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The Influence of Achievement Motivation and Adversity Intelligence on Students' Cognitive Learning Outcomes in Biology

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ABSTRACT

The national decline in Biology learning outcomes highlights the need to explore students' internal factors. This study aims to determine the influence of achievement motivation and adversity intelligence on the cognitive Biology learning outcomes of Grade XI students in public senior high schools in Makassar City. This research used a quantitative approach with an ex post facto design and correlational method. A total of 297 students were selected using cluster random sampling from four representative schools. Instruments included questionnaires on achievement motivation and adversity intelligence, as well as a cognitive biology test. Descriptive analysis showed that 35.3% of students had a moderate level of adversity intelligence (mean = 72.82), and 36.4% had a moderate level of achievement motivation (mean = 82.87). Cognitive learning outcomes were also mostly in the moderate category with an average score of 80.19. Inferential analysis indicated that achievement motivation ($r = 0.433$, $p < 0.05$) and adversity intelligence ($r = 0.416$, $p < 0.05$) had a positive and significant effect on learning outcomes. Simultaneously, both variables contributed 25.9% to cognitive learning outcomes. These findings underscore the importance of strengthening internal psychological aspects to support students' academic success in Biology.

INTRODUCTION

Education plays an important role in shaping the intellectual and moral structure of a nation in accordance with the goals of Indonesia's national development as stated in the Preamble to the 1945 Constitution: "to educate the life of the nation" and aligned with international goals in achieving one of the sustainable development goals (SDGs 2030). The function and purpose of national education can be achieved through 21st-century skills. Currently, changes occur rapidly in line with evolving challenges. The 21st-century skills (6Cs) consist of critical thinking, collban, bocaboration, communication, creativity, culture, and connectivity (Srirahmawati, Deviana, & Wardani, 2023).

These skills are essential for success in education, so students are expected to master them to ensure smooth learning processes and achieve strong academic outcomes. Pedagogical studies encompass the appropriate methods, techniques, approaches, and strategies for educating students and are crucial in efforts to improve the quality of education as outlined in the Merdeka Curriculum.. Biology, as a foundational science, plays a strategic role in improving human life and is used in various fields such as medicine, spatial planning, conservation, and restoration-supporting life at its peak. Macro-level data from national exams in Biology from the 2014 to 2019 academic years show a continual decline. This raises concerns about the future of the nation's younger generation, especially their resilience and independence in studying biology-related sciences, such as vaccine development, efforts to reduce national carbon emissions by 2030, protection of the Coral Triangle, sustainable natural resource management, and other national obligations governed by global macroeconomic rules placed upon Indonesia.

Mapping the key components of learning objectives can begin by categorizing factors into domains. The most fundamental aspect of learning is students' basic abilities as the foundation for understanding higher-level material, followed by achievement motivation as a drive for learning, and adversity intelligence as an individual's capacity to overcome learning challenges.Education has a vital role in shaping students into excellent national assets and in improving human resources. Through education, students gain knowledge and become more qualified. Therefore, education is considered a very important aspect of human life. People are expected to continually improve the quality of human resources and education in line with the times. This process involves not only expanding knowledge but also developing the skills and attitudes needed to apply that knowledge in daily life (Safitri et al., 2022).

This concept was well elaborated by Bandura in his development of reciprocal determinism, where behavior, cognition, and environment influence each other. Bandura emphasized that learning does not occur in isolation or under one-dimensional influences, whether internal or external, but through an interactive process where individuals are not only influenced by their environment but also have the capacity to influence it through their actions and behavior (Bandura, in Alam, 2022). In educational psychology, achievement motivation is an important internal element that can influence the learning process. Motivation drives students to strive for success and excellence in academic endeavors (Maslow in Adha et all,d, 2022). It is a key psychological factor that affects the amount of effort students voluntarily exert in learning (Vu et al., 2022). Students with high achievement motivation tend to set challenging goals, persevere through difficulties, and ultimately achieve higher academic outcomes. On the other hand, lack of motivation may lead to disengagement and poor performance. In addition, there is a concept of resilience that internally acts as a "remedy" to stress that may hinder students, especially in learning. The concept of adversity intelligence refers to students' ability to overcome and deal with challenges and setbacks during the learning process (Noltemeyer & Bush, 2013).

