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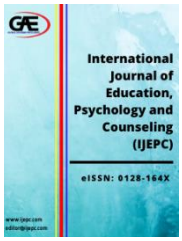

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ASSESSING ATTITUDE TOWARDS BIOLOGY AND ACHIEVEMENT IN CELL DIVISION AMONG RURAL SECONDARY SCHOOL STUDENTS

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Abstract:

Understanding cell division in Biology subject is often a challenge for students. The aim of this study was to evaluate rural secondary school students' attitudes toward biology and their achievement in cell division. A total of 249 science students from rural secondary schools participated in the study, which used the cell division test, and biology attitude questionnaire to collect data. The quantitative results showed a slight but significant relationship between students' achievement in cell division and their attitudes toward biology. The results showed a statistically significant but weak correlation between these two variables ($r = .398$, $p < .001$). The results can guide the development of pedagogical strategies that promote positive attitudes toward biology and ultimately improve student achievement in cell division in science education.

Keywords:

Attitude Towards Biology, Achievement, Cell Division

Introduction

Learning about cell division proved to be challenging for students from various countries. The cycle of compounds, the hormonal system, respiration through aerobic processes, cell and gene

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divisions and chromosomes are the five biology topics that students find most challenging to understand (Çimer, 2012). According to Güngör and Özkan (2017), research indicates that many students still find cell division to be a difficult subject, hence attempts to increase students' comprehension have not always been effective. In Fauzi and Mitalistiani (2018)'s study, it was found that Indonesian students felt the subjects of cell division, metabolism, and genetics are tough. Later Salleh *et al*. (2021) noted that difficult subjects to assess teacher and student opinions on complex biological concepts included division of cells, structure of cells and organisation, and the makeup of chemicals in the cell.

Meanwhile, Basri and Abdullah (2020) revealed that students in Sabah still have a poor and inadequate comprehension of basic genetic concepts, particularly those related to genes and chromosomes. The examination result is a clear indicator of how poorly students are understanding fundamental ideas. As a result, they are unable to comprehend the connections between these ideas and ideas like cell division and genetics. Anwar *et al.* (2019) conducted interviews with biology teachers in secondary schools in Bandung and found that pupils were still having trouble grasping the idea of cells.

Educational practice will be greatly impacted by an understanding of the relationship between student's attitude and achievement in cell division. Identifying the factors that influence student attitudes can help educators develop targeted interventions to support students in overcoming learning barriers. The findings can guide the development of pedagogical strategies that foster positive attitudes towards biology, ultimately improving student outcomes in cell division and science education overall. This study will contribute to existing knowledge on student attitudes towards biology and their impact on academic achievement in cell division.

A well-known psychological theory that describes and predicts behavior in people is known as Theory of Planned Behavior (TPB). The Theory of Planned Behavior has been extensively researched and used in many contexts, such as academic success and education. Studies have indicated that the Theory of Planned Behavior (TPB) can serve as a useful conceptual model to comprehend and forecast students' academic achievement. According to Ajzen and Madden (1986), the theory considers the possibility that an individual may feel powerless over their actions and unable to determine "how easy or difficult accomplishments or behaviors are likely to be become." According to the theory, an individual's ability to behave can be affected by a variety of internal and external elements, such as his or her knowledge and abilities, other people's cooperation, and a lack of resources.

According to the Theory of Planned Behavior, the intention to execute an act is the most essential component influencing the likelihood of taking it. Ajzen and Schmidt (2020) and La Barbera and Ajzen (2020) identify three factors that determine intention: attitude towards behavior, subjective norms, and perceived behavioral control. In the works of Hadera *et al.* (2007), figuring out the TPB can give important insight into how students' attitudes, peer pressures, and perceived abilities to manage their academic performance affect their intents and behaviors in the context of their academic achievement.

Research by Harackiewicz *et al.* (2008) and Bonsteel (2012) indicates that students who exhibit a high enthusiasm to participate in intellectual tasks are more likely to be dedicated to their studies, seek assistance when necessary, and persevere in the face of difficulties. Poor

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behavioural intentions, on the other hand, may result in lower academic achievement, disengagement, and lack of motivation (Huang, 2012).

Furthermore, DeBacker and Nelson (2000) pointed out that students who decide to pursue science courses beyond the minimum number of years in school do so because they perceive a link between science and these objectives. Students' attitudes towards studying cell division have a big impact on their intents and actions. Lee and Stankov (2018) discovered that favourable attitudes towards learning, attending courses, and participating in academic activities are frequently connected with higher academic achievement.

