The Influence of Digital Literacy and Learning Styles on Student Academic Achievement (Case Study: Gen Z Students in Asahan Regency)

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Abstract
This study aims to analyze the influence of digital literacy and learning styles on the academic achievement of Gen Z students in Asahan Regency. Rapid developments in digital technology require students to have good digital literacy skills and appropriate learning styles in order to achieve optimal academic performance. This study uses a quantitative approach with a survey method. The research population consisted of all Gen Z students in Asahan Regency, with a simple random sampling technique used. Data were collected through questionnaires that had been tested for validity and reliability. Data analysis was performed using multiple linear regression analysis with the help of statistical programs. The results showed that digital literacy had a positive but insignificant effect on student academic achievement. In addition, learning style also has a positive and significant effect on student academic achievement. Simultaneously, digital literacy and learning style have a significant effect on the academic achievement of Gen Z students in Asahan Regency. This study is expected to be taken into consideration by educational institutions in improving student academic achievement through strengthening digital literacy and developing effective learning styles.

Keywords: Digital Literacy, Learning Style, Academic Achievement, Gen Z Students

INTRODUCTION

The rapid development of digital technology has brought significant changes in the world of education, especially in the learning process in higher education. Generation Z students who were born and raised in the digital era are very familiar with information and communication technology. This condition requires students to have good digital literacy skills in order to be able to use technology effectively, critically, and responsibly in supporting academic activities. Digital literacy is an important factor in supporting the learning process, from searching for information, utilizing online learning platforms, to processing academic information. Digital literacy is an individual's ability to use, understand, evaluate, and participate effectively in the digital world, which includes an understanding of information and communication technology, the ability to access and use digital devices, and the skills to search for, evaluate, and use information critically. Digital literacy involves understanding basic technological concepts, such as operating hardware and software, as well as the ability to use various applications, programs, and digital platforms. In addition, digital literacy also includes an understanding of digital ethics, copyright, privacy, online security, and communication and collaboration skills using digital media (Sari & Alfiyan, 2023).

The development of information and communication technology (ICT) in the era of the Industrial Revolution 4.0 has brought major changes in various aspects of life, including education. The learning process, which was previously centered on lecturers, has now shifted to digital technology-based learning that requires students to be more independent and active in

searching for and managing information. Students are required not only to be able to use technology, but also to have good digital literacy skills in order to utilize information effectively, critically, and ethically. A good understanding of digital literacy is very important for the knowledge and competence of everyone involved in today's world. All individuals are responsible for using technology to communicate and interact with society. In addition to the importance of literacy, numeracy, and other skills, literacy is equally important, especially for the current generation that has grown up with digital technology and unlimited access to various ideas from the past (Wati et al., 2023).

Digital literacy can also address social inequality in society. The application of digital literacy can give voice to different perspectives and enable active participation without being hindered by economic, social, and gender factors. Digital literacy can also support improvements in the quality of education, such as access to online education and educational content(Pitrianti et al., 2023). Literacy is a person's ability to use skills and potential in managing and understanding information when reading, writing, calculating, and solving problems in everyday life (Idhartono, 2022). Digital literacy is very important for citizen participation and lifelong learning in today's digitally driven society. Educational institutions around the world face the task of incorporating digital literacy into their curricula and teaching methods to equip students for success in the digital age (Judijanto, 2024).

Digital literacy is one of the skills that students must master in order to prepare themselves for the 4th Industrial Revolution. The six basic literacies consist of literacy in reading and writing, science, numeracy, digital, financial, as well as cultural and civic literacy. Due to the rapid advancement of Information and Communication Technology (ICT), digital literacy, information literacy, and technological literacy have become as important as other general skills. (Karsoni, 2021).

Digital literacy among students encompasses four main aspects, namely: access to information, evaluation of information, production of digital content, and active participation in the digital space. These skills are crucial in supporting online learning processes and technology-based academic tasks. MSMEs (Micro, Small, and Medium Enterprises). Digital literacy indicators include technical skills, cognitive skills, ethical and social skills, information skills, and digital communication skills (Darmawan et al., 2025). Digital literacy is the knowledge and skills to use digital media, communication tools, or networks in finding, evaluating, using, creating information, and utilizing it in a healthy, wise, intelligent, careful, appropriate, and law-abiding manner in order to foster communication and interaction in everyday life (Suripah & Susanti, 2022). Digital literacy is the knowledge and ability to use digital media, communication tools, or networks in a healthy, wise, intelligent, appropriate, careful, and lawful manner in order to foster communication and interaction.