Learning outcomes play an essential role in Biology education, as they reflect students' progress in understanding Biology concepts. Biology learning involves both declarative knowledge (concepts, facts, principles, laws) and procedural knowledge (Azzahra, Arsih, & Alberida, 2023). Effective Biology instruction offers meaningful learning experiences to help students understand their environment. Therefore, students are expected to actively engage in learning rather than just listen and memorize the material delivered by teachers.

The dynamic environment of senior high schools, with demands such as rising education standards and changing industry benchmarks, often presents challenges that can hinder academic progress. High adversity intelligence enables students to remain resilient, adapt to change, and continue striving to achieve their academic goals despite difficulties (Boyce et al., 2021). Examining the two aforementioned factors is crucial in mapping psychosocial interactions in Biology learning at the senior high school level. This study focuses on exploring the influence of achievement motivation and adversity intelligence on students' cognitive learning outcomes in Biology among 11th-grade students at public senior high schools in Makassar City. The research also aims to examine educational strategies and interventions designed to improve students' academic outcomes in Biology.

MATERIALS AND METHODS

1. Time and Place of Research

This research was conducted at several public senior high schools in Makassar City during the even semester of the 2024/2025 academic year, specifically in January–February 2025. The details of the research locations are as follows SMAN 1 Makassar, SMAN 4 Makassar, SMAN 10 Makassar, and SMAN 14 Makassar.

2. **Types of research**

The type of research **is** multiple correlational, as the study aimed to examine the relationship and influence of two independent variables simultaneously on one dependent variable. Data analysis techniques included both simple and multiple linear regression analyses to determine the individual and combined effects of achievement motivation and adversity intelligence on learning

outcomes. The findings are expected to provide a deeper understanding of the internal psychological factors that contribute to students' academic success, particularly in the context of Biology education

3. **Research Methods**

This study employed a quantitative research approach with an ex post facto design and a multiple correlational method. The quantitative approach was chosen because the research aimed to measure and analyze the relationship between variables using numerical data, which were then processed statistically. Quantitative research allows the researcher to obtain objective and measurable insights into the extent to which the independent variables achievement motivation and adversity intelligence influence the dependent variable, namely students' cognitive learning outcomes in Biology**.**

The ex post facto design was used because the variables under investigation already existed naturally within the students and were not manipulated or treated by the researcher. In other words, the researcher did not conduct an experiment or apply direct intervention but merely observed and analyzed the relationships among the variables based on existing data.

4. Population and Sample

The population in this study includes all 11th-grade students at public senior high schools in Makassar City for the 2024/2025 academic year. The sample was selected from this population using cluster random sampling. This technique is used when the research subjects cover a large area such as a city or regency. The schools were selected based on the regional divisions of Makassar City. The population of 23 schools was divided into four clusters North, South, West, and East-taking into account the different characteristics of the students in each area.

The sample size from each school was determined using the Slovin formula with a 5% margin of error and a 95% confidence level (Sujarweni, 2021).

$$n = N / (1 + Ne^2)$$

Where:

n = sample size
N = population size
e = error tolerance (5%)

To determine the sample size from each school, proportional random sampling was used:

$$n_i = (N_i / N) \times n$$

Where:

n_i = sample size from school I
N_i = population of school i
N = total population
n = total sample

5. Research Procedure

This research began with an observation phase to gather initial information from several public senior high schools in Makassar city. The research procedure consisted of three key stages: preparation, implementation, and completion.