Another key component of the Theory of Planned Behavior is the idea of perceived behavioural control. It is defined by Jha *et al.* (2022) as an individual's sense of control and self-assurance in their capacity to carry out an action. George (2000) asserts that the most accurate indicator of attitudes towards science is self-efficacy. According to Respondek *et al.* (2017), perceived behavioural control, sometimes referred to as self-efficacy, is a student's confidence in his capacity to finish assignments, effectively manage his study time, and get beyond any obstacles he may face in his studies.

According to Harackiewicz *et al*. (2014), subjective norms connected to academic success include the impact of peers, educators, and parents on students' mindsets and actions towards their studies. Urdan and Schoenfelder (2006) found that encouragement from parents, educators' supportive attitudes, and good peer impact may assist students stay motivated and devoted to their studies.

A number of studies have found a significant relationship between participants' attitudes and success (Crede and Kuncel, 2008; Ogunyemi and Hassan, 2011; Ajayi, Kassim, Adewale and Abayomi, 2016; Sarwar, Bashir and Alam, 2017). A related study has shown that students are likely to perform better when they have positive attitudes toward science (Freedman, 1997; Oliver and Simpson, 1988; Weinburgh, 1995). According to the findings of Singh, Granville, and Dika (2002), students' attitudes toward science influenced how much time they spent on science tasks, which in turn affected their performance.

Students' perspectives regarding biology can have a big impact on their motivation, engagement, and eventually their academic achievement in the classroom. As a result, a student's mindset is very important to how successful they are in their field of study. Shah *et al. (2015*), Soomro, Qaisrani, and Uqaih (2011), Shah and Khan (2015), and other researchers have all conducted studies that highlight the impact of students' attitudes towards learning science courses on their academic achievement.

Effective educational research requires understanding the relationship between students' attitudes toward biology and their academic performance in cell division. The study aims to examine how students' attitudes and perceptions towards biology can impact their learning outcomes, particularly on topics such as cell division. Teachers can learn a lot about useful teaching techniques that will improve science teaching by looking at this context. Assessing the relationship between student attitudes and academic performance helps identify potential barriers to learning and provides insights into successful teaching practices. This knowledge can help design targeted interventions that effectively promote student learning.

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Research Question

1. What is the attitude towards biology and cell division performance among students in rural secondary schools?
2. Is there is any relationship between attitude towards biology with students' achievement in cell division among the rural secondary school students?

Methodology

Research Method

The study used a quantitative method to assess attitudes toward biology and achievement in cell division. Questionnaires or surveys are commonly used to acquire data from participants in cross-sectional studies (Schmidt and Brown, 2019). Survey research was used in this study to achieve the objectives of this research.

Participant

Based on Stockemer (2019), population refers to the entire group of subjects that researchers are interested in studying. In this study, the population consists of 675 science students from rural secondary schools in the southwest coast of Sabah. This study followed the procedures described by Hair *et al.* (2018) which recommended minimum observation-to-variable ratios, including 5:1 and ideally 15:1 or 20:1. A total of 249 students participated in this study, exceeding the minimum required sample size, corresponding to an observation-to-variable ratio of 15:1 determined based on these guidelines. Purposive and random sampling methods are combined in selecting the sample for this study. Purposive selection targets participants with specific characteristics relevant to the research topic, while random selection ensures representation from a broader population. This approach results in a diverse and comprehensive sample that includes a wide range of perspectives and experiences related to the research questions.

Instruments

In the quantitative research phase, students' attitudes toward biology are examined using the Biology Attitude Survey, which includes items on the 5-point Likert scale. Meanwhile, students' achievement in cell division is assessed through a cell division test consisting of 22 multiple-choice questions aligned with the Revised Bloom's Taxonomy and Form 4 Biology curriculum. After pilot testing and validation by experts, the Attitude across Biology Survey demonstrated high reliability with a Cronbach alpha coefficient of 0.8. The cell division test also has good reliability with a Cronbach alpha value of 0.72.

Data Analysis

The quantitative data collected through the survey will be analysed using statistical methods. Descriptive statistics are used to summarize the data collected, while inferential statistics can be used to identify relationships and associations between variables. Descriptive statistics used in this data research were mean, standard deviation, frequency, and percentage. The inferential statistic used is the Pearson product-moment correlation coefficient. The aim of all of these analyses is to provide answers to the research questions of the study.

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Result

Research Question 1: What is the attitude towards biology and cell division performance among students in rural secondary schools?

