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Relationship between Adversity Intelligence, Communication Skills and Digital Literacy with Biology Learning Outcomes of State High School Students in Enrekang Regency

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Abstract: This study was motivated by the low learning outcomes of biology phase E students of State High Schools in Enrekang Regency. This study aims to analyze the relationship between adversity intelligence, communication skills, and digital literacy with biology learning outcomes. Using quantitative methods of ex post facto type. The population was 1205 phase E students with a sample of 300 students selected by proportional random sampling. Data were collected using a Likert scale questionnaire and multiplechoice tests and the data were analyzed using regression analysis. The results of the analysis show that adversity intelligence has a significant relationship to learning outcomes with a sig value of 0.000 < 0.05 and a contribution of 30%; communication skills have a significant relationship to learning outcomes with a sig value of 0.000 < 0.05 and a contribution of 19.9%; digital literacy has a significant relationship to learning outcomes with a sig value of 0.000 < 0.05 and a contribution of 18.5%; adversity intelligence variables, communication skills and digital literacy together have a significant relationship to biology learning outcomes with a sig value of 0.000 < 0.05 and a contribution of 37.8%.

Keywords: Adversity intelligence; Communication skills; Digital literacy; Learning outcomes

Introduction

Education is the driving force of culture. Traditions can change at anyt ime, changes arise from the education process itself. If a country wants to build a better life, then its people must undergo education to develop their intellect (Sopacua & Fadli, 2022). The National Education System Law Number 20 of 2003 states that national education has the aim of improving skills, educating the nation's life, developing independence, creativity, having critical abilities and being able to improve their moral potential in accordance with the objectives of the national education system (Depdiknas, 2003).

The goals of national education can be realized through 21st century skills. Currently, the challenges are getting bigger, therefore students are expected to master 21st century skills including 6C, namely critical thinking, creativity, culture/citizenship, communication, collaboration, and connectivity (Anugerahwati, 2019). 21st century skills including the 6C are very beneficial for success in education. Education today does not only equip students with knowledge, but also to build learning abilities and support the development of students into active learners, critical in dealing with problems, creative and innovative in solving problems, having communication skills and achieving academic success (Hermansyah et al., 2021).

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Academic success is the end result of the learning process and reflects the quality of students in intellectual abilities, attitudes, and skills expressed in the form of grades (Fitriyah et al., 2020). The world of education makes learning outcomes a benchmark for academic success to ensure the quality of students (Wahyuningsih, 2020). Learning outcomes refer to changes in behavior experienced by students as a consequence of the learning process. These changes are in line with the learning objectives that have been set. Through the learning process, students gain new understanding, improve skills, and build more positive attitudes (Nurhayati et al., 2023). Learning outcomes play a crucial role in the biology learning process. Biology is the study of life, growth, functional, structural, distribution, evolution, and taxonomy of all living things (Farahani et al., 2023).

In the biology learning process, students are subjects who are able to manage themselves to achieve optimal learning. Therefore, students must be physically and mentally involved so that the learning process not only produces cognitive skills but also competent and skilled in psychomotor and affective aspects (Nurhayati et al., 2019). The biology learning process is carried out using the scientific method. This aims to improve the ability to think, work together, scientific attitudes and communication skills as important aspects that must be possessed by students (Angraini et al., 2022).

Based on information obtained by researchers through interviews with biology teachers of public high schools in Enrekang Regency, it was explained that in the learning process there were several students if given an assignment, case study, or project, students only answered soberly, lacked creativity, had difficulty in solving problems, and gave up easily. Some students are also not brave in expressing their opinions, asking questions or responding to the teacher, so that in discussion activities students find it difficult to discuss actively. This shows that the learning process is less effective because students are passive and communication in learning is dominated by the teacher. This condition will affect the learning outcomes of students. This is evidenced by the fact that there are still students who have Biology learning outcomes that have not reached the predetermined KKTP (Criteria for Achieving Learning Objectives).