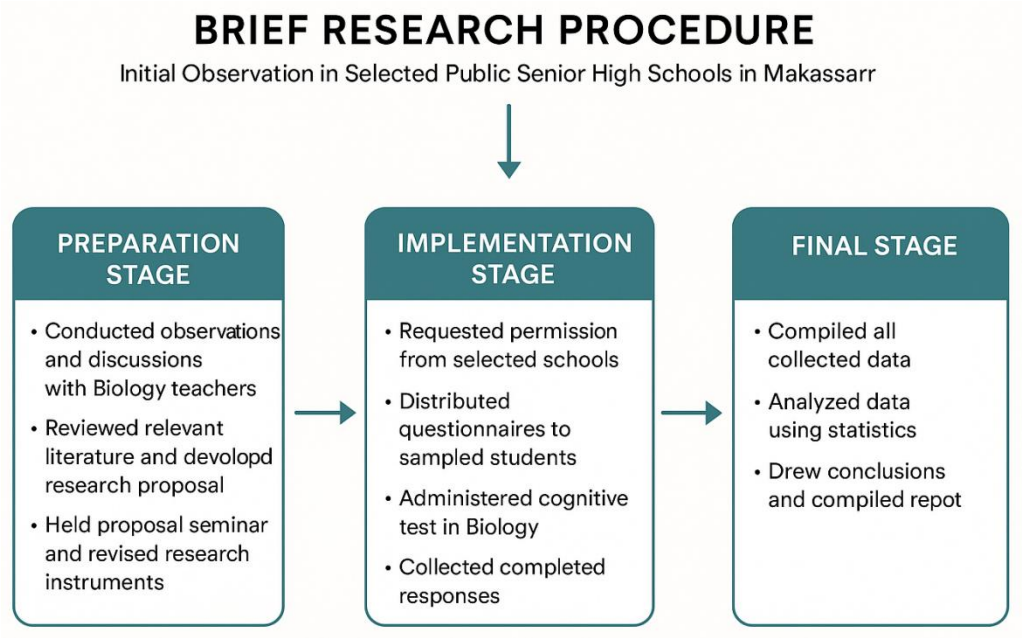

Figure 1. The research procedure consisted of three key stages

6. Data Collection

Data were collected using two techniques: questionnaires and tests. The questionnaire used was a closed-type questionnaire with a Likert scale, where responses were predefined and consisted of four options: strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD), with both favorable and unfavorable statements. This was used to collect data on students' adversity intelligence and achievement motivation. The test was used to collect data on cognitive learning outcomes in Biology, using multiple-choice questions.

7. Data Analysis

The collected data from questionnaires and tests were processed using SPSS version 24 for Windows, employing both descriptive and inferential statistical analysis. Descriptive statistics included measures such as maximum and minimum values, mean, mode, median, and standard deviation. Inferential analysis included by assumption tests (normality, homogeneity, and multicollinearity) and hypothesis tests (simple and multiple regression analysis).

RESULTS AND DISCUSSION

The descriptive statistical analysis describes each research variable, namely adversity intelligence (X_1) and achievement motivation (X_2), in relation to the cognitive biology learning outcomes (Y) of 11th-grade students at public senior high schools in Makassar City, with a total sample of 297 students. Data were collected through 30 questionnaire items and a 30-item learning outcome test. The descriptive analysis table of the research variables is presented in table 1 below:

Table 1. Descriptive Analysis of Research Variables

Variable	Mean	Max	Min	Median	Mode	Std. Dev
Adversity Intelligence	72.82	94	47	73	73	7.768
Achievement Motivation	82.87	98	63	83	88	7.736
Learning Outcomes	82.71	93	63	83	83	5.185

Based on the results of descriptive statistical analysis, it is known that the Adversity Intelligence of students has an average value of 72.82, with a maximum value of 94 and a minimum of 47. The median and mode values for this variable are the same, which is 73, indicating that most students have a relatively balanced level of adversity intelligence. The standard deviation of 7.768 indicates moderate variation in this data. Furthermore, the Achievement Motivation variable shows

an average value of 82.87, with the highest value of 98 and the lowest of 63. The median value is 83, while the mode is 88, indicating a tendency for values that are higher than the median. The standard deviation of 7.736 shows fairly consistent variation among students.

