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The Relationship Between Students' Learning Motivation and Academic Performance in A-Level Biology

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Abstract: There are multiple factors that influence academic performance. This study examines the relationship between learning motivation and academic performance in A-Level Biology students. A-Level Biology is part of the General Certificate of Education Advanced Level (A-Level) curriculum. A quantitative approach was adopted, with data being collected from 21 students via an online questionnaire. A quantitative approach was used, collecting data from 21 students through an online questionnaire. In this study, learning motivation comprises three dimensions, namely cognitive motivation, extrinsic motivation, and the need for achievement. At a macro level, there is a significant correlation between learning motivation and academic performance. At a micro level, correlation analysis revealed that cognitive motivation had the strongest positive impact on academic performance, while need for achievement showed a moderate correlation. Extrinsic motivation had no significant effect. The research not only reveals a correlation between learning motivation and academic performance but also suggests that fostering intrinsic motivation may be more effective in enhancing academic outcomes in A - Level Biology.

Keywords: Learning Motivation, Academic Performance, A-Level Biology

1. Introduction

A-Level Biology is designed for high school students aged 16 to 18. It aims to provide an in-depth understanding of biological concepts, preparing students for further studies in related fields at the university level [1]. Consequently, the learning process in A-Level Biology is influenced by multiple factors that affect academic performance, among which learning motivation, as a crucial driving force behind learning behavior, warrants in-depth exploration. Learning motivation refers to the psychological process that drives students to engage in learning activities, sustain their interest in learning, and achieve academic goals [2]. This study categorizes learning motivation into Cognitive Motivation, Extrinsic Motivation, and Need for Achievement. Cognitive motivation refers to the learning drive that arises from students' interest in the subject matter, curiosity, or intrinsic pursuit of knowledge [2]. Extrinsic motivation originates from external factors such as exam performance, parental expectations, university admission requirements, and social recognition. This type of motivation is typically short-term and relies primarily on external rewards or punishment mechanisms [3]. Need for achievement refers to the learning drive that motivates students to achieve personal goals, obtain outstanding academic results, or reach a certain level of academic accomplishment [4]. Academic performance serves as a key indicator of students' learning ability, reflecting not only their mastery of knowledge but also their cognitive abilities, learning strategies, and self-regulation skills

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[5]. Research suggests that high-achieving students typically exhibit strong academic self-efficacy, allowing them to manage their learning processes more effectively and demonstrate higher levels of academic resilience when facing challenges [4]. Moreover, Lalot and Houston highlighted the role of social comparison in academic achievement [6]. In recent years, research on the multidimensional factors influencing academic performance has increased, mainly focusing on the exploration of cognitive abilities, academic self-efficacy, learning strategies, and emotional regulation, as well as examining how different types of motivation impact students' learning outcomes [3-7]. Additionally, studies have analyzed the influence of psychological factors such as academic confidence, resilience, and social comparison on academic success [8]. Although these studies have made significant progress in identifying the determinants of academic achievement, research specifically targeting A-Level Biology remains limited. By exploring this relationship, the study seeks to help students make informed decisions when selecting A-Level subjects and improving their academic planning, while simultaneously providing guidance to teachers and parents regarding how to support and boost students' learning motivation so as to optimize teaching strategies.

2. Methods

This study employs a quantitative research approach, gathering data via a questionnaire survey, with the aim of exploring the relationship between learning motivation and academic performance in A - Level Biology. To ensure the reliability and validity of the questionnaire, this study refers to the Mathematics Learning Non-Intellectual Factors Questionnaire developed by Wang and Li and makes appropriate modifications based on the characteristics of A-Level Biology to align with the research objectives [9]. The questionnaire has undergone Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) and has demonstrated high internal consistency reliability (Cronbach's α coefficient), ensuring the reliability of the measurement tool. The study participants consist of students currently enrolled in A - Level Biology courses. The questionnaire was distributed both online, with 24 questionnaires distributed, 24 questionnaires collected, and 21 valid responses, accounting for 87.5% of the total. All data collection was conducted anonymously to protect participants' personal information. Data analysis was performed using SPSS statistical software.

The questionnaire adopts a five-point Likert scale, where participants choose the option that best matches their situation [10]. The response options for each item are "Strongly Agree (5 points)", "Agree (4 points)", "Neutral (3 points)", "Disagree (2 points)", and "Strongly Disagree (1 point)". The questionnaire consists of four sections: the first section (items 1-4) collects basic information such as gender, age, and duration of A-Level Biology study; the second section (items 5-16) measures learning motivation, where items 5-9 assess cognitive motivation, items 10-13 assess extrinsic motivation, and items 14-16 assess need for achievement; the third section (items 17-19) collects academic performance information, including the most recent A-Level Biology exam scores. Subsequently, descriptive statistical analysis was performed to calculate the mean and standard deviation for each dimension of learning motivation, providing an overview of the overall level of learning motivation. Finally, correlation analysis was conducted to explore the relationship between learning motivation and academic performance.

