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EXAMINING OF LECTURER INTERACTION, DIGITAL LITERACY, AND VISUAL MEDIA ON STUDENT LEARNING OUTCOMES: THE KEY ROLE OF LEARNING MOTIVATION AS A MEDIATION VARIABLE

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Abstract: This study examined of lecturer interaction on students' learning outcomes, with learning motivation serving as a mediating variable. The research employed a quantitative explanatory design using Partial Least Squares Structural Equation Modeling (PLS-SEM). The study was conducted in the Tadris Ilmu Pengetahuan Alam (TIPA) Study Program at UIN Syekh Wasil Kediri and involved 22 fifth-semester students selected through total sampling. Data were collected using a five-point Likert-scale questionnaire measuring lecturer interaction, learning motivation, and learning outcomes. The results showed that lecturer interaction did not have a significant direct effect on students' learning outcomes. However, lecturer interaction had a significant positive effect on learning motivation, and learning motivation significantly influenced learning outcomes. The mediation analysis further revealed that learning motivation significantly mediated the relationship between lecturer interaction and learning outcomes. These findings indicate that lecturer interaction contributes to student learning outcomes indirectly by strengthening learning motivation. The study highlights the importance of creating meaningful lecturer–student interaction in higher education as a way to foster student motivation and improve academic achievement. Therefore, efforts to enhance learning outcomes should focus not only on instructional delivery but also on building supportive and motivating academic interactions.

Keywords: Interaction Lecturer, Digital Literacy, Visual Media, Motivation Learning, Results Learn, SmartPLS

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INTRODUCTION

Higher education is undergoing significant transformation, particularly with the growing integration of digital technology and interactive learning environments into teaching and learning practices. Students no longer rely solely on conventional lectures as their primary source of knowledge, but are expected to engage actively in more dynamic and student-centered learning processes (Sya'bani et al., 2025). In the Science Education Study Program at UIN Syekh Wasil Kediri, learning demands are increasingly complex because students are required not only to understand abstract scientific concepts, but also to think critically and apply their knowledge in practical contexts. These conditions require learning strategies that do more than simply transmit information; they must also promote active student involvement through meaningful academic interaction (Lalufiansyah & Ariyanto, 2023).

Interaction between lecturers and students is one of the essential factors in the success of learning in higher education. Effective lecturer–student interaction does not merely involve the delivery of course material, but also contributes to the creation of a supportive learning environment, strengthens students' motivation, and enhances conceptual understanding (Lahagu et al., 2025). Students who are involved in two-way communication with their lecturers tend to be more confident, more active in asking questions, and more capable of constructing knowledge independently. However, many learning practices in higher education still remain one-directional, with lecturers dominating the instructional process and students positioned as passive recipients of information (Lalufiansyah & Ariyanto, 2023). Such conditions may reduce student engagement, weaken learning motivation, and eventually affect learning outcomes.

Learning motivation plays a central role in determining students' academic achievement. It reflects the internal drive that encourages students to participate actively, persist in completing academic tasks, and remain focused on learning goals (Uruk, 2021). Students with high learning motivation are generally more diligent, more engaged in classroom activities, and more likely to achieve better learning outcomes. In this regard, lecturer interaction may not always influence learning outcomes directly, but it can strengthen students' motivation, which in turn contributes to improved academic performance. Therefore, learning motivation can be understood as an important mediating factor in the relationship between lecturer interaction and student learning outcomes.

Although previous studies have discussed lecturer–student interaction and learning motivation in various educational contexts, research examining the mediating role of learning motivation in explaining the relationship between lecturer interaction and learning outcomes among science education students at UIN Syekh Wasil Kediri remains limited. This gap is

important because understanding how lecturer interaction contributes to students' academic performance through motivational processes may provide a more precise explanation of learning success in higher education.

Based on this background, this study aims to analyze the effect of lecturer interaction on students' learning outcomes, with learning motivation serving as a mediating variable. This study is expected to contribute to the development of more effective learning strategies by emphasizing the importance of constructive lecturer–student interaction in strengthening motivation and improving academic achievement. In addition, the findings are expected to provide practical implications for lecturers and higher education institutions in designing more responsive and student-centered learning processes.

