

The Effect of Multimedia Use and Teaching Methods on Learning Motivation in Islamic Astronomy among Students at a Modern Islamic Boarding School

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Abstract

This study examines the influence of multimedia use and teaching methods on students' motivation to learn Islamic astronomy (Ilmu Falak) at Pondok Pesantren Modern Islam Assalaam Surakarta, Indonesia. Ilmu Falak is a discipline that integrates religious doctrine, mathematical computation, and empirical astronomical observation, making it one of the more demanding subjects in the Islamic boarding school curriculum. A quantitative survey approach was employed with 44 students selected through simple random sampling from a population of 80 students who actively participated in the Ilmu Falak program. Data were collected using a 50-item Likert-scale questionnaire and analyzed through multiple linear regression, incorporating validity and reliability testing, normality, linearity, heteroscedasticity, and multicollinearity checks. Results indicate that multimedia use has a positive and statistically significant effect on learning motivation ($t = 2.773$, $p = 0.008$), whereas teaching methods show a positive but statistically non-significant effect ($t = 0.831$, $p = 0.411$). Tested simultaneously, both variables demonstrate a strong and significant joint effect on learning motivation ($F = 37.815$, $p = 0.000$), with a coefficient of determination of $R^2 = 0.648$, explaining 64.8 percent of the variance in motivation. These findings suggest that multimedia serves as a critical predictor of learning motivation in Ilmu Falak, most likely because visual and observational media reduce the cognitive difficulty of abstract astronomical concepts. The results carry implications for how modern pesantren should design instruction by integrating purposeful media selection with varied and dialogic pedagogical strategies.

Keywords: Multimedia learning; teaching methods; learning motivation; Ilmu Falak; pesantren; Islamic astronomy.

Received: May 13, 2026 | Revised: July 10, 2026 | Accepted: August 13, 2026

INTRODUCTION

Islamic astronomy, locally known as Ilmu Falak, occupies a distinctive position within the curriculum of Indonesian Islamic education. The subject concerns the movement and positioning of celestial bodies, particularly the sun, moon, and earth, as these relate to the determination of prayer times, the direction of the qibla, the start of Islamic months, and the prediction of eclipses. Because Ilmu Falak simultaneously draws on religious texts,

trigonometric formulas, coordinate systems, and direct sky observation, it is recognized as one of the most cognitively demanding components of the Islamic boarding school, or pesantren, curriculum.

In Indonesian society, Ilmu Falak carries practical significance that extends beyond the classroom. Debates about the sighting of the crescent moon, disagreements over qibla direction, and disputes about prayer timetables periodically surface as matters of public concern. The National Fatwa Commission of the Indonesian Council of Islamic Scholars addressed qibla direction through Fatwa MUI No. 3 of 2010, later revised as Fatwa MUI No. 5 of 2010, which clarified that qibla calculations must be based on substantive astronomical reasoning rather than a simplified westward orientation. The persistent relevance of such fatwas signals that public understanding of Ilmu Falak remains limited and that educational institutions bear a responsibility to improve it.

Within the pesantren system, Ilmu Falak is not universally taught. Neither the Ministry of Religious Affairs nor the Ministry of Education and Culture designates Ilmu Falak as a compulsory standalone subject for pesantren. Where it does appear, it is often treated as a supplementary program rather than a core course, and many students approach it with apprehension similar to that which mathematics tends to generate. This reluctance is compounded by teaching approaches that rely predominantly on verbal lecturing, insufficient media support, and limited opportunities for students to engage with observational instruments or simulation tools.

Pondok Pesantren Modern Islam Assalaam, located in Surakarta, Central Java, represents a notable exception. The institution has incorporated Ilmu Falak into its formal academic program and supports it through the Club Astronomi Santri Assalaam, a student astronomy organization established in 2005. The pesantren operates a dedicated astronomy facility, including a dome observatory with telescopes and digital learning resources. Despite this relatively robust infrastructure, preliminary observation suggests that student motivation to learn Ilmu Falak remains uneven, with some students showing strong engagement while others display avoidance behavior, including absenteeism, off-task use of laptops during class, and failure to complete assignments on time.

This pattern raises an empirical question about the relationship between institutional resources and student motivation. The availability of multimedia equipment and an observatory does not automatically translate into engaged learning. How these resources are used, and within what pedagogical framework, shapes the quality of the learning experience. Existing scholarship on Ilmu Falak education in Indonesia tends to focus on curriculum design, doctrinal debates between hisab (calculation) and rukyat (direct observation) methods, or the implementation of specific tools such as the Al-Murobba board. Comparatively few studies have tested empirically whether multimedia use and teaching methods predict student motivation to learn Ilmu Falak, particularly within a modern pesantren context that possesses an observatory.

