort (>16-35); (c) A little effort (>35-52); (d) Some effort (>52-89); (e) Considerable effort (>89-116); (f) Very great effort (>116-138); (g) Extreme effort (>138-150) (Sari, et al., 2022). Academic performance is measured using the SAPS instrument, which consists of 24 statements related to perceived academic performance during classroom learning with two main dimensions of academic performance namely individual performance and group performance (Jabir & Farooq, 2022). SAPS uses a 1 to 5 Likert scale with a coefficient of reliability value of .74.

Describing the data collected, descriptive statistical analysis is then carried out, namely the presentation of data is emphasized in the form of tables, graphs, and statistical measures, such as mean, variance, percentage, and so on (Marhawati, et al., 2022). After conducting descriptive analysis, data classification was carried out to analyze data based on respondents' answers to the questionnaire. As for the criteria used in the category of respondents' answers, to facilitate this, three categories are used, namely: High, Medium, and Low. Data categorization is carried out based on the formula in Table 1. Hypothesis testing was carried out using a correlation coefficient which aims to determine whether there is a relationship between mental workload and the academic performance of boarding students at Islamic Boarding High School Ihsanul Fikri Mungkid. The data scale in this study is ordinal data, therefore, statistical hypothesis testing uses nonparametric statistics using the Spearman rank test.

Table 1. Data Categorization Formula

No.	Formula	Category
1	$X \geq M + SD$	High
2	$M - SD \leq X < M + SD$	Medium
3	$X < M - SD$	Low

Results

Mental Workload Data

In this research, data on the mental workload of boarding students was obtained through a questionnaire. In this study, a single scale of 0-150 from RSME was used to measure the level of mental effort. The data obtained from the questionnaire was then analyzed and presented in Table 2 in the form of the number of students, highest score, lowest score, mean, median, mode and standard deviation. The frequency distribution of data from the RSME questionnaire can be seen in Figure 1.

Based on Figure 1, the largest frequency is in the category of Considerable effort made by 35.37%, while the smallest frequency is in the category of Absolutely no effort by 0.68%.

Table 2. Data Description of Mental Workload

Mental Workload Aspects	Highest Score	Lowest Score	Mean	Median	Mode	Std. Deviasi
Workload	150	30	81.63	80	60	27.48
Difficulty	130	30	81.22	80	70	25.62
Work Performance	150	50	98.16	90	90	20.48
Mental Effort	140	30	91.43	90	120	25.24
Restlessness	150	10	76.12	70	70	31.07
Fatigue	130	0	73.88	80	30	33.83
Total	710	220	502.45	500	650	123.28

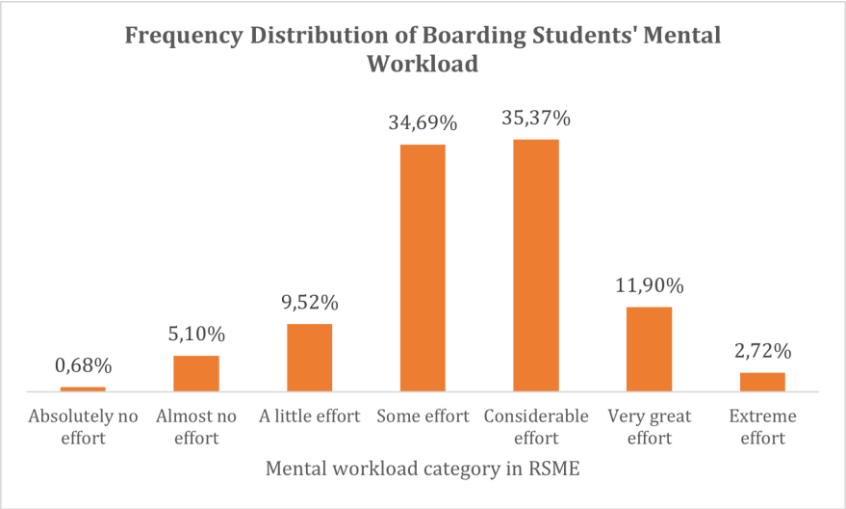

Figure 1. Frequency Distribution of Mental Workload Questionnaire Results Data

Based on the results of the questionnaire that students filled out, data classification is carried out by obtaining the mental workload of students in Table 3. Based on Table 3, the total number of boarding students analyzed at Islamic Boarding High School Ihsanul Fikri, results show that 57.1% of students have a moderate amount of mental workload. On the other hand, 20.4% experienced low mental workload, then the remaining 22.4% experienced high mental workload. The data shows that most students experience moderate mental challenges in their learning activities.