Several factors may contribute to the low learning outcomes of students in Biology subjects. Influencing factors can be divided into two types, namely internal and external factors (Setiawan, 2023). One of the internal factors that affect student learning outcomes is adversity intelligence. Adversity intelligence is the ability of individuals to face and overcome various difficulties, and turn challenges or obstacles into opportunities to achieve success (Yasarah et al., 2023). Learners who have good adversity intelligence will have self-confidence, self-assurance, a good level of control, have high responsibility, and have high fighting power, and never give up in facing problems (Tiara et al., 2023). However, based on Arni (2022), it shows that students' adversity intelligence is low. This is influenced by students who have the nature of giving up easily, being anxious when facing new difficult problems, fasting with their efforts, and having an important attitude that the problem is over quickly so that it is not maximized in solving.

Another internal factor that affects students' learning outcomes is communication skills. Communication skills are the ability to send and receive messages clearly, effectively, and accurately (Jamaluddin et al., 2024). Communication skills are needed in achieving success in the student learning process (Ningrum & Putri, 2020). Communication plays a role in the learning process to transfer knowledge and exchange ideas (Mayani et al., 2023). However, students' communication skills in the learning process are still relatively low. This is caused by many students lacking confidence in expressing ideas and lack of courage to appear in front of the class. There is also outside interference, where students are busy talking to their friends and not listening to the teacher's explanation so that students do not know what to ask and do not answer the teacher's questions when the teacher asks (Angganing et al., 2022).

In addition to internal factors such as adversity intelligence and communication skills, digital literacy is also an external factor that affects student learning outcomes. Digital literacy is the ability to access, use, assess, and understand information from various sources (Kurniawan & Sarah, 2023). Digital literacy is the knowledge of using digital media, communication networks in finding, using, evaluating, creating information and utilizing it wisely, intelligently, carefully, precisely and lawfully (Bahri et al., 2022). Digital literacy has an important role in biology learning to improve science process skills in understanding and concept discovery (Setiawan, 2023). However, research conducted by Rianto & Sukmawati (2021), shows that digital literacy is low. This is due to the low ability of students to evaluate information on the internet, students tend to be passive in receiving messages from digital media, acting more as consumers of information rather than active participants who are able to utilize social media to develop, and resulting in students often missing opportunities to participate and collaborate.

Based on this description, a study was conducted to determine the relationship between adversity intelligence, communication skills and digital literacy with the biology learning outcomes of public high school students in Enrekang Regency.

Method

Research Type and Research Design

This research uses a quantitative method of ex post facto correlational type. This study uses a correlational ex post facto approach determine the relationship between adversity intelligence, communication skills, and digital literacy with student learning outcomes, without providing treatment or manipulation of the variables studied.

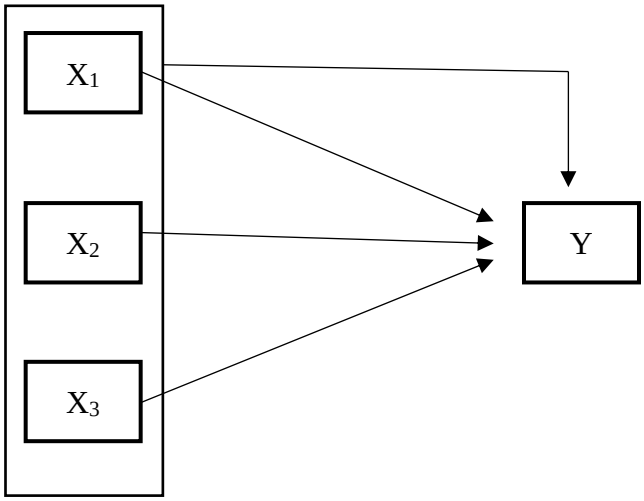

Figure 1. Research design

Description:
X_1 : Adversity intelligence
X_2 : Communication skills
X_3 : Digital literacy
Y : Biology learning outcomes

Population and Sample

The population in this study were all phase E students of public high schools in Enrekang Regency in the 2024/2025 school year. The technique used in sampling is cluster random sampling. Cluster random sampling is a sampling technique carried out in groups, where samples are taken from certain areas or groups, and all members in the group are made part of the sample (Nurkhasanah, 2022).