The current study addresses this gap. Drawing on quantitative survey data collected from students at Pondok Pesantren Modern Islam Assalaam Surakarta, it tests whether multimedia use and teaching methods independently and jointly influence student motivation to learn

Ilmu Falak. The research is grounded in motivation theory, the cognitive theory of multimedia learning, and contemporary scholarship on Islamic education management. It contributes to a small but growing body of empirical work on instructional quality in pesantren-based Ilmu Falak programs.

LITERATURE REVIEW

Learning Motivation in Islamic Education

Motivation is broadly understood as an internal or external force that energizes, directs, and sustains behavior toward a specific goal. In the context of learning, motivation shapes how attentively students engage with material, how persistently they practice difficult skills, and how willingly they seek additional information beyond what is required. McDonald defines motivation as an energy shift within the person that is expressed through feeling and triggered by a goal (Sardiman, 2011). This definition captures three essential properties: the energizing function, the affective dimension, and the goal orientation of motivated behavior.

Theories of motivation commonly distinguish between intrinsic and extrinsic forms. Intrinsic motivation arises from within the learner, driven by genuine curiosity, the satisfaction of understanding, or the sense that a subject is personally meaningful. Extrinsic motivation is generated by external incentives such as grades, teacher approval, competition, or institutional requirements. In pesantren education, this distinction is particularly relevant because students learn within a community defined by religious obligation, peer relationships, and guidance from a kiai (teacher-scholar). Both intrinsic and extrinsic motivational sources operate simultaneously, and neither form is inherently superior when the goal is sustained learning engagement (Purwanto, 2013).

Self-Determination Theory, developed by Deci and Ryan, provides a useful framework for understanding motivation in this context. The theory holds that autonomous, sustained motivation is most likely when three basic psychological needs are met: autonomy, competence, and relatedness. Autonomy refers to the learner's perception that their learning activities have personally meaningful reasons. Competence refers to the experience of gradually mastering challenging material. Relatedness refers to feeling connected to, guided by, and valued by teachers and peers (Ryan and Deci, 2000). In Ilmu Falak learning, these needs are particularly relevant because the subject is technically demanding, its practical value for religious life is significant, and the quality of interaction between kiai and student can greatly influence the learning atmosphere.

In the specific context of Islamic boarding schools, motivation to learn Ilmu Falak is best understood as a multidimensional construct. It encompasses not only a student's personal interest in astronomy but also their readiness to engage with abstract mathematical reasoning, their confidence in using observational instruments, and their sense of the subject's relevance to their daily religious practice. Research suggests that students who understand how Ilmu Falak connects to prayer times, fasting calendars, and qibla orientation are more likely to perceive the subject as meaningful and therefore more likely to sustain effort when content becomes difficult (Sardiman, 2011).

Multimedia in Learning

Multimedia is broadly defined as the use of computers to present and integrate text, sound, images, animation, and video so that users can navigate, interact, create, and communicate (Vaughan, cited in Bintaro, 2015). In educational settings, the most theoretically significant definition comes from Mayer (2001), who describes multimedia learning as receiving instruction through words and pictures simultaneously. Mayer's Cognitive Theory of Multimedia Learning rests on three foundational assumptions. First, humans process verbal and visual information through separate cognitive channels. Second, each channel has a limited processing capacity. Third, meaningful learning requires active cognitive engagement in the form of selecting relevant information, organizing it into coherent structures, and integrating it with prior knowledge.

These assumptions have important practical consequences for instructional design. Adding more visual elements to a lesson does not automatically improve learning. If the visual elements are irrelevant to the learning goal, they increase cognitive load without contributing to understanding. Effective multimedia design follows principles such as coherence (removing extraneous material), signaling (highlighting essential elements), contiguity (placing explanatory words close to corresponding images), and segmentation (presenting complex material in learner-paced steps rather than all at once). These principles are especially relevant to Ilmu Falak, where students must simultaneously process concepts such as declination, azimuth, altitude, and orbital geometry (Mayer, 2001).

Ilmu Falak requires spatial reasoning abilities that most students do not develop through verbal instruction alone. A student who hears the phrase "azimuth of the sun at solar noon" without a corresponding visual representation may struggle to form an accurate mental model. Simulation software, animated orbital models, telescope demonstrations, and digital sky projections can concretize these concepts and help learners build the representational structures needed to solve practical problems. When students experience a reduction in confusion and begin to feel that previously opaque material is understandable, their confidence and motivation tend to increase (Cromley and Chen, 2012).