Table 3. Categorization of Mental Workload of Boarding School Students

Mental Workload Rate	Number of students	Percentage
Low	10 students	20.4%
Medium	28 students	57.1%
High	11 students	22.4%

Academic Performance Data

Data on the academic performance of boarding students was gathered through a questionnaire. The questionnaire used a Likert scale to measure the academic performance of boarding students. The results of the descriptive data analysis processing are presented in Table 4. Table 4 shows that boarding

students have a mean score of 92.63. The highest value is 108 while the lowest value is 76 with a standard deviation of 7.839.

Table 4. Data Description of Academic Performance Boarding Students

Academic Performance Aspects	Highest Score	Lowest Score	Mean	Median	Mode	Std. Deviasi
Individual Performance	73	48	60.08	60	64	6.03
Group Performance	38	28	32.55	32	30	2.76
Academic Performance	108	76	92.63	92.00	89	7.83

Hypothesis Testing

Correlations

			Mental Workload	Academic Performance
Spearman's rho	Mental Workload	Correlation Coefficient	1.000	-.647**
		Sig. (2-tailed)	.	.000
		N	49	49
	Academic Performance	Correlation Coefficient	-.647**	1.000
		Sig. (2-tailed)	.000	.
		N	49	49

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 2. Spearman's rho Test Results

Based on Spearman's Rho correlation test result, the correlation coefficient is -0.647 and the significance value is 0.000 <0.05. The interpretation of these results is that the correlation is significant, where H0 is rejected and H1 is accepted. The results of the Spearman's Rho test on mental workload and academic performance of Islamic Boarding High School Ihsanul Fikri Mungkid students can be seen in Figure 2.

Discussions

Table 2 shows that this study was conducted on 49 Islamic Boarding High School Ihsanul Fikri students with the highest average obtained for work performance mental effort which amounted of 98.16 and the lowest average obtained for work fatigue mental effort which amounted of 73.88. The highest amount of mental workload for boarding students is 150 consists of mental efforts due to workload, work performance, and work anxiety. In addition, the lowest value of mental workload of boarding students is in the indicator of job fatigue of 0. Cumulatively, the mental workload of boarding students has an average value of 502.45. The highest and lowest value are 710 and 220, respectively.

Based on Table 2 the highest indicator is found in work performance with an average value of 98.16 which is included in the “Considerable effort” category. Student performance refers to the level of achievement of students in completing academic tasks, both in the form of learning outcomes such as grades and skills acquired during the learning process (Kumar, et al., 2021). This performance reflects the most significant mental workload felt by students, which is closely related to the demand

to achieve high results or performance in maximizing their ability to complete tasks during biology learning.

Based on the interview results, students feel that they need more effort to achieve learning goals and maximum results in completing their tasks during biology learning. High task demands during biology learning can affect students' performance. High academic standards encourage academic perfectionism to try very hard for perfect results but have the potential to cause stress or even disrupt overall academic performance (Aini, et al., 2024). Boarding students need to manage their time well so that dormitory tasks and learning goals can be maximally achieved. Students with good time management and long-term.

The second highest indicator is the mental work effort of boarding students during biology learning. This indicator refers to the amount of mental or cognitive effort expended by students in receiving, processing, and understanding information during the learning process (Sari et al., 2020). Based on Table 2, boarding students at Islamic Boarding High School Ihsanul Fikri require an average mental work effort of 91.43 during biology learning which is included in the “Considerable effort” category. Based on the results of interviews, students need considerable mental effort to be able to understand biology learning material, coupled with quite dense dormitory activities. The difficulty of biology subjects, the density of dormitory and academic assignments makes students expend more cognitive effort to understand the material during the learning process (Selatang, 2019; Azizah & Alberida, 2021). High mental effort can be an indication that the learning design has not been fully effective in facilitating students' learning process, so they have to work harder to build the necessary cognitive understanding (Putri & Ferazona, 2019).

The next indicator of mental workload is workload. This indicator refers to the tasks assigned to students during biology learning. The workload of boarding students in Table 2 is included in the “Some effort” category with an average of 81.63. Based on the results of interviews, students feel that biology assignments and boarding activities are not burdensome because of the clear deadlines coupled with working on assignments in groups makes it easier for students to manage their time effectively. Academic tasks designed according to the cognitive capacity of students can reduce the workload of students (Awanis, et al., 2023). Designing academic tasks by considering the cognitive capacity of students can reduce the workload felt by boarding students during biology learning.

The next indicator, namely work difficulties, refers to the obstacles experienced by boarding students in completing the task load during biology learning. Based on Table 2, students' work difficulties have an average score of 81.22 which is included in the “Some effort” category. The small work difficulty of boarding students in learning biology shows that the task load given follows their capacity and ability and is supported by a conducive learning environment. When tasks and learning methods are adjusted to the abilities of students, learning difficulties can be minimized so that students do not feel excessive difficulties (Harita, 2024).