3. Results

3.1. Descriptive Analysis of Students' A-level Biology Learning Motivation

3.1.1. Overall Analysis of A-level Biology Learning Motivation

The results showed that the total learning motivation scores ranged from 33 to 49, with a median of 42, a mean of 41.52, and a standard deviation of 4.47.

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Table 1: Descriptive Analysis of Learning Motivation

	N	Minimum	Maximum	Mean	Std. Deviation
Motivation	21	33	49	41.5238	4.46787

Since learning motivation was measured using 12 items, each scored on a 1-5 Likert scale, the theoretical score range should be 12 to 60. In this study, students' actual scores ranged from 33 to 49, indicating that their learning motivation was at a moderately high level, with no cases of extremely low scores.

From the mean value, 41.52 points suggest that the average score per item was approximately 3.46 (41.52 ÷ 12), which is close to the "Agree" response on the Likert scale. This suggests that students generally acknowledge their own learning motivation in A-Level biology, meaning they are willing to invest in learning and demonstrate a certain level of interest and drive for the subject.

Regarding the score distribution, the median of 42 indicates that half of the students scored above this value and half below, showing a relatively balanced distribution. Additionally, the standard deviation of 4.47 suggests some individual differences in learning motivation.

Overall, these findings suggest that A-Level biology students in this study generally have a high level of learning motivation, although individual differences still exist.

3.1.2. Analysis of Different Dimensions of A-level Biology Learning Motivation

In terms of cognitive motivation, students' scores ranged from 10 to 24, with a median of 20, a mean of 18.33, and a standard deviation of 4.05. These results indicate that students generally exhibit a strong cognitive motivation in their A-Level biology learning, meaning they are largely driven by interest in the subject itself, curiosity, or the appeal of challenging content. However, the relatively high standard deviation suggests individual differences, where some students show high cognitive motivation while others exhibit lower interest in biological studies.

Table 2: Descriptive Analysis of Cognitive Motivation

	N	Minimum	Maximum	Mean	Std. Deviation
Cognitive Motivation	21	10	24	18.3333	4.05380

With respect to extrinsic motivation, the scores of students spanned from 8 to 16, presenting a median of 13, a mean of 12.52, and a standard deviation of 2.77. Compared to cognitive motivation, the distribution of extrinsic motivation scores is more concentrated. The mean score of extrinsic motivation is slightly lower than that of cognitive motivation, suggesting that A-Level biology students are primarily driven by intrinsic interest and exploration rather than external pressure.

Table 3: Descriptive Analysis of Extrinsic Motivation

	N	Minimum	Maximum	Mean	Std. Deviation
Extrinsic Motivation	21	8	16	12.5238	2.76801

Regarding need for achievement, students' scores ranged from 8 to 13, with a median of 11, a mean of 10.67, and a standard deviation of 1.28. The relatively small standard deviation indicates that students have similar levels of achievement motivation in A-Level biology learning. Compared to cognitive and extrinsic motivation, the mean score for need for achievement is the lowest, implying that although some students may have a strong desire for academic success or competitive achievement, overall, students' drive for high performance in A-Level biology is relatively moderate.

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In summary, cognitive motivation had the highest mean score, indicating that most students are primarily driven by their interest in A-Level biology itself, while extrinsic motivation and need for achievement were relatively lower. These findings suggest that fostering students' intrinsic learning interest and academic exploration may be more effective in enhancing learning motivation than relying solely on external rewards or achievement-oriented incentives.

Table 4: Descriptive Analysis of Need for Achievement

	N	Minimum	Maximum	Mean	Std. Deviation
Need for Achievement	21	8	13	10.6667	1.27802

3.2. Correlation Analysis of A-Level Biology Students' Learning Motivation and Academic Performance

3.2.1. Overall Analysis of A-level Biology Learning Motivation

The correlation analysis indicates a significant positive relationship between learning motivation and academic performance ($r = 0.791$, $p=0.000<0.01$), suggesting that higher learning motivation is associated with better academic outcomes. Additionally, the impact of learning motivation can be observed in the selection of learning strategies. Highly motivated students tend to adopt deep learning strategies, such as critical thinking, information integration, and independent exploration, rather than relying on rote memorization or surface learning. The results of this study further reinforce the importance of learning motivation as a key predictor of academic success.