The steps for determining the research sample are: based on the regional division, schools in Enrekang District are divided into three regions, namely schools in the southern part of Enrekang, northern Enrekang and eastern Enrekang; two schools were taken from each region (South, North, and East) with consideration of urban and rural areas; Determination of the sample size using the Solvin formula with an error rate of 5% and a confidence level of 95% (Amin et al., 2023).

$$n = \frac{N}{1 + N\,(e)^2} \quad (1)$$

Description:
n : Number of samples
N : Total population
e^2 : Desired degree of precision (0.05)

Then, the number of samples from each high school was determined using the proportional random sampling formula with the following formula.

$$ni = \frac{Ni}{N} \times n \quad (2)$$

Description:
ni : Number of samples
Ni : Total population
N : Previous population size
n : Total number of samples

Table 1. Sample distribution of each school

School	Total population of phase E students	Sample
SMA Negeri 2 Enrekang	327	81
SMA Negeri 8 Enrekang	63	16
SMA Negeri 1 Enrekang	273	68
SMA Negeri 11 Enrekang	128	32
SMA Negeri 5 Enrekang	294	73
SMA Negeri 10 Enrekang	120	30
Total	1205	300

The research instrument used was a likert scale questionnaire for the variables of adversity intelligence, communication skills, digital literacy, affective and psychomotor learning outcomes. Cognitive learning outcomes using tests in the form of multiplechoice questions. The data obtained were then analyzed using the SPSS Version 24 application for descriptive and inferential analysis. Descriptive analysis includes determining the lowest value, highest value, middle value, mode, mean value, and standard deviation. Prerequisite inferential analysis includes normality test, linearity test, multicollinearity test, and heteroscedasticity test. Hypothesis testing using simple linear regression and multiple linear regression.

Result and Discussion

This study involves four main variables, namely adversity intelligence (X_1), communication skills (X_2), digital literacy (X_3) and biology learning outcomes (Y). The results of the study "the relationship between adversity intelligence, communication skills and digital literacy with biology learning outcomes of public high school students in Enrekang Regency" are presented as follows.

Table. 2 Descriptive analysis of X1, X2, X3 and Y

Variable	Mean	Median	Modus	Max	Min	Std. Dev
Adversity intelligence	72.42	73	73	97	57	6.804
Communication skills	68.1	69	72	97	41	8.198
Digital literacy	71.35	71	71	90	50	6.595
Learning outcomes	63.75	64	65	84	41	7.660

Descriptive Analysis of Adversity Intelligence

Adversity intelligence is the ability to understand, respond to and manage adversity and turn it into opportunity. It reflects how a person deals with challenges based on three main areas of science, namely cognitive psychology, mental neuroimmunology and neurophysiology (Pong & Lam, 2023).

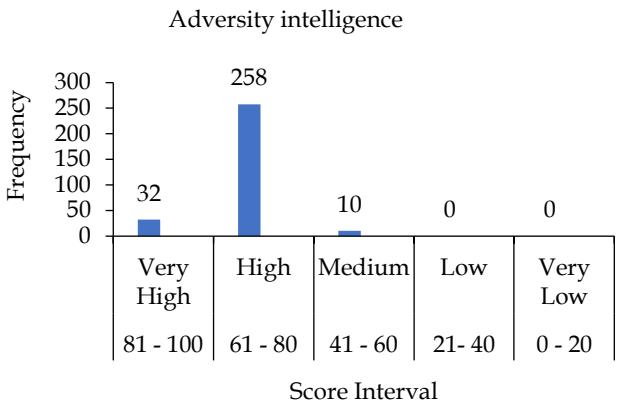

Figure 2. Diagram of adversity intelligence level

Based on Figure 2, it shows that adversity intelligence is in the high category with a frequency of 258 students with a percentage of 86%. These results indicate that most of the phase E students of public high schools in Enrekang Regency who are respondents have good adversity intelligence. High adversity intelligence indicates that students are able to control themselves well when facing difficult situations and are able to adapt according to the causes of the difficulties faced, thus avoiding the tendency to blame themselves excessively.

In line with research conducted by Rohma & Lataruva (2023), that the adversity intelligence of students is in the high category with a percentage of 40.9%. This means that students have a good level of adversity intelligence. Rathee & Sharma (2018) argued that students with high adversity intelligence have the ability to face difficulties, think positively in overcoming difficult situations, and rise quickly from adversity. They are able to solve the problems faced without blaming others. The difficulties experienced do not affect other aspects of life. Individuals see difficulties as temporary, so they believe that they will be overcome and consider them as challenges as well as opportunities for positive things.