Furthermore, there is student anxiety which refers to how much anxiety students experience while following or completing biology learning. Based on Table 2 shows that the work anxiety experienced by boarding students during biology learning is included in the “Some effort” category

with an average value of 76.12. During biology learning, students' anxiety level is relatively low. Teachers succeeded in creating a conducive and pleasant classroom environment during the learning process. Teachers who can manage the class well, provide emotional support, and apply varied learning methods help motivate students, thereby reducing students' anxiety (Rudiansyah, et al., 2016).

The last indicator, namely, the work fatigue of boarding students refers to how much students are saturated while participating in biology learning activities at boarding schools. Based on Table 2 shows that the fatigue experienced by boarding students during biology learning is included in the "Some effort" category with an average value of 73.88. Based on the results of interviews with students, the low level of fatigue during the biology learning process is because the teacher understands the condition of the students. A humanist and flexible teaching approach can contribute to the level of student fatigue. Teacher teaching that not only focuses on the material but also builds interpersonal relationships and pays attention to the physical and psychological conditions of students can reduce the fatigue felt by students (Aminuriyah, et al., 2022).

Based on Table 3, the mental workload of students at Islamic Boarding High School Ihsanul Fikri has a diverse percentage from low (20.4%), medium (57.1%) and high (22.4%), which is the moderate category has the largest percentage. The causes of the diversity of mental workload can come from external and internal factors of students. Some of these external factors include task demands, organization at school, and the environment at school and in the dormitory. The internal factors that cause students' mental workload can come from somatic factors related to physical conditions such as gender and age, and psychological factors such as motivation, perception, beliefs, and desires of the individuals concerned (Santoso & Rijanti, 2022). Mental workload in boarding students can also occur due to differences in perception, cognitive capacity, ability to manage tasks, and learning motivation of students affecting the level of mental workload felt (Bariyah & Siahaan, 2022). Students who like biology subjects will not feel a high mental workload during biology learning in class.

Overall, the average mental workload of boarding students at Islamic Boarding High School Ihsanul Fikri Mungkid is in the "Considerable effort" category with a percentage of 35.37% which can be seen in Figure 1. This also shows that students can control academic demands so that it does not become a high mental workload. The mental workload felt by each person is different depending on how the individual assesses and interprets an event cognitively, the ability of students to control the situation conditions that cause mental workload to appear related to various academic demands at school (Chen, et al., 2016).

Mental workload is common among students. Mental workload due to cognitive load at a moderate level can produce constructive effects because it can motivate, challenge, and encourage productivity toward students' academic achievement so mental workload is also needed in learning activities (Evans, et al., 2024). The mental workload can provide encouragement for individuals trigger the emergence of creativity, and perseverance in doing tasks, and trigger individuals to make decisions in constructively.

A moderate level of mental workload if a large amount and continuously experienced by students can pose a risk of illness for students such as physical and mental fatigue, headaches, indigestion, and irritability due to an imbalance between task demands and individual capacity (Octaviaji & Hidayati, 2024). In mental workload conditions, a person tends to experience a decrease in performance in doing and completing a task (Mahawati, 2021). This affects the ability and orientation of students towards the learning activities followed by students.

Handling the mental workload of students can be done by educational institutions by increasing the motivation of students by providing full support for students, increasing a positive environmental atmosphere, and always paying attention to the learning process applied in the classroom (Puspitasari & Affandi, 2024). Supporting a responsive learning environment such as applying the Social Emotional Learning approach during biology learning can help students cultivate social and emotional skills that can reduce mental stress (Qisthi, et al., 2024). Another thing that can be done is to manage biology learning time by considering breaks and lesson schedules to prevent the accumulation of excessive mental workload.

Several other ways to reduce mental workload include dividing complex tasks into simpler sub-tasks, providing direction during learning, considering the working memory capacity of different individuals, considering the level of task complexity and avoiding sudden increases in task complexity and applying breaks or cognitive breaks during intensive learning to prevent mental fatigue (Radüntz, 2020). Meanwhile, the efforts made by biology teachers at Islamic Boarding High School Ihsanul Fikri Mungkid in dealing with excessive mental workload in students are to provide clear deadlines for each task collection so that students have time to do the task according to the time management of each student.

Followed by data on academic performance results, based on Table 4 the individual performance of boarding students during biology learning has an average value of 60.08 which is included in the moderate category. Individual performance refers to the individual characteristics of students such as processing their own emotions and behavior to achieve learning goals, intellectual openness, flexibility, adaptability, curiosity to learn, self-regulation, and metacognition of students (Jabir & Farooq, 2022). Based on the results of interviews, students feel less than optimal during biology learning because of laziness and lack of motivation. Internal and external motivation of students is very important to maximize students' activities in the biology learning process. Low motivation can hinder the biology learning process which can affect student learning outcomes (Erpiyana, et al., 2022).