In the framework of Islamic educational philosophy, the use of learning media is not only permitted but encouraged as a legitimate *wasilah* (instrument) for the pursuit of beneficial knowledge. The Quran repeatedly instructs believers to observe the heavens and earth (Surah Yunus 10:101), and the tradition of Islamic science demonstrates that observation, calculation, and the use of instruments have always been integral to the study of celestial phenomena. Ibn Sina, al-Biruni, al-Khwarizmi, and other classical scholars combined rigorous empirical methods with strong religious commitment, establishing a tradition in which technology and faith are complementary rather than opposed (Izzuddin, 2012). Within this tradition, multimedia tools can be understood as contemporary instruments for the same purpose that earlier scholars pursued with astrolabes and celestial globes.

Motivational Theories and Their Relevance to Ilmu Falak Learning

Several theoretical models of motivation provide a framework for understanding student engagement with Ilmu Falak. Maslow's hierarchy of needs indicates that students whose

foundational physiological, safety, and social needs are met are better positioned to pursue higher-order educational goals such as knowledge acquisition and intellectual mastery. A well-functioning pesantren environment that provides structured daily routines, a supportive peer community, and attentive scholarly mentorship may fulfill many of these foundational needs, thereby freeing students to invest cognitive and motivational resources in demanding subjects like Ilmu Falak (Purwanto, 2013).

Expectancy-value theory offers a complementary lens, proposing that motivational engagement in a task is jointly determined by the learner's expectation of success and the perceived value of success. In Ilmu Falak, both dimensions present genuine challenges. Students may enter with low expectancy because the mathematical and observational demands of the subject exceed their previous preparation. They may also assign uncertain value to the subject if they cannot readily see how knowledge of prayer time formulas or hilal visibility criteria will be meaningful in their adult religious roles. Teaching strategies and media that make content accessible while simultaneously demonstrating its practical relevance to daily worship address both the expectancy and value components of motivation simultaneously.

Attribution theory adds a further dimension by examining how students interpret their successes and difficulties in learning. A student who attributes difficulty with Ilmu Falak computations to a fixed lack of mathematical talent is likely to disengage more readily than one who attributes the same difficulty to insufficient practice. Instructional environments that emphasize incremental mastery, celebrate progress, and frame observational and computational errors as expected steps in learning support more adaptive attributional patterns. Both teaching method and multimedia design can be understood as factors that shape the attributional context in which students interpret their learning experiences.

Teaching Methods and Learning Outcomes

Teaching methods are the structured approaches through which instructors organize content, media, interaction, and assessment in order to guide learning. They represent pedagogical decisions that shape whether students passively receive information or actively process, apply, and evaluate it. Research in educational psychology consistently shows that the choice of teaching method influences student engagement, understanding, and motivation (Hamdani, 2011).

In Ilmu Falak education, lecturing alone is insufficient because the subject requires students to move from conceptual understanding to computational skill to observational practice. A lecture that explains the formula for prayer time calculation without giving students the opportunity to work through a calculation, examine errors, or compare results with observed data misses much of what makes Ilmu Falak educationally valuable. Effective instruction in technically demanding subjects typically combines direct instruction with questioning, demonstration, problem-solving exercises, and guided practice (Djamarah and Zain, 2006).

The problem-solving method is particularly well-suited to Ilmu Falak because the subject is fundamentally about solving real religious and astronomical problems. Students who learn to identify the data needed for a qibla calculation, select the appropriate formula, perform the

computation, interpret the result, and verify against observation are engaging in exactly the kind of reasoning that Ilmu Falak demands in practice. When students experience learning as the resolution of meaningful problems, they are more likely to perceive effort as worthwhile and to maintain motivation over time (Dewey, as cited in Hamdani, 2011).

Discussion and questioning strategies also serve an important diagnostic function. Many misconceptions about Ilmu Falak arise not from a failure to listen but from prior mental models about the earth, sun, moon, and cardinal directions that are inaccurate. Direct questioning and open discussion surface these misconceptions so that they can be addressed collaboratively. A kiai who invites students to explain their understanding, predict the behavior of celestial bodies, or compare their calculation results with classmates is using teaching method as both a pedagogical strategy and a diagnostic tool.

Ilmu Falak as an Integrative Discipline

Ilmu Falak is defined as the science of studying the orbits and positions of celestial bodies, particularly the sun, moon, and earth, in relation to the performance of Islamic worship (Izzuddin, 2012). The term “falak” derives from the Arabic word for orbit and appears twice in the Quran, in Surah Yasin (36:40) and Surah al-Anbiya (21:33), both of which describe the sun and moon revolving in their respective orbits. The discipline is also known as Ilmu Hisab (the science of calculation), reflecting its primary activity of mathematical computation applied to astronomical data.

The practical scope of Ilmu Falak in Islamic jurisprudence encompasses four main domains. The first is the determination of prayer times, which are defined by solar positions such as zenith crossing, shadow length, sunset, and dawn. The second is the determination of qibla direction, which requires calculating the great-circle bearing from any location on earth to the Kaaba in Mecca. The third is the determination of the beginning of the Hijri month, which depends on the visibility of the crescent moon and involves both calculation and direct observation. The fourth is the prediction of solar and lunar eclipses, which is relevant to the Islamic practice of performing eclipse prayers (Izzuddin, 2012; Nillino as cited in Suwarno, 2011).