Meanwhile, the Learning Outcome variable shows an average value of 82.71, with a maximum value of 93 and a minimum of 63. The median and mode values are both at 83, which indicates a symmetrical data distribution. The standard deviation of this variable is 5.185, smaller than the other two variables, indicating that the learning outcomes of participants tend to be more homogeneous. In general, these data indicate that students have relatively high and consistent levels of achievement motivation and learning outcomes, as well as moderately varying levels of adversity intelligence.

Adversity Intelligence Description

According to Stoltz (in Alam, 2022), Adversity Quotient (AQ) is the ability of an individual to face, endure, and overcome difficulties. Individuals with a high AQ are less likely to give up, are more resilient to pressure, recover quickly from failure, and see challenges as learning opportunities. In a learning context, students with a high AQ can better manage academic stress, respond proactively to learning challenges, and have high intrinsic motivation.

Table 2. Distribution of Adversity Intelligence Scores students

Scor Interval	Category	Frequency	Percentage (%)
≥ 90	Very High	37	12.5
85-89	High	65	22.0
80-84	Moderate	135	45.5
75-79	Low	40	13.5
≤ 74	Very Low	19	6.5
TOTAL		297	100

Source of Data: Results of analysis using SPSS version 24.0 for Windows.

The table shows that most students fall into the moderate category, with 105 students (35.3%). Table 1 indicates the average AQ score is 72.82, which is also in the moderate range. This suggests that students have a reasonable ability to handle academic and non-academic challenges-an important asset for long-term learning success.

These findings are consistent with previous research Rahmawati (2019) found that students with good AQ tend to be persistent in solving difficult tasks.

Descriptive of Student Achievement Motivation

Achievement motivation is the internal drive that pushes individuals to reach certain academic standards. According to McClelland's theory individuals with high achievement motivation tend to set challenging goals and work hard to achieve them. This positively influences learning outcomes, as motivated students are more active, disciplined, and persistent.

Table 3. Distribution of Achievement Motivation Scores of students

Scor Interval	Category	Frequency	Percentage (%)
≥ 94	Very High	20	6.7
87-93	High	85	28.6
79-86	Moderate	116	39.1
71-78	Low	52	17.5
≤ 70	Very Low	24	8.1
TOTAL		297	100

The table shows that achievement motivation also falls into the moderate category, with 116 students (39.1%). This indicates that most 11th-grade students in Makassar's public high schools are internally prepared to pursue academic success and personal development.

Highly motivated individuals tend to work independently, quickly, and enjoy competition. This aligns with Abdullah and Qomariah's (2017) study, which found that highly motivated junior high students performed better academically.

Cognitive Learning Outcomes in Biology

According to Sudjana (2013), learning outcomes reflect students' abilities after educational experiences, encompassing cognitive (knowledge), affective (attitude), and psychomotor (skills) domains. While often measured by cognitive scores, true learning outcomes should reflect all three domains.

Table 4. Distribution of Biology Cognitive Learning Outcome Scores of Students.

Interval Nilai	Kategori	Frekuensi	Persentase (%)
≥ 90	Sangat Tinggi	37	12.5
85-89	Tinggi	65	22.0
80-84	Sedang	135	45.5
75-79	Rendah	40	13.5
≤ 74	Sangat Rendah	19	6.5
TOTAL		297	100

The table show the average score is 82.71, which falls into the "moderate" category. A total of 135 students (45.5%) fall into this category. This indicates that most students have a sufficient level of mastery of Biology material. Although better than the low category, improvement is still needed-especially for mastering complex material.

Sukmantara and Rizal Mubarak (in Alam, 2022) noted that learning outcomes not only reflect cognitive achievement, but also behavior, diligence, and attitude, thus offering a more holistic view.

Normality Test

The normality test aims to determine whether the residual values are normally distributed. A good correlation model will yield normally distributed residuals. According to the Kolmogorov-Smirnov test, if the significance value is > 0.05, the data is considered normally distributed.