Although previous studies have shown that teacher-related factors play an important role in shaping students' academic motivation and development, the available evidence still does not clearly explain how lecturer interaction influences learning outcomes through learning motivation as a mediating mechanism. Asadpour et al. (2025) demonstrated in their systematic review that teacher-related factors consistently affect students' academic motivation, while García et al. (2023) found that university students' perceptions of teacher behavior and credibility significantly predict their state motivation. In a related higher-education study, Mattanah et al. (2024) reported that faculty–student rapport was positively associated with student engagement and deep learning, with engagement functioning as a mediator. However, these studies have generally focused on adjacent constructs such as teacher credibility, rapport, engagement, satisfaction, or broader learning approaches rather than directly examining the mediation pathway linking lecturer interaction, learning motivation, and learning outcomes. In addition, the recent higher-education evidence cited here has mostly been drawn from broad university populations rather than from more specific disciplinary contexts such as science education. Therefore, a more context-specific and theoretically focused examination is still needed, particularly in the context of Indonesian Islamic higher education.

METHOD

Research Design

This study employed a quantitative explanatory design to examine the relationship between lecturer interaction, learning motivation, and student learning outcomes. The study specifically tested whether learning motivation mediated the effect of lecturer interaction on learning outcomes. To analyze the proposed relationships, the study used Partial Least Squares Structural Equation Modeling (PLS-SEM). This approach was selected because it is suitable

for examining predictive relationships among latent constructs and for testing mediation in a relatively small sample.

Participants and Research Setting

The study was conducted in the Tadris Ilmu Pengetahuan Alam (TIPA) Study Program at UIN Syekh Wasil Kediri, Indonesia. The participants were fifth-semester students enrolled in the program during the period of data collection. A total of 22 students participated in the study. Because the population was limited, the study applied a total sampling technique, in which all accessible members of the target population were included as respondents.

The sample size was determined based on the minimum-sample guideline commonly used in PLS-SEM, namely the 10-times rule. This rule suggests that the minimum sample should be at least 10 times the largest number of structural paths directed at any endogenous construct in the model. In the present study, the most complex endogenous construct was learning outcomes, which received two direct paths, namely from lecturer interaction and learning motivation. Based on this rule, the minimum required sample size was 20 respondents. Since this study involved 22 students, the sample met the minimum requirement for estimating the PLS-SEM model. However, this rule provides only a minimum threshold and does not guarantee strong statistical power. Therefore, the findings should be interpreted with caution and considered exploratory in nature

Variables and Measurement

This study involved three main variables: lecturer interaction as the independent variable, learning motivation as the mediating variable, and learning outcomes as the dependent variable. Lecturer interaction refers to the quality of academic communication and interaction between lecturers and students during the learning process. This construct included indicators such as clarity of communication, responsiveness to students' questions, feedback, and lecturer involvement in classroom learning. Learning motivation refers to students' internal drive to engage in learning activities, persist in completing academic tasks, and achieve learning goals. This variable included indicators related to persistence, interest in learning, and willingness to participate actively in academic activities. Learning outcomes refer to students' perceived academic achievement and understanding of course content. This construct included indicators related to conceptual understanding, academic performance, and learning achievement.

Variables study consists of on three group, namely **variables free, variable mediation, and variables bound**, which is explained with indicator main each as shown in **Table 1**.

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Table 1. Variables, Types, and Indicators

Type Variables	Variable Name	Key Indicators
Variables Free	Interaction Lecturer	Communication, feedback back, involvement
Variables Mediation	Motivation Study	Motivation intrinsic, extrinsic, persistence Study
Variables Bound	Learning outcomes	Academic grades, understanding concepts, skills

In a way more detailed, indicators each variables and sources academic presented in **Table 2**, which is base operationalization draft study this.

Table 2. Indicators Research and Resources Academic

Variables	Key Indicators	Source Academic / Journal
Interaction Lecturer	a. Verbal & nonverbal communication styles b. Attitude friendly & empathetic c. Involvement in discussion d. Response to question e. Support academic	Nurhidayah, Y., & Nurhayati, E. (2021). *Interaction Lecturers and Students in Online Learning*. Journal of Education, 12(2), 45–56.
Learning outcomes Science students	a. Academic grades b. Understanding science concept c. Ability think scientific Implementation draft in practice d. Participation active in learning	Syofyan, H. (2018). *Analysis of Learning Styles and Motivation on Science Learning Outcomes*. Journal of Education, 9(1), 55–64.
Motivation Learning (Mediation)	a. Motivation intrinsic b. Perseverance Study c. Objective clear learning d. Interest to material e. Need will achievement	Ghaybiyyah, N. (2021). *The Influence Motivation Study to Performance Academic Students*. Syntax Idea, 3(6), 112–120.