The integrative character of Ilmu Falak means that effective teaching requires more than transmitting formulas. Students need to understand the religious significance of what they are calculating, the mathematical reasoning that underlies each formula, the astronomical phenomena to which the formulas correspond, and the practical procedures for conducting observations or verifying computations with instruments. This complexity makes Ilmu Falak an ideal test case for examining the combined effects of multimedia and teaching method on motivation, because neither factor alone is likely to address all four dimensions of the subject.

METHODS

Research Design

This study employed a quantitative approach with a survey design. A survey method was selected because the research goal is to explain causal relationships between variables through hypothesis testing using structured questionnaire data. The research model is correlational-

explanatory, examining the degree to which multimedia use and teaching methods predict learning motivation in a naturally occurring educational context without experimental manipulation. This design is appropriate when the researcher seeks to understand relationships across a defined population using standardized measurement instruments (Sugiyono, 2015).

Research Setting and Participants

The research was conducted at Pondok Pesantren Modern Islam Assalaam Surakarta, located in Pabelan Village, Kartasura, Sukoharjo Regency, Central Java Province. The institution was founded in 1982 and currently operates multiple educational units including Madrasah Tsanawiyah (junior secondary), Madrasah Aliyah (senior secondary), Senior High School, and Vocational School. It applies a dual educational system called Majma' al Bahrain that integrates formal schooling with residential Islamic education.

The selection of this setting was motivated by several considerations. Pondok Pesantren Modern Islam Assalaam has a formal Ilmu Falak program supported by the Club Astronomi Santri Assalaam (CASA), established in 2005. The institution has a dedicated Dome Astronomy facility, laboratory space, and digital learning infrastructure, making it one of the relatively few pesantren with a comprehensive infrastructure for Ilmu Falak education. This context makes it an appropriate site for testing the relationship between multimedia use, teaching methods, and student motivation in a natural educational environment.

The population consisted of 80 students enrolled in the Ilmu Falak program at the time of the study. The sample was determined using the Slovin formula with a margin of error of 10 percent, yielding a minimum sample size of 44 respondents. Simple random sampling was employed, giving all members of the population an equal probability of being selected. The final sample of 44 students included respondents aged 13 to 18 years, with the majority being 17 years old (29.5 percent of the total). Male respondents constituted 61.4 percent (27 students) and female respondents 38.6 percent (17 students). By school grade, the largest group came from Grade XI (43.2 percent), followed by Grade IX (27.3 percent), Grade XII (18.2 percent), Grade VIII (9.1 percent), and Grade X (2.3 percent).

Instrumentation

Data were collected using a self-administered questionnaire consisting of 50 items distributed across three variables. The multimedia use variable (X1) was measured by 20 items covering six dimensions: familiarity with information and communication technology tools, the capacity of media to provide new and engaging learning experiences, the role of media in helping students keep pace with scientific and technological developments, the ability of media to stimulate learning motivation, the function of media in supporting the formation of mental models of abstract concepts, and the degree to which media reflects contemporary technological progress. These dimensions were adapted from frameworks proposed by Ariani and Haryanto (2010).

The teaching methods variable (X2) was measured by 15 items covering six dimensions: the quality of content delivery, the competence of the kiai as an instructor, student readiness to engage with applied methods, availability of learning resources and facilities, the learning

environment, and time management in instruction. These dimensions were adapted from Djamarah and Zain (2006). The learning motivation variable (Y) was also measured by 15 items organized into intrinsic dimensions (aspiration, desire, goal orientation, and felt need) and extrinsic dimensions (dynamic elements of teaching, content mastery, teaching skill, and conditions of the instructor). These dimensions were adapted from Sardiman (2011).

All items used a four-point Likert scale with response options ranging from Strongly Disagree (1) to Strongly Agree (4). The decision to use a four-point scale rather than a five-point scale was made deliberately to prevent midpoint responses that might obscure directional attitudes. Before the main data collection, the instrument was piloted and subjected to validity and reliability testing. Validity was assessed using Pearson product-moment correlation coefficients, with items retained when their *r*-value exceeded the critical value at the specified significance threshold. Reliability was assessed using Cronbach's Alpha, with values above 0.70 considered acceptable for educational research instruments.