Hastuti et al. (2017) stated that students with high adversity intelligence are able to achieve goals despite being faced with various challenges. The level of adversity intelligence can affect success in achieving goals, because adversity intelligence helps individuals assess the level of difficulty faced. Learners with high adversity intelligence will continue to try to overcome obstacles or problems and conduct self-evaluation to determine the right steps.

Descriptive Analysis of Communication Skills

Communication skills are expertise in conveying information from the information giver to the information receiver clearly and accurately, both verbally and nonverbally. These skills include verbal, nonverbal and social communication. In addition, communication skills are part of general skills that are important for learners to master, both in academic and non-academic contexts (Fadli & Irwanto, 2020).

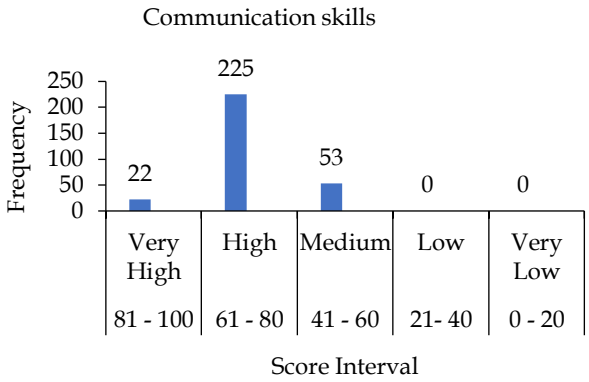

Figure 3. Diagram of communication skill level

Based on Figure 3, it shows that communication skills are in the high category with a frequency of 225 students with a percentage of 75%. These results indicate that most of the E phase students of State Senior High Schools in Enrekang Regency who are respondents have good communication skills. High communication skills indicate that students are able to convey and write information using appropriate, clear and fluent grammar, and are able to write information using appropriate, accurate and clear words.

In line with research conducted by Amaditha et al. (2024), that students' oral and written communication skills are in the high category with an average of 82.71. Learners have good communication skills characterized by learners who are able to communicate actively in the

learning process. Learners can ask questions to the teacher regarding things they don't know. Learners exchange ideas so that the delivery of information and communication can be well established. In written communication skills, learners are able to use systematic and effective language in their writing (Amaditha et al., 2024).

This is also in line with previous research conducted by Situmorang & Pandiangan (2022), showing that the overall communication skills of students are relatively high at 53%. This means that students are able to discuss, able to evaluate existing data, and can make reports with the right structure and grammar.

Descriptive Analysis of Digital Literacy

Digital literacy is a skill in utilizing digital software and technology supported by cognitive, social, motor, and emotional abilities. In addition, digital literacy also includes the ability to access, analyze, evaluate, navigate, search and produce information effectively and critically through various digital technologies (Feng & Sumettikoon, 2024).

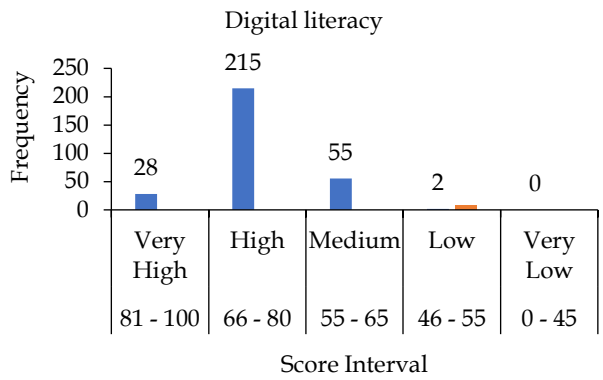

Figure 4. Diagram of digital literacy level

Based on Figure 4, it shows that digital literacy is in the high category with a frequency of 215 students and a percentage of 71.7%. These results indicate that most of the E phase students of public high schools in Enrekang Regency who were respondents had good digital literacy. High digital literacy indicates that students are able to use digital media, able to contribute and think critically in evaluating information, able to search and analyze information, and able to maintain security when using digital media.

