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The relationship between learning independence, motivation, science literacy skills, and learning outcomes of public high school students in North Kolaka Regency

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ABSTRACT

The purpose of this study was to determine the relationship between learning independence, learning motivation, science literacy skills, and the learning outcomes of students in grade XI at Public High School in North Kolaka Regency. This type of research is quantitative, employing an ex-post facto correlational approach. Data acquisition using non-test instruments, such as questionnaires, to assess learning independence and motivation. Administer test instruments, including essays and multiple-choice questions, on digestive system material to assess science literacy skills and learning outcomes. Descriptive statistical data analysis, and inferential statistical data analysis in the form of prerequisite tests (normality test, linearity test, heteroscedasticity test, and Multicolinerity test), hypothesis testing (simple linear regression analysis and multiple linear regression analysis). The value of the correlation coefficient (R) for students is 0.848, with an R-squared value or coefficient of determination of 0.719, and a significant level of 0.000. There is a positive and significant relationship between learning independence, learning motivation, and science literacy with students' learning outcomes on digestive system material at North Kolaka Regency SMAN. These three factors together contribute 71.9% to learning outcomes. Based on the correlation coefficient value, it is known that the relationship between learning independence, motivation, and science literacy skills is in the "strong" category based on the correlation coefficient guideline, the value of R Variable learning independence, learning motivation, science literacy skills predict learning outcomes on the digestive system material is significant between learning independence, learning motivation, science literacy skills with student learning outcomes.

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INTRODUCTION

21st-century education demands that students master complex skills, such as critical thinking, creativity, collaboration, and communication, while also becoming independent learners. Success in achieving these goals is reflected in student learning outcomes, which serve as primary indicators of material mastery and learning effectiveness. However, the reality on the ground often shows that student learning outcomes are still not optimal**.** Various factors influence learning outcomes, with learning independence and learning motivation being two crucial internal student factors (Angraini, 2016). Learning independence enables students to develop abilities autonomously without

relying on others (Rusman, 2014; Hendrik, 2018), while motivation acts as a primary driver that directs and sustains learning behavior (Sardiman, 2007; Dimyati, 2006). Previous research, such as Kartina (2018) and Hakim (2016), indicates a significant positive relationship between learning independence and Biology learning outcomes. Similarly, Rahman (2021) and Yuliati (2017) affirm that learning motivation has a positive impact on learning outcomes and science literacy.

This context becomes even more relevant given the challenges of science literacy in Indonesia. The 2018 *Programme for International Student Assessment* (PISA) results placed Indonesia in a low rank (71 out of 79 countries for science), indicating that students have limited ability to apply scientific knowledge to solve problems and understand phenomena (OECD, 2019). Initial observations in SMA (Senior High Schools) in North Kolaka Regency reinforce this issue. It was found that students' learning motivation remains varied, characterized by passive behavior, frequently entering and exiting class, completing assignments only at school, and even cheating during exams**.** Such behaviors indicate low learning independence and motivation, which can impact learning outcomes, particularly in Biology—a subject that demands analytical skills and science literacy.

This situation unfolds amidst the transition from Curriculum 2013 to the Merdeka Curriculum**,** designed to enhance flexibility, character development, and learning relevance. This new curriculum is expected to foster increased motivation and learning independence. However, its implementation in North Kolaka Regency and its impact on student learning independence, motivation, and science literacy in high schools have not yet been specifically researched. Therefore, this study is crucial for examining the relationships among these three variables and Biology learning outcomes for high school students in North Kolaka Regency within the context of Merdeka Curriculum implementation. By addressing these unexplored areas, this research aims to provide valuable insights into the effectiveness of the Merdeka Curriculum in fostering essential 21st-century skills and improving student achievement in Biology within the specific context of North Kolaka Regency. The findings are expected to offer practical recommendations for educators and policymakers seeking to optimize learning processes and outcomes.

METHOD

This research employs a quantitative, *ex-post facto* approach with a correlational nature. This research is conducted to examine events that have occurred without the need for treatment of the variables studied. The research design used in the study is the relationship between the variables of learning independence (X1), learning motivation (X2), and science literacy skills (X3) with learning outcomes (Y) (see Figure 1).