Data Analysis

Data analysis proceeded in two stages. The first stage involved descriptive statistics, including means, standard deviations, minimum and maximum scores, and frequency distributions for each variable. The second stage involved inferential statistics using multiple linear regression. Before regression was performed, four classical assumption tests were conducted. Normality of residuals was assessed using the Kolmogorov-Smirnov test and the Shapiro-Wilk test. Linearity was assessed using the deviation from linearity approach. Heteroscedasticity was assessed using the Glejser test, which regresses the absolute values of residuals against the independent variables. Multicollinearity was assessed using Variance Inflation Factor values and tolerance statistics.

Hypothesis testing involved three procedures. The partial influence of each independent variable on learning motivation was tested using *t*-tests, with a two-tailed significance threshold of 0.05. The simultaneous influence of both independent variables was tested using an *F*-test at the same significance level. The proportion of variance in learning motivation explained by the combined model was assessed using the coefficient of determination (R^2). All calculations were performed using SPSS version 21.0. Throughout the analysis, interpretations were guided by the substantive meaning of the coefficients rather than the statistical values alone, in order to ensure that the findings could be translated into meaningful recommendations for educational practice.

RESULTS

Descriptive Statistics

Table 1 presents the descriptive statistics for all three variables across the 44 respondents. All cases were complete, with no missing data, confirming that the dataset was suitable for further analysis.

Table 1. Descriptive Statistics for the Three Variables

Variable	N	Min	Max	Mean	Std. Dev.
Multimedia Use (X1)	44	181	280	216.11	22.336
Teaching Methods (X2)	44	175	276	214.39	22.360

Learning Motivation (Y)	44	178	280	219.64	21.579
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The mean score for multimedia use was 216.11 (SD = 22.336), suggesting that students generally perceived multimedia as present and beneficial in their Ilmu Falak learning. The relatively small standard deviation indicates a degree of homogeneity in students' perceptions of multimedia, meaning that most students shared a broadly similar experience with learning media. The mean for teaching methods was 214.39 (SD = 22.360), slightly lower than multimedia, reflecting a moderately positive assessment of the pedagogical approaches used by the kiai. The standard deviation for teaching methods was comparable to that of multimedia, indicating a similar level of variability across respondents. Learning motivation registered the highest mean at 219.64 (SD = 21.579), with a relatively small standard deviation, suggesting that the majority of students maintained a reasonably consistent and positive motivational orientation toward Ilmu Falak study.

Classical Assumption Tests

The normality of residuals was tested using both the Shapiro-Wilk test (appropriate for samples below 50) and the Kolmogorov-Smirnov test. The Kolmogorov-Smirnov statistic was 0.540 with an asymptotic significance of 0.932, well above the threshold of 0.05. The Shapiro-Wilk significance was 0.576, also above 0.05. Both tests confirm that the residuals of the regression model are normally distributed, satisfying a fundamental assumption for valid inference.

Linearity was tested by examining the deviation from linearity statistic for each predictor. For multimedia use, the significance of deviation from linearity was 0.255, exceeding 0.05. This result indicates that the relationship between multimedia use and learning motivation does not depart significantly from a linear form, justifying the use of linear regression for this predictor. A comparable result was obtained for teaching methods, supporting the linearity assumption across both predictors.

Heteroscedasticity was examined using the Glejser test. In this test, the absolute residuals were regressed against the two independent variables. Multimedia use yielded a coefficient of -0.120 with a significance of 0.373, and teaching methods yielded a coefficient of 0.137 with a significance of 0.309. Both significance values exceed 0.05, confirming that there is no significant pattern of heteroscedasticity in the model. The variance of residuals is constant across levels of the predictors, which supports the stability of the regression coefficients.

Multicollinearity was assessed using tolerance and Variance Inflation Factor values. Both multimedia use and teaching methods produced a tolerance value of 0.166 and a VIF of 6.009. While the VIF approaches the commonly cited upper reference of 10, it remains below that threshold, and the tolerance value, though modest, remains above 0.10. This result suggests that there is some degree of correlation between the two predictors, which is theoretically expected given that teachers who use diverse methods tend to incorporate media, and effective media use often requires intentional pedagogical framing. However, the degree of intercorrelation does not rise to a level that would seriously compromise the estimation of partial coefficients.

Multiple Regression Analysis

Table 2 presents the results of the multiple linear regression analysis. The regression equation derived from the analysis is as follows.

$$Y = 49.207 + 0.608 X_1 + 0.182 X_2 + e$$

Table 2. Multiple Linear Regression Coefficients (Dependent Variable: Y)

Predictor	B	Std. Error	Beta	t	Sig.
Constant	49.207	19.781		2.488	0.017
Multimedia Use (X1)	0.608	0.219	0.629	2.773	0.008
Teaching Methods (X2)	0.182	0.219	0.189	0.831	0.411

The constant term of 49.207 represents the predicted value of learning motivation when both predictors are set to zero, serving primarily as a mathematical baseline for the model. The coefficient for multimedia use is 0.608 with a standardized beta of 0.629. This coefficient indicates that, holding teaching methods constant, a one-unit increase in the perceived quality and use of multimedia is associated with a predicted increase of 0.608 units in learning motivation. The direction of this coefficient is positive and its magnitude suggests a meaningful practical relationship between media quality and student motivational orientation.