Table 5. Normality Test Results

Kologrov Smirnov	N	Sig. (2-tailed)	Keterangan
Unstandardized Residual	297	0,137	Normally distributed

Based on Table 3, the Sig. value is 0.137 > 0.05, indicating that the data from adversity intelligence and achievement motivation variables related to student learning outcomes are normally distributed. The Kolmogorov-Smirnov test is useful for determining whether the data deviates from a normal distribution. If the p-value is more than 0.05, the distribution is considered normal (Mishra, et al, 2019).

Homogeneity Test

The homogeneity test checks whether two variables originate from groups with the same variance (homogeneous). The decision criterion is p-value > 0.05.

Table 6. Homogeneity Test Results

Variable	Levene Statistic	Df1	Df2	Sig.	Conclusion
Adversity Intelligence	0.02	1	296	0.961	Homogeneous
Achievement Motivation	0.349	1	296	0.555	Homogeneous
Learning Outcomes	0.038	1	296	0.845	Homogeneous

All variables show p > 0.05, indicating that the data comes from groups with equal variance **(**homogeneous**)**. Levene's test is used to assess the equality of variances for a variable calculated for two or more groups. If the significance value (p-value) is greater than 0.05, it suggests that the variances are equal (homogeneity of variance assumption is met (Field, 2013, p. 163).

Multicollinearity Test

This test examines whether there is a strong correlation among the independent variables. The model is considered free from multicollinearity if tolerance > 0.100 and VIF < 10.00.

Table 7. Multicollinearity Test Results

Variable	Tolerance	VIF	Conclusion
Adversity Intelligence	0.708	1.412	No multicollinearity
Achievement Motivation	0.708	1.412	No multicollinearity

All values meet the criteria, indicating no multicollinearity between the independent variables. Multicollinearity is a potential concern when tolerance values are below 0.10 or VIF values exceed 10. Values within the acceptable range suggest the absence of multicollinearity problems (Hair et al., 2019, p. 134).

Hypothesis Test 1

Effect of Adversity Intelligence on Cognitive Biology Learning Outcomes

The influence of adversity intelligence on students' Biology cognitive learning outcomes is significant with a p-value of 0.000 < 0.05. Coefficient of Determination (R^2): 0.483→ Adversity intelligence contributes 48.3% to the learning outcomes. The remaining 51.7% is influenced by other unexamined factors.

Table 8. Effect of Adversity Intelligence on Learning Outcomes

Model	B	Std. Error	R	R^2	T	sig.
Constant	48.983	2.047	0.695	0.483	23.931	.000
X_1	0.463	0.028			16.569	

Regression Equation:$\hat{Y} = 48.983 + 0.463X_1$. For each 1-point increase in adversity intelligence, learning outcomes increase by 0.463 units. These results are supported by Mwivanda & Kingi (2019), which showed that adversity intelligence significantly improves academic performance.

The positive regression coefficient indicates that there is a "positive relationship" between adversity intelligence and cognitive biology learning outcomes. This means that the higher the adversity intelligence possessed by students, the higher the learning outcomes they achieve. The correlation coefficient (R) value obtained was 0.695, which is in the strong category. This shows that there is a strong relationship between adversity intelligence and cognitive biology learning outcomes. In addition, the determination coefficient (R^2) value of 0.483 indicates that 48.3% of the variability in cognitive biology learning outcomes can be explained by the adversity intelligence variable. The remaining 51.7% is influenced by other factors not included in this study, such as learning motivation, family environment, teaching quality, learning facilities, and other psychological aspects. This indicates that although adversity intelligence plays a major role, the influence of other external and internal variables is also significant and cannot be ignored. Safi'I et al (2021) also found that AQ is a significant predictor of student performance in their study, obtaining (R2) 0.540.

From the results of the t-test, the t-count value was obtained at 16.569, which is greater than the t-table of 1.968. This shows that adversity intelligence has a significant effect on cognitive biology learning outcomes. The significance value (Sig.) obtained is 0.000, which is much smaller than the limit of $\alpha = 0.05$. This strengthens the evidence that the effect does not occur by chance, but is statistically significant.