The development of the digital world can be utilized to improve the ability to find, use, summarize, evaluate, create, and communicate information when using digital technology. In this era of digital literacy, it presents a challenge for users in accessing, selecting, and utilizing information (Rochmatika & Yana, 2022). In addition to digital literacy, students' learning styles are also factors that influence academic success. According to Woolfolk, it is very important for each student to know their learning style in order to develop their potential and

knowledge. According to De Poter & Mike, learning styles are divided into three (3) types, namely visual learning style, auditory learning style, and kinesthetic learning style (Syeila et al., 2023). Learning styles are personal ways of processing information while learning new concepts or principles. He also categorizes learning styles into four levels: concrete experience, reflective observation, abstract conceptualism, and active teaching. This leads to various styles or strategies as individuals process information from various stimuli in their respective environments. Thus, the assumption of different individuals becomes an important concept to explain individual differences in processing information from reference materials, completing tasks, solving problems, and answering exam questions (Hasanuddin, 2021).

Learning style is the way an individual uses their abilities and can be defined as "a combination of cognitive characteristics, affective factors, and physiological factors that act as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment." Style is an approach. This explains how individuals learn or how each person learns, because with different learning styles and learning to focus on new processes, it is very difficult to learn and study new processes. Student success in the learning process is determined by the students themselves. Applying different learning styles can help teachers adequately and maximally transfer all learning materials to students. (Azizah et al., 2023). Each student has a different learning style, such as visual, auditory, and kinesthetic, which affects how they receive, understand, and process information. The mismatch between the learning method and the student's learning style can hinder the process of understanding the material, thereby impacting low academic achievement. Therefore, understanding students' learning styles is important for educational institutions in designing more effective and adaptive learning strategies.

Student learning styles do not appear instantly, but are shaped by various factors, including family background, learning patterns, psychological conditions, and biological aspects. In a college environment, awareness of student learning styles plays a crucial role in determining teaching approaches. Education that is able to identify the learning preferences of its students can develop more appropriate and varied learning methods. Learning styles are the unique ways in which individuals capture, process, and store information. Each individual has certain learning tendencies, such as visual (learning through images and sight), auditory (learning through hearing), and kinesthetic (learning through practice and movement) (Darmawan et al., 2025). A suitable learning style will help students understand the material more easily, increase learning motivation, and encourage academic achievement. In the context of digital-based learning, students are required to be more aware of their personal learning styles so that they can adapt to online learning methods. Indicators of learning styles are:

a. *Visual:* better understands information through graphs, images, maps.
b. *Auditory:* learn more effectively through discussions, listening to explanations, and audio recordings.
c. *Reading/Writing:* preferring to learn through texts, notes, and reading books.
d. *Kinesthetic:* learning through hands-on practice, experiments, and simulations.

Achievement is the result of an activity that has been done or created, either individually or in a group. Achievement will never be given or produced as long as a person does not do an activity. In addition, academic achievement is the result of a learning activity accompanied by

a change achieved by a student, expressed in the form of interest and intelligence as a measure of the student's level of success with a standard that has been created and becomes perfection for students in thinking and acting (Rabaani & Indriyani, 2024). Academic achievement is defined as the outcome of education, the extent to which a student, lecturer, and other education participants have achieved their educational goals. It aims to measure academic achievement through dimensions such as student GPA, time spent studying, and multitasking (Trisna & Putri, 2022). Student academic achievement is a key indicator of the success of the learning process in higher education. In Asahan Regency, Generation Z students face various challenges in the academic world, such as the demand for optimal use of digital technology and adaptation to diverse learning methods.

Academic achievement is the result achieved by students from learning activities that have been followed within a certain period of time. This result is an indicator of the success of students in mastering the knowledge, skills, and competencies developed by the courses in the study program. Academic achievement has three main aspects: cognitive (the ability to think, understand, and evaluate course material), affective (attitudes, interests, motivation, and values related to the learning process), and psychomotor (practical skills or abilities acquired during lectures). At the university level, academic achievement is measured using the following standard indicators:

a. Grade Point Average (GPA), the average score of learning outcomes that reflects students' absorption capacity for the semester.
b. Cumulative Grade Point Average (CGPA), the total average score of learning outcomes obtained by students from all courses taken since the beginning of their studies until the current semester.