Furthermore, the indicator of group performance of boarding students in Table 4 during biology learning has an average value of 32.55 which is included in the moderate category. Group performance refers to the performance of students in group learning such as expressing ideas, interpreting, responding to other people's messages, teamwork, communication, leadership roles and student empathy (Jabir & Farooq, 2022). Based on the results of interviews, students are less than optimal in group learning, because they have difficulty expressing their opinions. Lack of understanding of the material, low self-confidence and concerns about negative judgment from friends inhibit students from expressing opinions in groups (Anggraini & Nora, 2024). This hinders students' communication and collaboration in the group, thus reducing their group performance.

Based on Table 5, the overall academic performance of Islamic Boarding High School Ihsanul Fikri Mungkid students is in the moderate category with a percentage of 69.4%. This shows that during biology learning, students are not maximized in carrying out academic tasks and need to be improved. Improving students' academic performance can develop better learning habits and improve their overall learning outcomes (Harmawan & Istiyowati, 2024).

Although in general the condition of students' academic performance is in the moderate category, there are some students in the high category (16.3%) and low category (14.3%) which can be seen in Table 5. Differences in academic performance can be influenced by internal factors from learners, one of which is motivation. Intrinsic motivation plays an important role in encouraging active involvement and achievement of students (Chong & Sutawidjaya, 2022). Learning motivation can encourage students to be more disciplined and focused during biology learning.

External factors that can affect students' academic performance are teachers. One of the ways that teachers can improve academic performance is by actively involving students during learning as a mediator to increase self-efficacy or students' belief in their abilities in the academic field (Putra, et al., 2024). Biology teachers should adopt innovative teaching strategies in teaching some difficult topics, presenting difficult concepts more clearly from simple to complex (Bichi, et al., 2019).

Ways to improve students' academic performance, especially in STEM learning such as biology, can be done by schools by improving dormitory facilities and supporting the learning environment so that students can study without distractions (Gyeltshen & Rai, 2023). Teachers and stakeholders need to motivate students to develop good study habits to improve their academic performance. The combination of a conducive learning environment and effective learning strategies can improve the academic performance of boarding school students especially during biology learning (Rambe, 2023).

Based on Figure 2 found that the correlation coefficient between mental workload on the academic performance of boarding students during biology learning at Islamic Boarding High School Ihsanul Fikri Mungkid is in the “Strong relationship” category with a coefficient value of -0.647. The negative sign on the correlation coefficient indicates a negative linear relationship or an opposite relationship (Arikunto, 2016). This means that the higher the level of mental workload, the lower the academic performance of students and vice versa. Then the significance shows (Sig) 0.000 <0.05 then H0 is rejected and H1 is accepted. Based on these results, there is a “strong” negative relationship between mental workload on the academic performance of boarding students at Islamic Boarding High School Ihsanul Fikri Mungkid.

The results of these findings corroborate Mehta's (2020) findings that mental workload has a significantly negative effect on the performance of boarding students. If mental workload increases, academic performance decreases. This is also in line with research by Parray & Khan (2024) which shows that as the complexity of a person's mental workload increases, individual performance will decrease. High mental workload causes a decrease in academic performance during biology learning due to increased cognitive stress that interferes with concentration during the learning process. High mental workload has a negative impact on students' learning ability (Hidayati & Basyari, 2024).

Based on these findings, it does not mean that mental workload is the only factor that determines the high and low academic performance of boarding school students. However, there are several other factors that affect students' academic performance such as cognitive ability, self-efficacy, self-esteem, self-concept, information technology, teachers and the environment (Shi & Qu, 2022; Muharom, et al., 2024; Alani & Hawas, 2021). Students need to manage emotions to cope with academic pressure and maximize performance in completing each academic task.

Conclusion

Based on the research results, it can be concluded that there is a strong relationship between mental workload on the academic performance of boarding students during biology learning at Islamic Boarding High School Ihsanul Fikri Mungkid with a coefficient value of -0.647. This means that the higher the mental workload, the lower the academic performance and vice versa, the lower the mental workload, the higher the academic performance.

The mental workload of boarding students at Islamic Boarding High School Ihsanul Fikri Mungkid is generally in the “Considerable effort” category with indicators of work performance and mental work effort having an average of “considerable effort” (98.16 and 91.43). The academic performance was also in the moderate category (92.63). These findings highlight the importance of managing academic demands through effective learning strategies and a supportive school environment to reduce mental workload and optimize students’ academic performance, especially in boarding school.

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