To test the validity of the overall model, an ANOVA test was conducted. The ANOVA results in Table 4.8 show an F-count value of 274.538, which is much higher than the F-table of 3.88. The significance value is also 0.000, which again confirms that the overall regression model is significant in explaining the relationship between adversity intelligence and learning outcomes.

Adversity intelligence, or resilience, refers to an individual's ability to adapt well and recover from stress or adversity. In the context of education, adversity intelligence allows students to manage stress and learning obstacles so that they remain motivated and focused on achieving academic goals (Wang, Haertel, & Walberg, 2021). According to Self-Determination theory (Deci & Ryan, 2020), individuals who have adversity intelligence tend to have basic psychological needs met, such as competence and control over the environment, which support effective learning processes and better learning outcomes.

Juwita, et al. (2020) This study reviewed the role of AQ in education, focusing on research design, types of participants, and the contribution of AQ to learning outcomes. The results showed that AQ has a significant influence on improving student learning outcomes and skills. Mwivanda and Kingi (2019) in the research that has been conducted also found a significant positive effect between the dimensions of adversity intelligence and students' academic achievement.

Hypothesis Test 2

Effect of Achievement Motivation on Cognitive Biology Learning Outcomes

Achievement motivation also has a significant effect with a p-value of $0.000 < 0.05$. $R^2 = 0.455$ → Achievement motivation contributes 45.5% to learning outcomes; the remaining 54.5% is influenced by other factors.

Table 9. ffect of Achievement Motivation on Learning Outcomes

Model	B	Std. Error	R	R^2	t	Sig.
Constant	45.303	2.399	0.674	0.455	18.880	0.000
X_2	0.451	0.029			15.656	

Regression Equation: $\hat{Y} = 45.303 + 0.451X_2$ → A 1-point increase in achievement motivation raises learning outcomes by 0.451 units. This is in line with research by Wilkesmann et al. (2021), Dong (2023), Alawiyah & Sulistiyo (2018), and others.

The positive regression coefficient value (0.451) indicates that achievement motivation has a positive relationship with cognitive biology learning outcomes. This means that the higher the achievement motivation of students, the higher their learning outcomes in biology.

The correlation coefficient value (R) obtained of 0.674 is included in the "strong" category, which means that the relationship between achievement motivation and cognitive biology learning outcomes is statistically strong. The R^2 value of 0.455 or 45.5% indicates that the achievement motivation variable contributes 45.5% to the variation in cognitive biology learning outcomes of students. The remaining 54.5% is influenced by other factors not examined in this study, such as emotional intelligence, learning environment, teacher teaching methods, and student learning readiness. This finding shows that achievement motivation does have a large influence, but other external and internal factors also play a role in shaping student learning outcomes.

Based on the t-test, the t-count value was 15.656, which is much greater than the t-table value of 1.968. This shows that the influence of achievement motivation on cognitive biology learning outcomes is statistically significant. This is also reinforced by the significance value (Sig.) of 0.000, which is smaller than $\alpha = 0.05$. Therefore, the research hypothesis that there is an influence of achievement motivation on learning outcomes can be accepted. To test the significance of the overall model, the ANOVA test was used, the results of which are shown in Table 4.8. The F-count value of 245.108 is much greater than the F-table value of 3.87, and the significance value of 0.000.

Furthermore, the Expectancy-Value theory (Wigfield & Eccles, 2020) explains that achievement motivation is influenced by students' expectations of success and the value they place on

the task. If students believe that their efforts will produce good results and they consider learning important, then their achievement motivation will increase, resulting in better learning outcomes. Based on research conducted by Hasnawaty et al. (2019), it was found that there is indeed an influence of achievement motivation on student learning outcomes. This is also in line with research conducted by Muhajirin et al. (2020) that there is a positive and significant relationship between student achievement motivation and student learning outcomes.

Hypothesis Test 3

Combined Effect of Adversity Intelligence and Achievement Motivation on Learning Outcomes

The combined effect of adversity intelligence and achievement motivation is also significant, with Sig. = 0.000 < 0.05. R = 0.780, R^2 = 0.609→ These variables jointly explain 60.9% of the variation in students' cognitive learning outcomes.