In line with research conducted by Nuezca et al. (2024), that students' digital literacy is in the high category. Learners with high digital literacy show good ability to operate and access digital media, able to understand, interpret and respond to information in digital media. Learners are also able to participate in digital spaces, usually through discussions with peers on the WhatsApp application or in video conferences.

This is also in line with previous research conducted by Hermawati et al. (2024), showing that students' digital literacy is in the good category. In terms of students being able to use digital media, utilize digital media in learning, and understand related ethics and safety when using digital media. Achievement in this good category can provide significant benefits in the implementation of digital-based learning, because these skills support the effectiveness and smoothness of the learning process that utilizes technology.

Descriptive Analysis of Learning Outcomes

Learning outcomes are the skills that students acquire after undergoing the learning process. Learning outcomes play an important role in the learning process because they provide insight to the teacher about the progress of students in achieving their learning goals. This information becomes a reference for the implementation of subsequent teaching and learning activities (Adijaya et al., 2023).

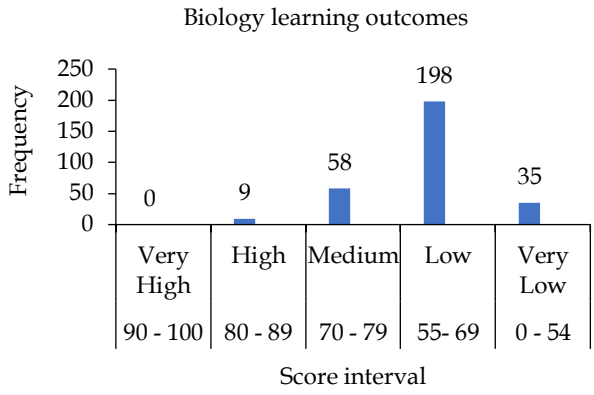

Figure 5. Diagram of learning outcome levels

Based on Figure 5, it shows that learning outcomes are in the low category with a frequency of 198 students and a percentage of 66.0%. These results indicate that most of the E phase students of State High Schools in Enrekang Regency who were respondents had poor learning outcomes. This means that the biology learning outcomes of students have not been maximized and need to be improved. Based on the analysis of cognitive learning outcomes, low scores were obtained on questions that tested the level of analyzing (C4), while high scores were obtained on questions with the level of remembering (C1) and understanding (C2). This shows that the higher the cognitive level, the more difficult the questions given, so the scores obtained by students tend to be lower. In addition, learning outcomes are also influenced by mastery of material on certain subtopics. In subtopics that are more mastered by students, questions with high cognitive levels can be answered correctly. In contrast to questions on subtopics that are

less mastered with low cognitive levels cannot be answered correctly.

In line with research conducted by Palullu & Bahri (2023), that the learning outcomes of students are in the low category with a frequency of 66 students and a percentage of 25%. The learning outcomes of students in the low category indicate that the biology learning outcomes of students have not been maximized and need to be improved. This is due to the cognitive level of the question, low scores are obtained by students at a high cognitive level. In addition, mastery of material on certain subtopics also affects learning outcomes. Low scores are obtained from questions on subtopics that are less mastered by students even at low cognitive levels.

Nadir et al. (2021) state that students' learning outcomes are in the low category which can be caused by an unconducive learning environment, such as students paying less attention and even playing during the learning process, non-optimal classroom management and monotonous teacher teaching style and incomplete material delivery.

Prerequisite Analysis

Normality Test

The results of the Kolmogorov-Smirnov normality test analysis of data on students have a Sig. > 0.05. It can be concluded that the variable scores of adversity intelligence, communication skills and digital literacy on students' biology learning outcomes are normally distributed.

Table 3. Normality test results

Test Statistics	Sig. (2-tailed)	Description
One-Sample Kolmogorof-Smirnov	0.200	Normally distributed

Linearity Test

The basis for making a linearity test decision is the sig. value < 0.05, then there is a linear relationship between the independent variable and the dependent variable. If the sig. value > 0.05, then there is no linear relationship between the independent variable and the dependent variable. Based on Table 4. it is known that the sig. value < 0.05, so there is a linear relationship between the independent variable and the dependent variable.