GPA is the main benchmark used to classify a student's level of success, often associated with graduation predicate (cum laude, very satisfactory, satisfactory). Academic achievement is the learning outcome achieved by an individual in learning activities in a school or campus environment, which can be seen from grades, cumulative grade point average (GPA), or other academic evaluations. Academic achievement is influenced by several factors, such as learning motivation, environment, learning readiness, including learning style and the ability to use technology as a learning tool. The indicators of academic achievement are academic grades (GPA, course grades, exam scores), understanding of subject matter, quality of assignments and projects, involvement in academic activities, and critical thinking and problem-solving skills(Darmawan et al., 2025). Amidst these changes, digital literacy has become a basic skill that every student must possess. Digital literacy is not only about the ability to operate technological devices, but also the ability to access, understand, evaluate, and utilize digital information critically and ethically in an academic context. This ability has proven to be very influential in the success of students in facing technology-based learning systems.

Given these conditions, this research is important to determine the influence of digital literacy and learning styles on the academic achievement of Generation Z students in Asahan. The results of this study are expected to contribute to the development of more effective learning strategies and serve as a consideration for educational institutions in improving the quality of higher education.

Based on the discussion above, it can be concluded that digital literacy and learning styles are two interrelated factors that play an important role in supporting students' academic achievement, particularly among Generation Z who have grown up in a digital environment.

Digital literacy enables students to access, evaluate, and use digital information effectively, critically, and ethically in the learning process, while learning styles influence how students receive, process, and understand academic information. A mismatch between students' digital literacy skills, learning styles, and the learning strategies applied in higher education may hinder optimal learning outcomes and lead to lower academic achievement. Therefore, an empirical study that simultaneously examines the influence of digital literacy and learning styles on the academic achievement of Generation Z students, especially in Asahan Regency, is necessary to provide a foundation for developing more adaptive, effective, and student-centered learning strategies in higher education.

METHOD

This study uses a quantitative method, which is effective in describing data-based educational phenomena that can be analyzed statistically. The population of this study consists of active students in Asahan Regency who have used AI technology in learning. In this study, data processing was carried out using SPSS (Statistical Program for Social Sciences) version 27 software. Classical assumption tests were used in this study, namely normality tests, multicollinearity tests, and heteroscedasticity tests. The hypothesis tests used were multiple linear regression tests, F tests (simultaneous), t tests (partial), and r2 tests (coefficient of determination) (Syera et al., 2025). The population in this study was all Gen Z students in Asahan Regency, while the sample was taken according to the criteria of students who actively use digital media in the learning process, have experience in online learning, either fully or partially within a certain period, have experience using digital learning platforms, and are willing to fill out the research questionnaire. The instrument used in this study was a questionnaire. This questionnaire was designed based on a 5-point Likert scale to measure the frequency of digital literacy and learning styles in relation to students' academic achievement and its impact on student learning outcomes.

RESULTS

Classical Assumption Test

A good regression model must satisfy the absence of classical assumptions in the model. If classical assumptions still exist, then the regression model has bias. The following are the results of the classical assumption test on the influence of Digital Literacy, Learning Style, and academic achievement of Gen Z students in Asahan Regency:

Normality Test

The normality test aims to test whether in the regression model, the disturbance variable or residual has a normal distribution. As is known, in this study, the normality test uses the One Sample Kolmogorov Smirnov Test. The normality test table is as follows:

Table 1. Normality Test Results

One-Sample Kolmogorov-Smirnov Test

		LAG_RES
N		59
Normal Parameters [a,b]	Mean	-.1472
	Standard Deviation	2.60382
Most Extreme Differences	Absolute	.100

	Positive	.100
	Negative	-.044
Test Statistic		.100
Asymp. Sig. (2-tailed)[c]		.200[d]

a. Test distribution is Normal.
b. Calculated from data.

Table 1 shows that the results of the normality test, namely the data on a sample of 60 respondents, indicate that the variables of digital literacy (X1) and learning style (X2) on student academic achievement (Y) are normally distributed. This is proven by the significance value exceeding the error limit of 0.200 > 0.05. Thus, the research variables are normally distributed and can proceed to the next test.