Table 5: Correlations of learning motivation and academic

		Learning Motivation	Academic Performance
Learning Motivation	Pearson Correlation	1	.791**
	Sig. (2-tailed)		.000
	N	21	21
Academic Performance	Pearson Correlation	.791**	1
	Sig. (2-tailed)	.000	
	N	21	21
**. Correlation is significant at the 0.01 level (2-tailed).			

3.2.2. Analysis of Different Dimensions of A-level Biology Learning Motivation

In addition to learning motivation, this study also examines the relationships between cognitive motivation, extrinsic motivation, and achievement with academic performance. The findings reveal a strong positive correlation between cognitive motivation and academic performance ($r = 0.773$, $p=0.000<0.01$), indicating that students with a higher interest in cognitive exploration and knowledge comprehension tend to achieve better academic results. This is consistent with prior research suggesting that cognitively motivated students are more inclined to engage in deeper thinking, analysis, and knowledge synthesis, all of which are associated with higher academic performance [11].

Table 6: Correlations of cognitive motivation and academic performance

		Cognitive Motivation	Academic Performance
Cognitive Motivation	Pearson Correlation	1	.773**
	Sig. (2-tailed)		.000

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Table 6: (continued).

	N	21	21
Academic Performance	Pearson Correlation	.773**	1
	Sig. (2-tailed)	.000	
	N	21	21

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

In contrast, extrinsic motivation demonstrates a negative correlation with academic performance ($r = -0.393$), though it does not reach statistical significance ($p = 0.078$). This suggests that relying on external incentives, such as grades, scholarships, or social recognition, may not be the most effective way to enhance academic performance and, in some cases, might even undermine students' intrinsic interest in learning. However, as the correlation is not statistically significant, the effect of extrinsic motivation may vary depending on individual differences or contextual factors.

Table 7: Correlations of extrinsic motivation and academic performance

		Extrinsic Motivation	Academic Performance
Extrinsic Motivation	Pearson Correlation	1	-.393
	Sig. (2-tailed)		.078
	N	21	21
Academic Performance	Pearson Correlation	-.393	1
	Sig. (2-tailed)	.078	
	N	21	21

Finally, need for achievement exhibits a moderate positive correlation with academic performance ($r = 0.496$, $p < 0.05$), suggesting that students who experience a sense of achievement in their academic journey tend to perform better. A sense of achievement can enhance learners' self-efficacy, thereby fostering motivation and encouraging sustained effort in their studies. However, compared to learning motivation and cognitive motivation, the impact of achievement on academic performance is relatively weaker, indicating that while it serves as a contributing factor, it is not a decisive one.

Table 8: Correlations of need for achievement and academic performance

		Achievement	Academic Performance
Need for Achievement	Pearson Correlation	1	.496*
	Sig. (2-tailed)		.022
	N	21	21
Academic Performance	Pearson Correlation	.496*	1
	Sig. (2-tailed)	.022	
	N	21	21

*. Correlation is significant at the 0.05 level (2-tailed).

4. Conclusion

This study delved into the relationship between learning motivation and academic performance among A - Level Biology students. Employing a quantitative research approach, data were collected via an online questionnaire survey. The participants consist of students currently enrolled in A-Level Biology courses. The questionnaire, adapted from the Mathematics Learning Non-Intellectual Factors Questionnaire [9], assesses students' learning motivation and academic performance. The collected

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data were analyzed using descriptive statistics and correlation analysis via SPSS software. The findings indicate that learning motivation is a significant predictor of academic performance, with cognitive motivation showing the strongest positive correlation. Students who demonstrate higher cognitive motivation—characterized by intrinsic interest and curiosity—tend to achieve better academic results. Additionally, achievement motivation also exhibits a moderate positive correlation with performance, suggesting that the sense of accomplishment contributes to students' academic success. In contrast, extrinsic motivation does not show a significant relationship with academic performance, implying that external incentives such as grades and social expectations may not be the most effective drivers of student achievement.

Despite these valuable insights, this study has certain limitations. Firstly, due to time constraints, the research scope was limited, with a relatively small sample size. A larger and more diverse group of participants could provide a more comprehensive understanding of the relationship between learning motivation and academic performance. Secondly, the study adopted a purely quantitative research method using a questionnaire survey. Although this approach facilitated statistical analysis of learning motivation and academic performance, it failed to capture students' subjective experiences, attitudes, and underlying motivations. A mixed-methods approach incorporating qualitative interviews or focus groups could provide richer insights into students' thought processes and learning behaviors. Moreover, the study concentrated solely on A - Level Biology students, thereby restricting the generalizability of the findings to other subjects. Furthermore, future study could consider generate longitudinal studies which could provide deeper insights into how learning motivation evolves over time and how it impacts long-term academic performance.

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