Table 10. Combined Effect

Model	B	Std. Error	R	R^2	F	Sig.
Constant	36.629	2.189				
X_1	0.311	0.029	0.780	0.609	228.286	0.000
X_2	0.282	0.029				

Multiple Regression Equation:$\hat{Y} = 36.629 + 0.311X_1 + 0.282X_2$→ Both variables have positive coefficients, indicating positive influence on cognitive learning outcomes. These findings align with studies by Yuliana & Sari (2020), Firdaus & Santika (2019), Rahmawati & Suryanto (2021), among many others.

The multiple correlation coefficient (R) value of 0.780 indicates a strong relationship between the combination of adversity intelligence and achievement motivation variables on cognitive biology learning outcomes. This value indicates that both variables together have a close relationship with student learning outcomes. In line with research conducted by Yuliana and Sari (2020) that adversity intelligence and achievement motivation have a significant effect on student learning outcomes. Furthermore, research conducted by Firdaus and Santika (2019) also showed a significant effect between achievement motivation and adversity intelligence in supporting student learning achievement.

Rahmawati and Suryanto (2021) also showed the same results, namely that adversity intelligence and achievement motivation together have a positive effect on student learning outcomes. The R^2 value of 0.609 means that 60.9% of the variation in cognitive learning outcomes can be explained by the adversity intelligence and achievement motivation variables. The remaining 39.1% is explained by other variables not examined in this study. The results of the ANOVA test in Table 4.8 show that the F-count value of 228.286 is much greater than the F-table of 3.03, and the significance value (Sig) is 0.000 <0.05. This means that the regression model is simultaneously statistically significant, so that the alternative hypothesis is accepted, namely that there is a significant influence of adversity intelligence and achievement motivation on cognitive learning outcomes in biology.

The positive and significant influence between adversity intelligence and achievement motivation on learning outcomes shows that the two variables complement each other in shaping students' academic achievement. Adversity intelligence allows students to stay focused and not give up easily when facing learning challenges, such as material difficulties or pressure from the environment. This ability is very important, especially in learning situations that are full of dynamics and the possibility of failure. In addition, achievement motivation acts as an internal driver that increases students' enthusiasm and learning efforts. A student who has high achievement motivation tends to set clear learning goals, strive to achieve those targets, and utilize various available resources to learn more effectively (Pintrich & Schunk, 2002). With strong motivation, students can maximize the potential of their adversity intelligence to overcome learning obstacle

CONCLUSION

Based on the theoretical review, data analysis, and discussion, it can be concluded that all research variables fall into the moderate category. There is a significant influence of both adversity intelligence and achievement motivation on the cognitive learning outcomes in Biology of 11th-grade public high school students in Makassar City, with a significance value of 0.000 < 0.05, and a combined contribution of 60.9% to the learning outcomes. The adversity intelligence of Grade XI students at public senior high schools in Makassar is categorized as moderate, with an average score of 72.82. This indicates that most students are moderately capable of handling academic challenges. The achievement motivation of these students is also in the moderate category, with an average score of 82**.**87, reflecting a sufficient level of internal drive to succeed academically. The cognitive learning outcomes in Biology of the students are likewise in the moderate category, with an average score of 82.71, suggesting a generally adequate understanding of biological concepts among students. There is a positive and significant influence of adversity intelligence on students' cognitive learning outcomes in Biology, with a regression coefficient of **0.**311, an effective contribution of 32.5%**,** and a relative contribution of 53.4% to the total influence of independent variables. Achievement motivation also has a positive and significant influence on cognitive learning outcomes, with a regression coefficient of 0.282**,** an effective contribution of 28.4%**,** and a relative contribution of 46.6%**.** Collectively, adversity intelligence and achievement motivation contribute effectively to 60.9% of the variance in students' cognitive learning outcomes (R^2 = 0.609), indicating that these two variables play a dominant role in determining students' academic performance in Biology.

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