Table 4. Linearity test results

Variables	Sig.	Description
X_1 - Y	0.000	Linear
X_2 - Y	0.000	Linear
X_3 - Y	0.000	Linear

Multicollinearity Test

The basis for making multicollinearity test decisions is the tolerance value > 0.1 and the VIF value < 10 for all variables. This means that there is no deviation between the independent variables or there are no symptoms of multicollinearity.

Table 5. Multicollinearity test results

Variables	Tolerance	VIF
Adversity Intelligence	0.675	1.482
Communication Skills	0.667	1.498
Digital Literacy	0.829	1.207

Heteroscedasticity Test

The results of the heteroscedasticity test obtained sig. > 0.05 on the variables of adversity intelligence, communication skills, and digital literacy. This means that there are no symptoms of heteroscedasticity.

Table 6. Heteroscedasticity test results

Variables	Sig.	Sig Level
Adversity Intelligence	0.830	0.05
Communication Skills	0.665	0.05
Digital Literacy	0.121	0.05

Hypothesis Test Results

Relationship between Adversity Intelligence and Learning Outcomes

The significance value on the adversity intelligence variable is 0.000 < 0.05, which indicates that there is a relationship between adversity intelligence and biology learning outcomes of phase E students of State Senior High Schools in Enrekang Regency. The regression coefficient value (r) of the adversity intelligence variable on learning outcomes of 0.548 indicates that the relationship between adversity intelligence and students' biology learning outcomes is in the moderate category. Thus, it can be concluded that the better the adversity intelligence possessed by students, the tendency of learning outcomes also increases.

Furthermore, to see the size of the contribution of the adversity intelligence variable to learning outcomes can be seen in the r square value in the table or can be determined using the coefficient of determination formula = r^2 x 100% = 30%. This means that adversity intelligence contributes 30% to learning outcomes, while the remaining 70% is influenced by other factors not examined in this study.

Table 7. Relationship between adversity intelligence and biology learning outcomes

Model	R	R Square	Unstandardized Coefficient B	Sig.
Constant			19.104	0.000
1	0.548	0.300	0.616	0.000

Based on the data analysis results in Table 7. obtained the regression equation Y = a + $\beta_1 X_1$, namely Y = 19.104 + 0.616X_1. The coefficient value of β_1 is 0.016, which means that if adversity intelligence increases by 1

point, then learning outcomes will increase by 0.616. Because the coefficient value of β_1 is positive, the direction of the influence of adversity intelligence with learning outcomes is positive.

In line with previous research conducted by Sigit et al. (2019) shows that there is a significant relationship between adversity intelligence and student learning outcomes. The higher the adversity intelligence possessed by students, the higher the learning outcomes. Learners with high adversity intelligence have a significant ability to face challenges or obstacles without blaming others, regardless of the results obtained from their efforts. Learners tend to see every difficulty and obstacle as a responsibility that must be resolved to completion.

Ariska & Sumunar (2018) stated that there is a positive and significant relationship between adversity intelligence and student learning outcomes. The higher the level of adversity of students, the higher the learning outcomes. In addition, it turns out that the level of adversity intelligence in students has a big influence on their learning outcomes. Adversity intelligence is one of the factors that most determine a person's success. Learners who have high adversity intelligence will always take responsibility for what they do to complete it.

Relationship between Communication Skills and Learning Outcomes

The significance value on the communication skills variable is 0.000 < 0.05, which shows that there is a relationship between communication skills and biology learning outcomes of phase E students of State Senior High Schools in Enrekang Regency. The value of the regression coefficient (r) of the communication skills variable on learning outcomes of 0.446 indicates that the relationship between communication skills and students' biology learning outcomes is in the medium category. Therefore, it can be concluded that the better the communication skills of students, the tendency of their learning outcomes also increases.

Furthermore, to see the size of the contribution of the communication skills variable to learning outcomes, it can be seen in the r square value in the table or can be determined using the coefficient of determination formula = r^2 x 100% = 19.9%. This means that communication skills contribute 19.9% to learning outcomes, while the remaining 80.1% is influenced by other factors not examined in this study.