Heteroscedasticity Test

The heteroscedasticity test aims to test whether in the regression model there will be unequal variance from one observation to another. As known in this study, the heteroscedasticity test uses the Glajser test. The following table shows the heteroscedasticity test results:

Table 2. Heteroscedasticity Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.767	3.871		.457	.650
	LAG_X1	-.033	.096	-.047	-.347	.730
	LAG_X2	-.032	.079	-.054	-.401	.690

a. Dependent Variable: LAG_ABS_RES

Table 2 shows that the results of the heteroscedasticity test using the Glejzer test indicate significant values (sig.) for variable X (digital literacy, learning style, and student academic achievement), where the significant values are (0.730; 0.690) with a sig value > 0.05. Therefore, it can be concluded that there is no heteroscedasticity in the regression model.

Multicollinearity Test

The multicollinearity test aims to test whether the regression model finds correlations between independent variables. The multicollinearity test table is as follows:

Table 3. Multicollinearity Test Results

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	LAG_X1	.993	1.007
	LAG_X2	.993	1.007

a. Dependent Variable: LAG_Y

Table 3 shows that the regression model does not experience multicollinearity. This can be seen in the tolerance values of each variable, which are greater than the default value of 0.10. Meanwhile, the VIF values are also below 10. Therefore, it can be concluded that there is no multicollinearity between the independent variables in the regression model.

Hypothesis Testing

Multiple Linear Regression Test

Multiple linear regression analysis aims to determine the effect of independent variables, namely Digital Literacy (X1) and Student Learning Style (X2), on the dependent variable, namely Student Academic Achievement (Y). The regression test results are as follows:

Table 4. Multiple Linear Regression Test Results
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.180	4.056		2,017	.049
	LAG_X1	.026	.100	.024	.259	.796
	LAG_X2	.683	.086	.730	7.937	<.001

a. Dependent Variable: LAG_Y

Table 4 shows that the results of multiple linear regression tests can be used to create the following linear regression equation: Y = **8.180 + 0.026X1 + 0.683X2**. The meaning of this multiple linear regression equation is as follows:

a. The constant value of 8.180 indicates that if the values of *the Digital Literacy* (X1) and Learning Style (X2) variables are 0 or do not increase, the value of the Student Academic Achievement (Y) variable will remain at 8.180. This indicates that there are other factors that influence student academic achievement besides digital literacy and learning style.

b. The regression coefficient of *the Digital Literacy* (X1) variable is 0.026, which shows that for every 1% increase in the *Digital Literacy* (X1) variable, the Student Academic Achievement (Y) variable will increase by 0.026%.

c. The regression coefficient of the Learning Style variable (X2) is 0.683, which indicates that for every 1% increase in the Learning Style variable (X2), the Student Academic Achievement variable (Y) will increase by 0.683%.

F Test (Simultaneous Test)

The F test basically shows whether the independent or free variables included in the model have a combined effect on the dependent variable. The results of the F test can be seen in the following table:

Table 5. F Test Results (Simultaneous Test)
ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	517.245	2	258,623	31,580	<.001[b]
	Residual	458,605	56	8,189		

	Total	975,851	58			

a. Dependent Variable: LAG_Y

b. Predictors: (Constant), LAG_X2, LAG_X1

Table 5 shows that in column df 1 = 2 and df 2 = 56, the f table obtained is ftabel (2;56) of 3.16. From this table, it can be seen that the fhitung value is 31,580, which is greater than ftabel (3.16), and the significance value is 0.001 (<0.005). This means that the independent variables consisting of Digital Literacy (X1) and learning style (X2) simultaneously (together) have a positive and significant effect on the dependent variable, namely Student Academic Achievement (Y). This shows that the regression model in this study is truly acceptable and can be used for prediction.

t-test (Partial Test)

The t-test is used to determine whether Digital Literacy (X1) and Learning Style (X2) partially have a significant effect on Student Academic Achievement (Y). The test uses a significance level of 0.05. The results of the t-test can be seen in the following table:

Table 6. Results of the t-test (Partial Test)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.180	4.056		2,017	.049
	LAG_X1	.026	.100	.024	.259	.796
	LAG_X2	.683	.086	.730	7.937	<.001

a. Dependent Variable: LAG_Y

Table 6 shows the explanation of each variable in the partial test as follows:

a. The t-value for *Digital Literacy* is 0.259 and the t-table value is 1.67203, meaning that t-value < t-table, i.e., 0.259 < 1.67203. The significance value for *Digital Literacy is 0.796 >* 0.05. This means that the *Digital Literacy* variable has no partial effect and is not significant on Student Academic Achievement.

b. The t-value for Learning Style is 7.937 and the t-table value is 1.67203, meaning that t-value > t-table, i.e., 7.937 > 1.67203. The significance value of Student Academic Achievement is 0.000 < 0.05. This means that Learning Style partially has a positive and significant effect on Student Academic Achievement.