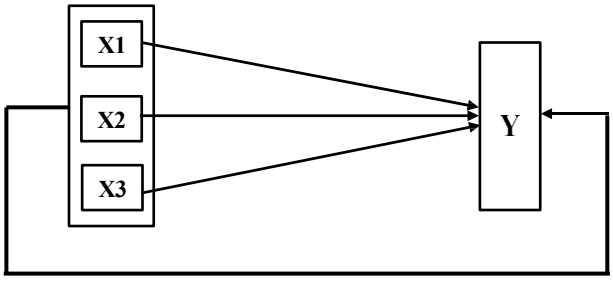

Figure 1. Research `design concept (Sugiyono, 2010)

The population of this study consists of all students in Class XI of Public Senior High School in North Kolaka Regency, totaling 876 students. The sampling technique in this study was a purposive sampling technique, with a sample of four schools consisting of 275 students. The sample selection criteria are public high schools in North Kolaka Regency that have implemented an independent curriculum. The method used to determine the sample size is the Slovin formula, which allows for the calculation of the required sample size for each school, as shown in Table 1.

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

Where N is the total population, n is the number of samples, and e is the significance value (0.05). The number of samples is shown in Table 1.

Table 1. Number of research samples

Curriculum	School Name	Number of Learners in Sample School
Merdeka	SMAN 1 Pakue	308
Merdeka	SMAN 1 Lasusua	235
Merdeka	SMAN 1 Batu Putih	160
Merdeka	SMAN 1 Kodeoha	173
Total		**876**

The research instruments used are both test and non-test instruments, in the form of questionnaires, to assess learning independence and learning motivation. Administer test instruments, such as essays and multiple-choice questions, to evaluate science literacy skills and learning outcomes. This study employs data collection techniques in the form of a questionnaire, specifically the Learning Independence Questionnaire and Learning Motivation, which consists of a list of questions or statements given to respondents to answer the posed problems in a closed manner. The measurement scale used in research with this questionnaire is the Likert scale model. The answer to each instrument item using the Likert scale *has* a gradation from very positive to very negative.

The test questions used in this study are science literacy questions in the form of descriptions, designed to measure science literacy indicators such as identifying scientific issues, explaining scientific phenomena, and using scientific evidence. This student learning outcomes test instrument determines the extent to which students have achieved the learning objectives set.

In this study, the data analysis techniques employed included descriptive statistical analysis and inferential statistical analysis, which took the form of prerequisite tests and hypothesis tests. Where the prerequisite tests (normality test, linearity test, Heteroscedacity test, and Multicollinearity test), hypothesis testing (simple linear regression analysis, multiple linear regression analysis, and coefficient of determination). The data obtained were then analysed using *SPSS Version 29* application for descriptive and inferential analysis.

RESULTS AND DISCUSSION

The results of the data obtained relate to learning independence, learning motivation, science literacy skills, and student learning outcomes regarding the material on the digestive system at SMA Negeri in North Kolaka Regency.

Table 2. Distribution of students' learning independence level on digestive system material public senior high schools in North Kolaka Regency

Percentage	Frequency	Percentage (%)	Criteria
84,24 - 96	35	12.7	Very High
76,41- 83,24	109	39.6	High
68,58 - 75,41	107	38.9	Medium
60,75 - 67,58	22	8	Low
49 - 59,75	2	7	Very Low
Total	**275**	**100**	

Based on the analysis in Table 2, it is known that the learning independence of students falls within the interval value of 76.41-83.24, with a frequency of 109 students, representing a percentage of 39.6%. Therefore, the level of learning independence of students on the material of the digestive system at SMAN in North Kolaka Regency is in the high category.

Table 3. Distribution of students' learning motivation level on system material public senior high schools in North Kolaka Regency

Value	Frequency	Percentage (%)	Criteria
87,24 - 98	16	5.8	Very High
80,08 - 86,24	64	23.3	High
72,92 - 79,08	131	47.6	Medium
65,76 - 71,92	52	18.9	Low
55 - 64,76	12	4.4	Very Low
Total	**275**	**100**	

Based on the analysis in Table 3, it is evident that the learning motivation of students falls within the interval value of 72.92-79.08, with a frequency of 131 students, representing a percentage of 47.6%. Therefore, the level of learning motivation of students regarding the material on the digestive system at SMAN in North Kolaka Regency is categorized as moderate.