Table 8. Relationship between communication skills and biology learning outcomes

Model	R	R Square	Unstandardized Coefficient B	Sig.
Constant			35.399	0.000
2	0.446	0.199	0.417	0.000

Based on the data analysis results in Table 8. obtained the regression equation Y = a + β_2X_2, namely Y = 35.399 + 0.417X_2. The coefficient value of β_1 is 0. 417, which means that if communication skills increase by 1 point, then learning outcomes will increase by 0.417. Because the coefficient value of β_1 is positive, the direction of the influence of communication skills with learning outcomes is positive.

In line with previous research conducted by Pusvita et al. (2023) shows that there is a significant relationship between students' communication skills and learning outcomes. Learners who have good communication skills are able to play an active role in the learning process, express opinions clearly, understand other people's perspectives, and work together effectively. In addition, good communication skills also enable learners to organize in-depth analysis and convey conclusions clearly which can affect their learning outcomes.

Learners with good communication skills will find it easier to undergo daily learning activities which affect student learning outcomes. Maximum learning outcomes can be achieved if communication in the learning process takes place effectively. A conducive learning process can be created through harmonious interactions between educators and students, with communication as the main factor in building mutual understanding (Pramusinta & Dewi, 2023).

The Relationship between Digital Literacy and Learning Outcomes

The significance value on the digital literacy variable is 0.000 < 0.05, which indicates a relationship between digital literacy and learning outcomes. The regression coefficient value (r) of the digital literacy variable on learning outcomes of 0.430 indicates that the relationship between digital literacy and students' biology learning outcomes is in the moderate category. Therefore, it can be concluded that the better digital literacy students have, the tendency of their learning outcomes also increases.

Furthermore, to see the size of the contribution of the digital literacy variable to learning outcomes, it can be seen in the r square value in the table or can be determined using the coefficient of determination formula = r^2 x 100% = 18.5%. This means that digital literacy contributes 18.5% to learning outcomes, while the remaining 81.5% is influenced by other factors not examined in this study.

Table 9. Relationship between digital literacy and biology learning outcomes

Model	R	R Square	Unstandardized Coefficient B	Sig.
Constant			28.110	0.000
3	0.430	0.185	0.499	0.000

Based on the data analysis results in Table 9. obtained the regression equation $Y = a + \beta_3X_3$, namely $Y = 28.110 + 0.\ 0.499X_3$. The coefficient value of β_1 is 0. 499, which means that if digital literacy increases by 1 point, then learning outcomes will increase by 0.499. Because the coefficient value of β_1 is positive, the direction of the effect of digital literacy on learning outcomes is positive.

In line with research conducted by Adha et al. (2022), that digital literacy has a positive and significant effect on student learning outcomes. Good digital literacy skills are very important for students to support learning in the digital era. These skills help learners find sources of information, think critically, and process data from digital media. A high level of digital literacy positively influences learning outcomes by expanding access to quality resources, improving understanding of material, and encouraging creativity and independence, thus supporting the achievement of optimal learning outcomes.

Lestariani (2023) stated that digital information literacy and learning outcomes have a strong relationship. Good digital literacy skills support learners in accessing information widely and diversely, creating a flexible learning environment, and increasing motivation. According to Anuratha (2020), good digital literacy not only teaches how to operate technology, but also helps learners understand information appropriately and relevantly, so that they can gain accurate knowledge. This allows learners to utilize technology to complete tasks efficiently without time and space constraints and move from passively receiving materials to actively seeking information. The role of teachers is crucial in developing students' digital literacy. Teachers function as facilitators who support learners in utilizing digital resources to learn independently, creatively and productively, ultimately contributing to academic success and improved learner outcomes in the digital era.

The Relationship between Adversity Intelligence, Communication Skills and Digital Literacy with Learning Outcomes

The significance value on the variables of adversity intelligence, communication skills and digital literacy is 0.000 < 0.05 which indicates that there is a relationship between adversity intelligence, communication skills and digital literacy with learning outcomes. The correlation coefficient (r) of the adversity intelligence, communication skills, and digital literacy variables together on the learning outcomes variable is 0.615, indicating that the relationship between adversity intelligence, communication skills, and digital literacy with the learning outcomes variable is in the strong category. So, it can be concluded that the better the adversity intelligence, communication skills and digital literacy possessed by students, the tendency of students' learning outcomes will increase.