R^2 Test (Coefficient of Determination Test)

The Coefficient of Determination (R^2) essentially measures the extent to which the model is able to explain the variation in the dependent variable. The coefficient of determination value is between zero and one. A small R^2 value means that the ability of the dependent variables is very limited. A value close to one means that the independent variables provide almost all the information needed to predict the variation in the dependent variable. The coefficient of determination values can be seen in the following table:

Table 7. Results of the Coefficient of Determination Test (R^2 Test)

Model Summary[b]

Model	R	R Square	Adjusted R-Square	Standard Error of the Estimate
1	.728[a]	.530	.513	2.86171

a. Predictors: (Constant), LAG_X2, LAG_X1
b. Dependent Variable: LAG_Y

Table 7 shows that the coefficient of determination test R2 shows that the correlation or relationship (R) value is 0.728. From this output, the coefficient of determination (R^2) is 0.530, which means that the influence of variable (X1), Student Learning Style (X2) on Student Academic Achievement (Y) is 47%, and the remaining 53% is influenced by other variables.

DISCUSSION

The Influence of *Digital Literacy* (X1) on Student Academic Achievement (Y)

Digital literacy is an individual's ability to understand, use, evaluate, and create information through digital technology effectively and responsibly. Digital literacy not only includes technical skills in using digital devices but also concerns understanding content, cyber security, and communication ethics in the virtual world. Based on the results of calculations and data analysis conducted by the researcher, the t-value for Digital Literacy is 0.259 and the t-table value is 1.67203, meaning that t-value > t-table, i.e., 0.259 < 1.67203. The significance value of Digital Literacy is 0.092 < 0.05. This means that the variable of digital literacy does not have a positive and significant partial effect on student academic achievement. Although partially, the variable of digital literacy does not have a significant effect on student academic achievement, the positive direction of the relationship indicates that an increase in X tends to increase Y. These research results are in line with previous studies conducted (Darmawan et al., 2025) entitled "The Influence of Digital Literacy and Learning Styles on Student Academic Achievement in the Era of Learning" which shows that both digital literacy and learning styles have a positive and significant effect on student academic achievement, both partially and simultaneously. These findings indicate that students' ability to access, understand, and use digital technology, as well as their awareness of their personal learning styles, greatly determine their academic success in the modern learning era.

The Influence of Student Learning Styles (X2) on Student Academic Achievement (Y)

Learning styles help adjust learning strategies, increase motivation, and reduce frustration. However, the human brain is flexible, so don't get stuck on one style. The best learning styles use visual elements such as pictures, diagrams, mind maps, or videos. They make it easy to remember information presented graphically. However, student academic achievement is the end result of a long learning style process. Campuses need to know how to move students to a level of readiness for relevant learning styles. Based on the calculations and data analysis conducted by the researcher, the t-value for Learning Style is 7.937 and the t-table value is 1.67203, meaning that t-value > t-table, i.e., 7.937 > 1.67203. The significance value of Student Academic Achievement is 0.000 < 0.05. This means that the Student Learning Style variable has a partial positive and significant effect on Student Academic Achievement. These research results are in line with the research conducted by (Dawenan et al., 2024) entitled "The Relationship Between Learning Style and the Cumulative Grade Point Average (CGPA) of Pskps Fkik Ulm Students". The results show a significant relationship between learning style and student CGPA.

CONCLUSION

The conclusion of this study is:
1. The independent variables consisting of *Digital Literacy* (X1) and Learning Style (X2) simultaneously (together) influence the dependent variable, namely Student Academic Achievement (Y).

2. The *Digital Literacy* variable (X1) partially has no significant effect on Student Academic Achievement (Y). However, the positive direction of the relationship indicates that an increase in X tends to increase Y.

3. The Learning Style variable (X2) partially has a positive and significant effect on Student Academic Achievement (Y). The more learning styles provided, the more students will improve their Academic Achievement.

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