Table 4. Distribution of students' science literacy level on system material public senior high schools in North Kolaka Regency

Value	Frequency	Percentage (%)	Criteria
68,74 - 84	17	6.2	Very High
57,58 - 68,74	60	21.8	High
46,42 - 57,58	104	37.8	Medium
35,26 - 45,42	74	26.9	Low
17 - 34,26	20	7.3	Very Low
Total	**275**	**100**	

Based on the analysis in Table 4, it is evident that the Science Literacy ability of students falls within the interval value of 46.42-57.58, with a frequency of 104 students, representing a percentage of 37.8%. Therefore, the level of motivation of students to learn about the digestive system material at SMAN in North Kolaka Regency is categorized as moderate.

Based on Table 5, it is evident that the learning of all students is at the near value of 75-80 with a frequency corresponding to 90 students, resulting in a percentage of 32.7%. Therefore, it can be concluded that the level of learning outcomes of students related to the material of the digestive system of SMAN in North Kolaka Regency is in the medium category.

Table 5. Distribution of student learning outcome levels on system material public senior high schools in North Kolaka Regency

Value	Frequency	Percentage (%)	Criteria
87 - 96	33	12	Very High
81 - 86	58	21.1	High
75 - 80	90	32.7	Medium
69 - 74	61	22.2	Low
60 - 68	33	12	Very Low
Total	**275**	**100**	

Based on the results of data analysis, inferential statistical data analysis is carried out. Specifically, the prerequisite test aims to verify the data's validity before hypothesis testing is conducted. The inferential statistical data analysis of the prerequisite test is as follows.

Table 6. Normality test of learning independence, motivation to learn, science literacy skills, and learner learning outcomes

Kolmogorov-Sminov Test				
No.	**Variables**	**Alpha (α)**	**Sig. (2-tailed)**	**Description**
1	Learning independence	0,05	0,87	Normal
2	Learning Motivation	0,05	0,74	Normal
3	Science Literacy Skills	0,05	0,200	Normal
4	Learning Outcomes	0,05	0,200	Normal

Based on the data analysis in Table 6, it can be seen that the significance value (*P*) is greater than 0.05. Therefore, it can be concluded that the data analysis results for the variables of learning independence, learning motivation, science literacy skills, and learning outcomes are normally distributed.

Table 7. Multicollinearity test learning independence, learning motivation, and science literacy skills

Variables	*Tolerance*	*VIF*	Description
Learning Independence	0,990	1,010	No multicollinearity
Learning Motivation	0,986	1,014	No multicollinearity
Science Literacy Skills	0,996	1,004	No multicollinearity

Based on data analysis in Table 7. Good data is characterised by a correlation model if there is no multicollinearity, which indicates that there is no regression relationship between the independent variables, namely learning independence, learning motivation, and science literacy skills. The basis for decision making is that there is no multicollinearity if the *tolerance* value> 0.100 and the VIF value < 10.00. Based on the multicollinearity test results in the table above, the variables of learning independence, learning motivation, and science literacy skills are considered.

Table 8. Heteroscedasticity test of learning independence, learning motivation, and science literacy skills

Variables	*Tolerance*	Description
Learning Motivation	0,515	No heteroscedasticity
Metacognitive Ability	0,784	No heteroscedasticity
Science Literacy Skills	0,930	No heteroscedasticity

Based on the analysis results in Table 8, good data is characterized by a correlation model, provided there is no heteroscedasticity, and if the significance value between the independent variable and the absolute residual is greater than 0.05. Based on the results of the heteroscedasticity

test in the table above, the variables of learning independence, learning motivation, and science literacy skills are considered.

Table 9. Linearity test of learning independence variables, learning motivation, and science literacy skills with learning outcomes

Variables	*Sig.*	Description
Learning Independence	0,872	Linear
Learning Motivation	0,496	Linear
Science Literacy Skills	0,085	Linear

Based on the data analysis in Table 9, it can be seen that the *deviation from linearity* value (Sig.) > 0.05. Therefore, it can be concluded that the data from the linear regression test analysis on the variables of learning independence, learning motivation, and science literacy skills with learning outcomes are linear.