The coefficient for teaching methods is 0.182 with a standardized beta of 0.189. This coefficient also carries a positive sign, indicating that more effective teaching methods are associated with higher learning motivation. However, the absolute magnitude of this coefficient is considerably smaller than that of multimedia use, and it is accompanied by a much larger standard error, reducing confidence in its precision. The direction of the effect is theoretically consistent, but its statistical strength is weaker under the constraints of the current model.

Hypothesis Testing

The first hypothesis proposed that multimedia use has a positive and significant effect on learning motivation. The t-statistic for multimedia use was 2.773 with a significance value of 0.008. Because 0.008 falls below the predetermined threshold of 0.05, this hypothesis is supported by the data. The use of multimedia tools in Ilmu Falak instruction is a statistically significant predictor of student learning motivation in this sample.

The second hypothesis proposed that teaching methods have a positive and significant effect on learning motivation. The t-statistic for teaching methods was 0.831 with a significance value of 0.411. Because 0.411 exceeds 0.05, this hypothesis is not supported by the data in terms of statistical significance. Teaching methods show a positive directional effect, meaning the relationship points in the expected direction, but the effect does not reach the significance threshold when multimedia use is simultaneously held constant in the model.

Table 3 presents the results of the F-test for the simultaneous hypothesis.

Table 3. ANOVA Table for Simultaneous F-Test (Dependent Variable: Y)

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	12983.608	2	6491.804	37.815	0.000
Residual	7038.574	41	171.673		
Total	20022.182	43			

The F-statistic was 37.815 with a significance of 0.000. This value substantially exceeds the F critical value of 3.05 at the specified degrees of freedom, confirming that the regression model is statistically significant. The third hypothesis, proposing a simultaneous positive and significant effect of multimedia use and teaching methods on learning motivation, is therefore supported. Both variables operating together represent a meaningful and statistically credible explanatory model for learning motivation in this context.

The coefficient of determination (R^2) was 0.648, with an adjusted R^2 of 0.631. This result indicates that 64.8 percent of the variance in learning motivation among the respondents can be attributed to the combined effects of multimedia use and teaching methods. The remaining 35.2 percent of variance reflects the influence of factors not captured in this model, including personal interest in astronomy, prior academic performance, peer support networks, the quality of observational practice opportunities, the broader academic culture of the pesantren, and individual psychological traits.

Table 4. Model Summary for Coefficient of Determination

Model	R	R Square	Adjusted R Square	Std. Error
1	0.805	0.648	0.631	13.102

DISCUSSION

The Role of Multimedia in Supporting Ilmu Falak Motivation

The finding that multimedia use significantly predicts learning motivation in Ilmu Falak is both statistically robust and theoretically coherent. Ilmu Falak is a subject defined by the intersection of abstract concepts and empirical realities. Students must develop an accurate mental model of celestial geometry, including how the position of the sun changes relative to an observer at different times and latitudes, how the horizon-to-zenith arc of the moon varies across the lunar cycle, and how geographic coordinates translate into angular relationships between locations. These are inherently spatial concepts that resist purely verbal description.

Multimedia addresses this problem by providing representational anchors. When a student sees an animated simulation of the sun's arc across the sky at different declinations, or observes a digital projection of hilal visibility zones calculated from astronomical parameters, an abstract formula becomes connected to a visible, comprehensible phenomenon. This process of concretization is what Mayer (2001) describes as the formation of a coherent mental representation through dual-channel processing. Students who can form such representations

are more likely to experience the subject as manageable rather than impenetrable, and a sense of manageability is closely linked to the motivational dimension of self-efficacy.

The standardized coefficient of multimedia use ($\text{Beta} = 0.629$) suggests that among the two predictors in this study, multimedia carries considerably more predictive weight than teaching methods in explaining variance in motivation. This finding is consistent with the nature of the subject matter. Students at the pesantren level may already be accustomed to a range of teaching styles from different kiai, and they may not experience sharp variation in instructional method across courses. In contrast, the presence or absence of observational tools, digital astronomy software, and visual demonstrations may represent a more tangible and differentiating feature of the Ilmu Falak learning experience. The Dome Astronomy facility and the activities of CASA at Pondok Pesantren Modern Islam Assalaam likely contribute to students' perception that media is a meaningful part of their learning, which in turn may heighten motivational engagement.