Furthermore, to see the size of the contribution of the adversity intelligence variable, communication skills and digital literacy to learning outcomes can be seen in the r square value in the table or can be determined using the coefficient of determination formula = r^2 x 100% = 37.8%. This means that adversity intelligence, communication skills and digital literacy contribute 37.8% to learning outcomes, while the remaining 62.2% is influenced by other factors not examined in this study.

Table 10. Relationship between adversity intelligence, communication skills and digital literacy with learning outcomes

Model	Unstandardized Coefficient B	R	R Square	Sig.
Constant	3.410			
1	0.428	0.615	0.378	0.000
2	0.140			
3	0.277			

Based on the data analysis results in Table 10, obtained the regression equation, namely:

$$Y= 3.410 + 0.428X_1 + 0.140X_2 + 0.277X_3 \quad (3)$$

The value of a = 3.410 which means that in the presence of adversity intelligence, communication skills and digital literacy, the amount of student learning outcomes is 3.410 units. The coefficient value of β_1 is 0.428, which means that if adversity intelligence increases by 1 point while the value of communication skills and digital literacy remains fixed, then learning outcomes increase by 0.428 with the assumption that the other independent variables are the same. The coefficient value of β_2 is 0.140, which means that if communication skills increase by 1 point while the value of adversity intelligence and digital literacy remains, then learning outcomes increase by 0.140 with the assumption that the other independent variables are the same. The coefficient value of β_3 is 0.277, which means that if digital literacy increases by 1 point while the value of adversity intelligence and communication skills remains, then learning outcomes increase by 0.277 with the assumption that the other independent variables are the same.

Adversity intelligence, communication skills and digital literacy have complementary roles in supporting

the improvement of students' learning outcomes. If learners are able to demonstrate a high level of adversity intelligence, have effective communication skills, and master digital literacy well, it will have a positive impact on the quality of learner learning outcomes. These three aspects, when developed together, not only help learners overcome challenges in the learning process but also encourage learners to achieve good learning outcomes. In other words, success in learning is strongly influenced by a combination of the ability to persevere and overcome difficulties, the skills to convey and receive information, and the ability to utilize technology effectively.

These three factors interact with each other and have a relationship with each other that can affect learner learning outcomes. High adversity intelligence can improve learners' communication skills, as learners who are able to face challenges will be more active in communicating to exchange ideas and understanding (Pong & Lam, 2023). Good digital literacy skills can also strengthen learners' adversity intelligence, as learners can utilize technology effectively in finding creative solutions in overcoming learning challenges (Anuratha, 2020). Overall, good adversity intelligence, communication skills and digital literacy can contribute positively to learners' learning outcomes. In other words, success in learning is strongly influenced by a combination of the ability to persist in facing and overcoming difficulties, the skills to convey and receive information, and the ability to utilize technology effectively.

Conclusion

From the results of this study, it can be concluded that there is a significant and positive relationship between adversity intelligence and biology learning outcomes of phase E students of State Senior High Schools in Enrekang Regency, in the moderate category with a regression coefficient value of 0.548 and contributes 30% to learning outcomes, while the remaining 70% is influenced by other factors; there is a significant and positive relationship between communication skills and biology learning outcomes of phase E students of State Senior High Schools in Enrekang Regency, in the moderate category with a regression coefficient value of 0.446 and contributes 19.9% to learning outcomes, while the remaining 80.1% is influenced by other factors; there is a significant and positive relationship between digital literacy and biology learning outcomes of public high school students in Enrekang Regency, in the moderate category with a regression coefficient value of 0.430 and contributes 18.5% to learning outcomes, while the remaining 81.5% is influenced by other factors; there is a significant and positive relationship between adversity intelligence, communication skills and digital literacy together on the biology learning outcomes of public high school students in Enrekang Regency, in the strong category with a regression coefficient value of 0.615 and contributes 37.8% to learning outcomes, while the remaining 62.2% is influenced by other factors.

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Author Contributions

A., conceptualized the research, research procedures, analyzed the data and wrote the article. N.B. and M.J., supervised the writing of the article, reviewed and validated the research instruments used.

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Conflicts of Interest

The authors declare no conflict of interest.

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