Table 10. Relationship between learning independence and learning outcomes

Model	R	R Square	Adjusted R Square	Sig
1	.816[a]	.666	.665	0,000

Based on data analysis, Table 10. obtained a correlation coefficient (R) value in students of 0.816 with an *R square* value or coefficient of determination of 0.666 with a significant level of 0.000. This indicates that learning independence, as measured by student learning outcomes, contributes 66.6% to the involvement of student learning outcomes in the material on the digestive system in high schools in North Kolaka Regency. Based on the correlation coefficient value, it is evident that the relationship between independence and learning outcomes falls into the "Strong" category, as defined by the R value correlation coefficient guidelines.

Table 11: Relationship between learning motivation and learning outcomes

Model	R	R Square	Adjusted R Square	Sig
1	.755[a]	.570	.568	0,000

Based on data analysis in Table 11. obtained the value of the correlation coefficient (R) in students of 0.755, with the value of *R Square* or the coefficient of determination of 0.570, with a significant level of 0.000. This shows that learning motivation, as it contributes to student learning outcomes, accounts for 57% of the involvement in student learning outcomes in the digestive system of SMAN in North Kolaka Regency. Based on the correlation coefficient value, it is evident that the relationship between learning motivation falls into the "Moderate" category, as per the correlation coefficient guideline for R values.

Table 12: Relationship between science literacy skills and learning outcomes

Model	R	R Square	Adjusted R Square	Sig
1	.733[a]	.537	.535	5.21724

Based on data analysis in Table 12. obtained the correlation coefficient (R) on students of 0.733 with the value of R *Square* or the coefficient of determination of 0.537 with a significance level of 0.000. This indicates that the contribution of science literacy to student learning outcomes is 53.7% in the involvement of students in learning about the digestive system at SMAN in North Kolaka

Regency. Based on the correlation coefficient value, it is evident that the relationship between science literacy skills and learning outcomes falls into the "medium" category, as defined by the correlation coefficient guideline R value.

Table 13. Relationship between learning independence, learning motivation, science literacy skills, and learning outcomes

Model	R	R Square	Adjusted R Square	Sig
1	.848[a]	.719	.716	0,000

Based on data analysis in Table 13. obtained the correlation coefficient (R) value in students of 0.848 with the value of *R Square* or the coefficient of determination of 0.719 with a significant level of 0.000. This indicates that learning independence, learning motivation, and science literacy skills, as well as student learning outcomes, contribute 71.9% to their involvement in student learning outcomes in the digestive system of SMAN in North Kolaka Regency. Based on the correlation coefficient value, it is evident that the relationship between learning independence, learning motivation, science literacy skills, and learning outcomes falls into the "Strong" category, as defined by the correlation coefficient guidelines.

DISCUSSION

Based on the results of the analysis of research data that has been done, the discussion of this study aims to explain the results of research related to the relationship between learning independence variables, learning motivation, science literacy skills, and student learning outcomes on the material of the digestive system of SMAN in North Kolaka Regency.

Student learning outcomes are a crucial indicator of the success of the educational process. Various factors can affect student learning outcomes, including learning independence, learning motivation, and science literacy skills. This aligns with research, which suggests that students' success in learning is determined by many factors, one of which is learning motivation (Rohman, 2018). One of the factors that will be studied as a potential influence on student learning outcomes is the student independence factor, which is part of the internal factors (Laksana, 2019).

Learning independence requires students to have initiative, be active, and be involved in the learning process to improve their learning achievement. Essentially, independence is the behaviour of individuals who can take the initiative, overcome obstacles/problems, and have the confidence to carry out learning activities (Aritonang, 2021). This is in line with research (Rijal & Suhadir, 2016), specifically based on the correlation coefficient value between learning independence and cognitive biology learning outcomes, which was obtained at 0.579. It is well known that the relationship between the two variables is quite strong. The relationship is real, characterized by a significance value of 0.00. Learning independence contributes 33.5% to the cognitive learning outcomes of biology. In addition to learning independence, a factor that affects learning outcomes is learning motivation. In line with the findings of Minarti (2019), there is a positive relationship between learning independence and learning outcomes.