The survey data support this interpretation in a specific way. A substantial majority of respondents expressed strong preference for learning Ilmu Falak within the observatory facility, and nearly all expressed the desire for a complete and well-equipped learning space. These preferences suggest that students associate the physical and digital learning environment with the quality of their motivational experience. Research in educational psychology confirms that environments perceived as well-resourced and supportive of active engagement tend to enhance intrinsic motivation by satisfying the psychological need for competence (Ryan and Deci, 2000).

From an Islamic educational perspective, the use of multimedia in Ilmu Falak education is entirely consonant with the tradition of scholarly inquiry that has characterized Islamic astronomy since the classical period. Scholars such as al-Battani, al-Biruni, and al-Farghani employed the best instruments available to them for celestial observation and calculation. The use of telescopes, projection domes, and computational software in the contemporary pesantren context represents a continuation of this tradition rather than a departure from it. When students perceive that their use of technology in studying Ilmu Falak is connected to a rich scholarly heritage and to the practical requirements of religious life, the subject acquires a dimension of meaning that pure computation cannot provide.

Teaching Methods and Their Relationship to Motivation

The non-significant partial effect of teaching methods on learning motivation ($t = 0.831$, $p = 0.411$) requires careful interpretation. The positive direction of the coefficient confirms that more effective teaching methods are theoretically associated with higher motivation, but the effect does not achieve statistical significance in this sample. Several substantive explanations are worth considering.

The first possibility is that the range of instructional variation experienced by students at the pesantren was not wide enough to produce a statistically detectable pattern. If the majority of kiai relied primarily on a combination of lecturing and question-and-answer exchange without substantial variation in method, students' perceptions of teaching method may have been relatively uniform, leaving little variance to explain in their motivational responses. The

smaller coefficient for teaching methods compared to multimedia may therefore reflect a real difference in the instructional ecology of the pesantren rather than a theoretical conclusion that method is unimportant.

The second possibility concerns the high correlation between the two predictors ($VIF = 6.009$). When multimedia and teaching methods are strongly correlated, as they are likely to be in a well-resourced pesantren where teachers who use media tend to also use more active pedagogical strategies, the regression model has difficulty separating their unique contributions. Some of the motivational variance attributable to teaching methods may be subsumed within the coefficient for multimedia use, attenuating the partial effect of method. This is a known limitation of multiple regression with correlated predictors, and it suggests that the contribution of teaching methods to motivation may be underestimated in this model.

A third possibility is that student motivation in Ilmu Falak is more immediately responsive to the accessibility of experiential and visual media than to the pattern of teacher-student interaction. This would be consistent with a view of Ilmu Falak as a discipline in which the encounter with physical phenomena, whether through telescopes, projections, or simulation software, produces a qualitatively different kind of engagement than even skillful verbal instruction. Teaching methods may exert their motivational influence indirectly, through the learning atmosphere they create and the depth of understanding they foster, rather than directly on the motivational state that students report in questionnaire responses.

Despite the non-significant partial finding, teaching methods retain strong theoretical and practical importance. The quality of pedagogical engagement determines whether multimedia tools are used generatively or passively. A kiai who projects a simulation of hilal visibility and then asks students to explain which factors shift the visibility boundary, calculate the altitude required for naked-eye observation, or compare simulated results with historical rukyat data is using method to activate the cognitive processes that multimedia stimulates. A kiai who plays the same simulation without follow-up dialogue produces a spectacle rather than a learning experience. The fact that method did not achieve independent significance in this study does not diminish its pedagogical necessity; it suggests rather that method operates most powerfully in conjunction with media and within a learning culture that values inquiry.

Simultaneous Effects and Implications for Educational Management

The simultaneous model explains 64.8 percent of the variance in learning motivation, which is a substantial proportion for a two-variable model in a social science context. This result has several implications for how Pondok Pesantren Modern Islam Assalaam and similar institutions manage the educational environment for Ilmu Falak.

First, the result confirms that multimedia and teaching methods operate as a functionally integrated system rather than as independent levers. Students experience media and instruction simultaneously; the presence of a well-equipped observatory does not automatically generate motivation if the teaching approach is didactic and passive, and even skillful instruction may not fully compensate for the absence of visual and observational media in a subject that requires spatial reasoning. Educational managers who wish to improve motivation in Ilmu

Falak need to invest in both dimensions simultaneously and ensure that they are aligned pedagogically.

Second, the finding that 35.2 percent of variance remains unexplained by the model points to the importance of factors beyond media and method. These likely include students' prior mathematical self-efficacy, their personal interest in astronomy before entering the program, the quality of peer learning within CASA activities, the availability of guided observation opportunities, the academic culture of the pesantren, and the scheduling of Ilmu Falak within the broader weekly program. Each of these factors represents a potential additional lever for improving motivation and warrants investigation in future research.