Research data collected use **questionnaire closed with Likert scale 1–5**, which has tested its validity through **outer loading (>0.7)** and **AVE (>0.5)**. Reliability instrument tested with **composite reliability (>0.7)** and **Cronbach's alpha (>0.7)** For ensure internal consistency of the instrument measurement. Data analysis was carried out through two Stages. First, **test the measurement model (outer model)** For evaluate validity indicators and constructs, as well

as reliability construct. Second, **test the structural model (inner model)** For evaluate influence variables free to variables bound and role mediation motivation study. Test this covering **R-square** For see contribution variables free , **path coefficient** For measure influence direct and No direct intervariable, and **bootstrapping** for know significance (t- statistics and p-value) (Juniarty & Wijayanti , 2025) .

Before testing the structural relationships, the measurement model was evaluated to ensure that all constructs met the required standards of validity and reliability. Convergent validity was assessed at both the indicator and construct levels. At the indicator level, outer loading values were examined, with values of 0.70 or higher considered ideal. However, indicators with loadings between 0.60 and 0.70 were still considered acceptable when the construct showed adequate Average Variance Extracted (AVE) and composite reliability. At the construct level, convergent validity was confirmed when the AVE value exceeded 0.50, indicating that the construct explained more than half of the variance of its indicators.

Discriminant validity was assessed using the Fornell-Larcker criterion by comparing the square root of the AVE for each construct with its correlations with other constructs. A construct was considered to have adequate discriminant validity when the square root of its AVE was greater than its correlations with other constructs, indicating that the construct was empirically distinct from the others.

Reliability was evaluated using Cronbach's alpha and composite reliability. A value above 0.70 for both measures indicated satisfactory internal consistency. Composite reliability was emphasized because it is considered more appropriate for PLS-SEM in assessing the consistency of latent construct measurement. During the outer model evaluation, indicators with low loading values were reviewed and removed gradually when necessary. The model was then re-estimated until all retained indicators and constructs met the minimum thresholds for validity and reliability. After the measurement model was confirmed, the inner model was assessed using R-square, path coefficients, and bootstrapping to test the significance of direct and indirect effects.

Based on framework research, the hypothesis proposed is: **H1.** Lecturer interaction has a positive effect on students' learning outcomes. **H2.** Lecturer interaction has a positive effect on students' learning motivation. **H3.** Learning motivation has a positive effect on students' learning outcomes. **H4.** Learning motivation mediates the relationship between lecturer interaction and students' learning outcomes.

FINDING AND DISCUSSION

Study This involving 22 students of the Study Program Tadris Knowledge Knowledge Nature (TIPA) class of 2023 at the State Islamic University of Syekh Wasil Kediri. Characteristics respondents served based on type gender and origin school for give description beginning about background behind subject study.

Table 3. Characteristics Respondents Based on Type Sex

Type Sex	Amount	Presentation
Man	6	27.3%
Woman	16	72.7%
Total	22	100%

Based on Table 3, majority respondents various sex Woman by 72.7%, while man by 27.3%. Dominance student Woman This show trend height participation Woman in field science education. Conditions this can also influence dynamics learning, especially in matter interaction, motivation, and engagement in the academic process.

Table 4. Characteristics Respondents Based on Origin School

Origin School	Amount	Percentage
Senior High School	8	36.4%
Vocational School	2	9.1%
MAN	6	27.3%
MA	6	27.3%
Total	22	100%

Based on Table 4, respondents originate from background behind diverse education, namely SMA (36.4 %), MAN (27.3%), MA (27.3%), and SMK (9.1%). Diversity This show that student own experience different learning before enter college high. High school and MAN graduates generally own base more theoretical strong, whereas vocational school graduates tend to own experience learn more applicable. Difference This potential influence method student in understand material, interact with lecturers, and utilizing learning media.

Analysis results descriptive show that all over variables study is in the category Good to very good. Interaction lecturer get average score of 4.35 (very good), which indicates that lecturer has capable build effective communication, providing chance discussion, as well as respond question student in a way active. Digital literacy is acquired score 4.10 (good), which indicates that student Enough capable in utilise digital technology in learning, even though Still need improvement in evaluate source information in a way critical. Visual media acquires score

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4.40 (very good), which indicates that the use of media such as video and animation is very helpful in increase understanding Students. Learning outcomes and motivation learn each one acquires scores of 4.25 and 4.30 which are included very good category, showing that student own achievements academic and encouragement high learning.