Many factors can affect student learning outcomes, one of which is learning motivation. High motivation in students to learn will have a positive impact on optimal learning outcomes (Salsa, 2022). Motivation in learning is essential for achieving the expected goals of the teaching and

learning process, so student motivation needs to be built. Someone makes an effort because of motivation. Better motivation in learning will yield good results; in other words, diligent effort based on motivation will enable the production of exemplary achievements. This finding aligns with research conducted by Yunanti (2016), which suggests a positive relationship between student learning motivation and biology learning outcomes. This finding aligns with research by Heryati (2022), which indicates a positive relationship between biology learning motivation and students' cognitive learning outcomes. The simple regression equation produced in this study is $\hat{Y} = 0.770 + 0.070X2$, with a strength of the relationship between the X2 variable and Y of 0.710. In line with Wini's research (2022), namely the results of the learning motivation of class XI students during learning at SMAN 2 Solok Selatan in biology subjects are included in the good category, this is evidenced by the average score of the motivation questionnaire of 78% and this shows that there is a significant relationship between motivation and learning outcomes.

The next factor that influences learning outcomes is science literacy skills. In line with the study conducted by Riatin (2021), which yielded a correlation coefficient value of 0.734, a positive relationship exists between science literacy skills and student learning outcomes. This positive relationship explains that high science literacy skills are also associated with high student learning outcomes. Science literacy-based learning will have an impact on student learning outcomes. Science literacy skills are essential in the learning process to make students more engaged. Active learning is particularly suitable for biology lessons, as it creates new experiences and fosters understandings that positively impact student learning outcomes. This finding aligns with research by Aritonang et al. (2021), which suggests a positive relationship between students' science literacy skills and their biology learning outcomes.

Based on the results of data analysis, it is known that there is a relationship between learning independence, learning motivation, science literacy skills with learning outcomes of students of class XI SMAN in North Kolaka Regency which can be seen from the significance value which means that there is a relationship between learning independence, learning motivation, science literacy skills with learning outcomes can be seen from the correlation coefficient (R) value in students of 0.848 with the value of *R Square* or the coefficient of determination of 0.719 with a significant level of 0.000. There is a positive and significant relationship between learning independence, learning motivation, and science literacy with students' learning outcomes on digestive system material at North Kolaka Regency SMAN. These three factors together contribute 71.9% to learning outcomes. Based on the correlation coefficient value, it is evident that the relationship between learning independence, motivation, and science literacy skills falls into the "strong" category, as defined by the R value correlation coefficient guidelines. There is a significant correlation between learning motivation and biology learning outcomes, with motivation contributing 25.9% to achievement. Reading habits directly affect science literacy skills, while learning motivation indirectly affects literacy through academic achievement (Yanti et al., 2021).

The implication is that students who demonstrate a high level of independence in organizing and monitoring their learning, supported by strong internal motivation to learn, and possess the ability to understand and apply scientific concepts (science literacy) tend to achieve better learning outcomes. This finding aligns with various educational theories that emphasize the importance of

internal student factors and is supported by previous studies, such as Damopoli (2017), who found a significant correlation between learning motivation and Biology learning outcomes. Comprehensively, the results of this study provide strong empirical evidence that to improve Biology learning outcomes among North Kolaka Regency SMAN students, educational interventions need to focus on strengthening learning independence, increasing motivation, and developing students' science literacy skills, in line with the objectives of the Merdeka Curriculum.

Based on the results of the analysis and discussion presented, it can be concluded that learning independence, learning motivation, and science literacy skills play an essential role in influencing learning outcomes. This finding aligns with previous studies that demonstrate a positive relationship between learning independence, learning motivation, science literacy skills, and learning outcomes. Therefore, educators and parents must create a learning environment that fosters the development of these three aspects. Efforts such as giving students the freedom to manage their own learning time, providing constructive feedback, and offering interesting learning resources can help improve learners' learning independence, motivation, and science literacy skills.

CONCLUSIONS

Based on the research conducted at SMAN Kolaka Utara Regency, it can be concluded that students' learning independence regarding digestive system material is high, indicating their ability to learn independently. However, students' learning motivation and science literacy skills fell into the medium category, indicating a need for improvement in both aspects. Learners' learning outcomes on the same material also showed a moderate category, indicating the influence of other factors. Furthermore, this study found a significant positive relationship between learning independence, learning motivation, and science literacy skills with students' learning outcomes. This means that the higher the level of autonomy, motivation, and science literacy, the better the learning outcomes. The findings also confirm a significant and positive relationship between the three variables and students' learning outcomes.

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