Table 1 showed a neutral attitude level in all components: Attitude toward Learning Cell Division (LC), Intention (IN), Normative Beliefs (NB), Perceived Self-efficacy (PS), and Behavioural Beliefs (BB). The research analysis suggested that students with a mean below 2.5 had a negative attitude, those with a mean of 2.5 to 3.5 were neutral, and those with a mean above 3.5 had a positive attitude. Data analysis revealed that the majority of rural science class students held a neutral attitude toward biology.

Table 1: Descriptive Statistics for Students' Attitude towards Biology

Component	N	Mean Score	SD
LC	249	2.96	.709
IN	249	3.06	.602
NB	249	2.97	.912
PS	249	3.22	.475
BB	249	3.00	.952

The students' achievement level was evaluated using descriptive analysis, including frequency and percentage, mean, and standard deviation. The average score of the Biology Test was calculated and divided into three categories to assess the rural science class students' achievements. The results for the students' achievement in cell division based on their test scores are presented in Table 2. According to Table 2, 21.7% achieved a High level, 48.5% achieved a Moderate level, and 29.8% achieved a Low level of performance in cell division. It can be concluded that the majority of rural secondary science class students attained a moderate level in cell division.

Table 2: Descriptive Statistics Result for the Level of Students' Achievement in Cell Division

Level	Frequency	Percentage %
High	54	21.7
Moderate	121	48.5
Low	74	29.8
Total	249	100

***Research Question 2*:** Is there is any relationship between attitude towards biology with students' achievement in cell division among the rural secondary school students?

Table 3 presents the results of the Pearson Product Moment Correlation Coefficient analysis examining the relationship between students' attitude towards biology and their achievement in cell division. The findings revealed a statistically significant but weak correlation between these two variables ($r = .398$, $p < 0.001$).

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Table 3: Pearson Product Moment Correlation Coefficient Analysis for the Attitude towards Biology and Achievement in Cell Division

		Achievement in Cell Division
Attitude towards Biology	r	.398**
	p-value	<.001
	N	249

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

Discussion

In this study, it was found that majority of Form Four science class students from rural secondary schools in South West Coast of Sabah had neutral attitudes toward biology. The results of this study were similar to those of VLckove *et al.* (2019), who found that Czech secondary school students have a neutral attitude towards biology. Similar results were reported for high school students by Trumper (2006) and Ekici and Hevedanli (2010), as well as for university students by Usak *et al.* (2009). Prokop, Tuncer, and Chuda (2007) found favourable attitudes regarding biology in their study of primary school students, while Babu *et al.* (2014) and Zeidan *et al.* (2015) discovered statistically better attitudes about biology among rural students - which contradicts the research findings.

Brickhouse and Potter (2001) suggest that students' scientific identity includes their beliefs about themselves, their perceived abilities, and their ambitions in the field of science. These factors influence students' effort levels, time commitments, and persistence when faced with learning challenges. Students with a neutral attitude do not take situations or events seriously and often push problems aside so others can solve them. The concept of a neutral attitude refers to a person not having a strong positive or negative attitude towards a particular issue or behaviour. For example, in biology, a person with a neutral attitude would have neither a strong interest nor a dislike for the subject. This lack of strong emotions could potentially affect academic performance in the subject. According to research by Crawley and Coe (1990), students' decisions to take more science courses are influenced by the social support of their peers. Students' self-perception as potential scientists are also enhanced when they are surrounded by classmates with similar interests (Stake and Nikens, 2005). However, lack of or lower social support contributed to neutral attitudes toward biology, suggesting that respondents were not sufficiently motivated to learn biology. When students can connect biological events to their daily experiences, it helps improve their attitude to understand the importance of biology.

Monika and Adman (2017) define self-efficacy as a person's belief in their ability to complete a task or activity. This belief influences the tasks they pursue and the goals they set for themselves. Helplessness results from feeling unqualified, whereas self-efficacy is defined as having faith in one's own skills. Every person has unique ideas about their abilities. Surveys found that students with low self-efficacy felt they had put in maximum effort but still had difficulty in understanding the concepts of cell division. Conversely, a student with high self-efficacy expressed his determination to excel in examinations due to his dedicated study efforts. Pratiwi *et al.* (2021) discovered that students who have high levels of self-efficacy are eager to tackle demanding assignments, whereas those who have low levels of self-efficacy might shy

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away from demanding study assignments. They also try harder to complete learning tasks than lower-achieving students (Santrock, 2013).

At the same time, this study also found that the majority of Form Four science class students from rural secondary schools in South West Coast of Sabah achieved moderate success in their cell division test. According to Prihastuti *et. al*. (2020) and Atan (2020), achieving a moderate score on the biology test means more than just a basic understanding of the subject; It can also indicate a deeper understanding and application of concepts. Furthermore, moderate performance in the biology test implies that students are able to assess the validity and reliability of scientific information, evaluate experimental design and methodology, and draw evidence-based conclusions (Ramlawati *et. al*., 2020; Mukti *et.al*., 2021; Wulandari *et.al.*, 2020).