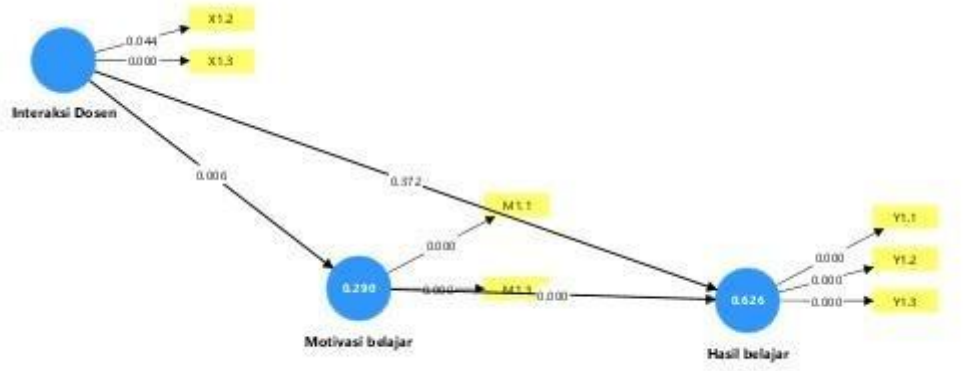


Figure 1. Research Model Construct Final Stage

Based on **Figure 1**, it can be seen that interaction lecturer own influence to motivation learning and motivation Study influential to results Study students. Besides that, motivation learning also plays a role as variables mediation that connects variables interaction lecturer with results learn. This is show that improvement results Study No happen in a way direct through interaction lecturer, but through improvement motivation Study student.

Next, the results testing validity indicator shown in Table 5. At this stage measurement model testing, carried out evaluation to validity and reliability indicators. Some indicators that are not fulfil loading factor value ≥ 0.5 is eliminated for get a better model good. After it is done iteration, the final model is obtained which meets the requirements criteria validity and reliability.

Table 5. Final Stage Loading Factor Values

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
M1.1 <- Motivation Study	0.910	0.903	0.060	15,297	0.000
M1.3 <- Motivation Study	0.927	0.928	0.048	19,500	0.000
X1.2 <- Interaction Lecturer	0.669	0.612	0.333	2.011	0.044
X1.3 <- Interaction Lecturer	0.884	0.821	0.241	3,662	0.000
Y1.1 <- Learning outcomes	0.917	0.899	0.078	11,783	0.000
Y1.2 <- Learning outcomes	0.893	0.881	0.068	13,139	0.000
Y1.3 <- Learning outcomes	0.830	0.829	0.084	9,861	0.000

Based on **Table 5**, all indicator own loading factor value is above 0.5 so that declared valid in represent latent variable. The most dominant indicator in the variable motivation Study reflect students' perseverance and internal drive in finish task. On the variable interaction lecturer, indicator dominant show involvement active lecturer in the learning process. Meanwhile that, on the variable results learning, indicators dominant reflect ability student in understand and master concept. This is show that internal student factors and quality interaction learning own role important in determine results Study. Next, testing validity discriminant done use mark AVE root for ensure that every construct own good ability in differentiate himself with construct other.

Table 6. AVE Root Value of Construct

	Learning outcomes	Interaction Lecturer	Motivation Study
Learning outcomes	0.881		
Interaction Lecturer	0.552	0.784	
Motivation Study	0.775	0.538	0.919

Based on **Table 6**, values AVE root of each construct more big compared to with correlation between construct others. This is show that the model has fulfil discriminant validity criteria, so that every latent variables are capable explain the indicators in a way specific without happen overlapping overlap between construct. Evaluation of structural models done for know strength connection between variables in the research model.

Table 7. R-Square Value

	R-square	Information
Learning outcomes	0.626	62.6 % of the Learning Outcomes variable can explained by variables *Interaction Lecturers* and *Motivation Study*, while the remaining 37.4% explained by other factors outside the research model.
Motivation Study	0.290	As much as 29% of the variables Motivation Study can explained by variables *Interaction Lecturers*, while the remaining 71% explained by other factors that are not entered in the research model.