Third, the profile of the student sample is relevant to interpretation. The majority of respondents were in Grade XI, a year in which students have typically had enough exposure to the subject to form coherent perceptions but are still within their primary learning trajectory. Students in this grade may be particularly sensitive to the quality of their learning tools because they are beginning to engage with more complex applications of Ilmu Falak such as eclipse prediction and advanced hisab methods. The motivational influence of multimedia at this stage may be especially pronounced because the subject matter has become sufficiently demanding to require visualization and cannot be managed through memorization alone.

Alignment with Prior Research and Theoretical Frameworks

The significant effect of multimedia on learning motivation is consistent with findings from meta-analytic reviews of multimedia learning, which conclude that well-designed visual and interactive media produce stronger learning outcomes than text-based instruction alone, particularly when the subject matter involves spatial or dynamic processes (Cromley and Chen, 2012). The findings are also consistent with studies of media use in pesantren-based science education that report enhanced engagement when students interact with instruments and observational tools, as seen in research on the Al-Murobba board and other falak learning devices (Ni'am and Fuscha, 2021).

The positive but non-significant partial effect of teaching methods is less commonly reported in the educational research literature, though it aligns with studies in which instructional method effects are absorbed into the broader learning environment construct or mediated through self-efficacy and prior interest variables (Fathurrahman, 2020). The pattern is also consistent with Self-Determination Theory predictions that the motivational impact of pedagogical strategy is contingent on whether it succeeds in satisfying the need for autonomy and competence, which may vary considerably across students with different backgrounds in Ilmu Falak.

The overall model fits within a framework of educational management that emphasizes the systemic integration of resources, pedagogy, and learning culture. Research on technology adoption in Islamic boarding schools has noted that the degree to which multimedia is institutionally embedded, rather than merely available, determines its educational value (Al-Karimah, Abdullah, and Mujahid, 2021). Pondok Pesantren Modern Islam Assalaam's structural support for astronomy, through a dedicated Dome Astronomy facility, a formally recognized astronomy unit within the organizational chart, and the CASA program, suggests

that multimedia at this institution has achieved a degree of institutional embedding that supports its positive motivational impact.

CONCLUSION

This study examined the effect of multimedia use and teaching methods on learning motivation in Ilmu Falak among students at Pondok Pesantren Modern Islam Assalaam Surakarta. Based on data collected from 44 student respondents and analyzed through multiple linear regression, three main conclusions can be drawn.

Multimedia use demonstrates a positive and statistically significant effect on learning motivation in Ilmu Falak. Students who perceive multimedia tools as accessible, well-maintained, and genuinely helpful for understanding abstract astronomical concepts report higher levels of learning motivation. This finding is consistent with the cognitive theory of multimedia learning and reflects the particular need for visual and experiential representations in a discipline that requires spatial reasoning about celestial phenomena.

Teaching methods demonstrate a positive but statistically non-significant partial effect on learning motivation when multimedia use is controlled in the model. The positive direction of the coefficient supports the theoretical expectation that effective pedagogy contributes to motivation, but the absence of statistical significance suggests that in this sample, the perceived variation in teaching method was not wide enough, or was too correlated with multimedia use, to produce a clearly separable motivational effect. This finding does not dismiss the importance of teaching method; it identifies a gap between current instructional practice and what a more varied, dialogic, and inquiry-based approach might achieve.

Tested simultaneously, multimedia use and teaching methods together exert a strong and significant effect on learning motivation, with the model explaining 64.8 percent of motivational variance. This result supports the conclusion that improving student motivation in Ilmu Falak requires an integrated approach that aligns media quality with pedagogical strategy rather than treating them as independent variables.

These findings carry several practical implications. For institutional leaders at Pondok Pesantren Modern Islam Assalaam and similar institutions, the results support continued investment in multimedia infrastructure for Ilmu Falak, including telescope maintenance, astronomy software licenses, digital projection capabilities, and observatory scheduling that makes observational practice a regular rather than occasional feature of the curriculum. For kiai who teach Ilmu Falak, the findings point to the value of developing pedagogical repertoires that include problem-solving activities, structured discussion, and guided observation alongside direct instruction. Investing in one without the other reduces the motivational potential of both.

Future research should consider several extensions of this study. First, a larger sample drawn from multiple pesantren with varying levels of multimedia infrastructure would allow for more generalizable conclusions and a more precise estimation of the teaching method effect. Second, longitudinal research that tracks student motivation across multiple semesters would clarify whether the effects observed here persist and grow or diminish over time. Third, studies incorporating mediating variables such as self-efficacy, prior mathematical ability, and

the quality of CASA activities could illuminate the mechanisms through which multimedia and teaching methods exercise their motivational influence. Finally, qualitative research examining the instructional interactions within Ilmu Falak classrooms at PPMI Assalaam would provide contextual depth that quantitative models cannot fully capture.

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