In addition, the study examined the relationship between students' attitudes towards biology and their achievement in cell division. Attitude was assessed using the Biology Attitude Study, while performance was measured using the Cell Division Test. The analysis revealed a significant but weak positive correlation between students' attitudes toward biology and their performance in cell division among rural secondary school students. This finding is consistent with previous studies by Obsorne *et al.* (2003), who also found limited evidence of a relationship between attitude and performance. Despite some significant correlations, they were all relatively weak. Overall, the results suggest that there is a meaningful relationship between attitude and academic performance, suggesting that students with positive attitudes toward biology tend to perform better academically in the subject.

Neutral attitudes toward biology can have a significant impact on academic performance (Harackiewicz *et. al.*, 2008). Lack of enthusiasm for the subject can make it difficult for some people to stay motivated and committed to their studies, leading to poorer performance and less effort in understanding biological concepts. Additionally, a neutral attitude may lead to lower engagement and participation in classroom activities, potentially resulting in lower achievement levels compared to students with a positive attitude toward the topic. Conversely, people with a positive attitude towards biology often show more interest and passion for the field. For example, a student is more likely to have a strong intention to learn and exhibit appropriate behaviours if he has a positive attitude toward learning, believes his family and peers have high expectations of him in terms of academic achievement, and feels confident in their ability to perform well academically. Parents act as role models for children and motivate them to excel in school. When parents support their studies, students are more likely to be academically motivated. Offering a reward after receiving test results is one way for parents to motivate their children. Some students enrol in courses based solely on the influence of their peers, without considering whether they have the necessary skills and interest. The results of this study showed that students' attitudes toward biology were neutral. Therefore, their performance in the cell division test is average.

From this study, we can conclude that both peer and family support are very important in influencing or motivating students to excel in their studies. In the words of Ficano (2012), peer pressure is a major influencing factor within informal groups such as peer groups. In the educational context, it affects students' academic performance from secondary to tertiary levels and remains a social factor throughout higher education. Positive peer pressure can motivate students to stay in tune with their class group, promoting overall progress and ensuring the

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achievement of common goals. However, negative effects of peer pressure in the classroom can impact students' overall performance as well as their motivational beliefs, attitudes toward learning, and their expectations of success. When what students learn has meaning in their lives, they are more likely to be driven to learn.

It is also noted that the role of teachers in inspiring children was crucial. According to Singh and Singh (2021), teachers can encourage their students to learn by giving them helpful feedback to help them become proficient. Providing thoughtful and constructive feedback not only facilitates learning, but also empowers students to take charge of their own educational journey and develop confidence in their abilities. Furthermore, receiving such feedback from teachers about their efforts leads students to cultivate the belief that they can achieve success through hard work and dedication. A clear overview of students' attitudes toward learning biology can alert teachers to whether they need to contribute to a positive attitude in the teaching and learning process. Teachers can integrate the Theory of Planned Behavior into classroom activities by promoting a growth mindset and creating a supportive learning environment where effort and resilience are valued. Encouraging students to set academic goals, providing them with constructive feedback, and acknowledging their progress can improve their attitudes toward learning and increase their perceived control over academic tasks. Additionally, creating opportunities for peer collaboration and promoting positive social norms may influence students' behavioural intentions toward academic tasks.

Limitation

Generalizations to biology were not possible because the study only examined one of the biology topics. This test is designed around the topic of cell division. Therefore, the results of this study cannot be applied to all biological topics. It can only be generalized in the same topic.

Future Research

This study highlights the importance of fostering a positive attitude toward biology to improve student performance in certain topics such as cell division. Further research could examine interventions aimed at improving students' attitudes toward biology and potentially leading to improvements in academic performance in related subjects. It is suggested that the population and sample of the study come from both rural and urban school districts. In addition, future studies can be conducted on different groups of research topics, for example by including a sample from the arts field. A larger sample will be useful to determine the differences between urban and rural students in their attitudes toward biology and academic performance.

Conclusion

In summary, the study showed a relationship between students' attitudes towards biology and their performance in the subject of cell division. The results suggest that a neutral attitude toward biology is associated with moderate success in cell division, while a positive attitude leads to higher performance. The findings can guide the development of pedagogical strategies that promote positive attitudes toward biology and ultimately improve student performance in cell division and overall science education. This study will contribute to our existing knowledge about students' attitudes toward biology and their influence on academic performance in cell division.

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