Based on **Table 7**, the R-square value of 0.626 shows that variables results Study can explained by the interaction lecturers and motivation Study by 62.6%, while the rest influenced by other factors outside the model. While that, the R-square value is 0.290 for the variable motivation Study show that variables This influenced by interactions lecturer by

29%. This is show that the model has ability sufficient explanation well, though Still there is other factors that have not been entered in study.

Table 8. f-Square Value

	Learning outcomes	Interaction Lecturer	Motivation Study
Learning outcomes			
Interaction Lecturer	0.068		0.408
Motivation Study	0.857		

Based on **Table 8**, it is known that interaction lecturer own weak influence to results learn, but own strong influence to motivation learning. On the other hand, motivation Study own very strong influence to results learn. This is show that motivation Study is factor the main determining factor success academic student. Testing hypothesis done for know connection between variables in the research model.

Table 9. Path Coefficients

	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Interaction Lecturer -> Learning outcomes	0.213	0.894	0.372
Interaction Lecturer -> Motivation Study	0.195	2,759	0.006
Motivation learning -> Learning outcomes	0.148	4,546	0.000

Based on **Table 9**, it is known that interaction lecturer No influential significant to results Study in a way directly. This is show that interaction lecturer Not yet capable in a way direct increase results Study without existence support internal factors of students. However, the interaction lecturer influential significant to motivation learning, which means the more good the interactions that are established, the more tall motivation Study students. Besides that, motivation learning also has an effect significant to results learning, which shows that student with motivation tall tend own achievements more academic Good.

Hypothesis testing was conducted to examine the direct and indirect relationships among the variables in the proposed structural model. The results showed that lecturer interaction did not significantly affect learning outcomes directly, but it significantly influenced learning motivation. In addition, learning motivation had a significant effect on learning outcomes and significantly mediated the relationship between lecturer interaction and learning outcomes.

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Table 10. Summary of Hypothesis Testing Results

Hypothesis	Decision	Conclusion
H1: Lecturer interaction has a positive effect on students' learning outcomes.	**Rejected**	Lecturer interaction does not have a significant direct effect on students' learning outcomes.
H2: Lecturer interaction has a positive effect on students' learning motivation.	**Supported**	Lecturer interaction has a significant positive effect on students' learning motivation.
H3: Learning motivation has a positive effect on students' learning outcomes.	**Supported**	Learning motivation has a significant positive effect on students' learning outcomes.
H4: Learning motivation mediates the effect of lecturer interaction on students' learning outcomes.	**Supported**	Learning motivation significantly mediates the relationship between lecturer interaction and students' learning outcomes.

Table 10 summarizes the results of hypothesis testing in the structural model. The findings indicate that lecturer interaction did not have a significant direct effect on students' learning outcomes, as shown by the t-value of 0.894, which is lower than the critical value of 1.645. Therefore, H1 was rejected. This result suggests that lecturer interaction alone was not sufficient to directly improve students' learning outcomes.

However, lecturer interaction had a significant positive effect on students' learning motivation, with a t-value of 2.759, which exceeded the critical value of 1.645. Thus, H2 was supported. This finding implies that better interaction between lecturers and students can strengthen students' motivation to learn. Furthermore, learning motivation showed a significant positive effect on students' learning outcomes, as indicated by the t-value of 4.546, which was higher than 1.645. Therefore, H3 was supported. This means that students with higher learning motivation tended to achieve better learning outcomes.

In addition, the mediation test showed that learning motivation significantly mediated the relationship between lecturer interaction and learning outcomes, with a t-value of 2.291, which was greater than the critical value of 1.645. Accordingly, H4 was supported. This result confirms that lecturer interaction contributes to students' learning outcomes indirectly by enhancing their learning motivation. Overall, the findings demonstrate that learning motivation

plays a central mediating role in connecting lecturer interaction with students' learning outcomes.

CONCLUSION

Based on results research, can concluded that results Study student influenced by interactions lecturers, digital literacy, and visual media with motivation Study as variables mediation main. Interaction lecturer No influential direct to results learn, but influential significant to motivation learn. This is show that effectiveness interaction lecturer lies in its ability in increase motivation students. Digital literacy has an impact positive to results study, good in a way direct and through motivation study. Meanwhile that, visual media is influential to results Study in a way No direct through motivation learn. This is show that utilization technology and learning media will more effective if capable push internal motivation of students. Motivation Study become factor the most dominant key in increase results learn. Therefore that, the increase quality learning need focused on strengthening motivation Study through effective interaction, utilization digital literacy, as well as use of interesting and relevant visual media

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