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From Digital Attendance to Discipline Transformation: An Empirical Study of Behavioral Visibility, Moral Surveillance, and Religious Self-Regulation

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Abstract: Digital transformation in education is advancing rapidly, yet empirical understanding of how technology contributes to student discipline development in Islamic education remains relatively limited. This study aims to examine the relationship between the QR-Code Attendance System, Behavioral Visibility, Parental Digital Engagement, Digital Moral Surveillance, Religious Self-Regulation, and Student Discipline Transformation. The study used a quantitative explanatory survey design involving 436 madrasah students who have used a QR-code-based attendance system. Analysis was conducted using Structural Equation Modeling–Partial Least Squares. The results indicate that the QR-Code Attendance System increases Behavioral Visibility, which in turn strengthens Parental Digital Engagement. Parental Digital Engagement is positively associated with Digital Moral Surveillance, which fosters the development of Religious Self-Regulation. Religious Self-Regulation, in turn, contributes to Student Discipline Transformation. All mediation pathways showed strong significance, including full serial mediation from the digital attendance system to student discipline transformation. These findings expand our understanding of the relationships among digital educational governance, family engagement, moral surveillance, and religious character formation, and highlight the importance of integrating technology and values to strengthen student discipline in madrasahs. In practice, madrasah administrators should integrate attendance systems with timely parental engagement, constructive moral oversight, and support for religious self-regulation to translate attendance data into sustainable disciplinary practices.

Keywords: QR-Code attendance system; behavioral visibility, parental digital engagement, digital moral surveillance, religious self-regulation.

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INTRODUCTION

Digital transformation has become one of the most influential trends in the global education system over the past decade (Blyznyuk et al., 2025; Taufikin et al., 2024). The development of information technology is no longer limited to administrative functions. However, it is increasingly integrated into the processes of learning management, Behavioral monitoring, school–family communication, and the shaping of educational institutional culture (Haleem et al., 2022; Selwyn, 2019). In various educational contexts, digitization is seen as a way to enhance efficiency, transparency, and accountability through systems that enable real-time data collection and use (Gavrus et al., 2025; Lu et al., 2026). However, these developments also raise important questions about how technology influences student behaviour, particularly regarding discipline, responsibility, and character development. This issue is increasingly relevant in Islamic educational institutions, which are responsible not only for academic achievement but also for developing students' moral and

religious values (Arar & Oplatka, 2022; Lisnawati et al., 2026; Ritonga et al., 2026; Taufikin et al., 2026). In this context, using the QR-Code Attendance System as part of digital educational governance presents new opportunities and challenges for understanding the relationship between technology, supervision, family involvement, and changes in student behavior.

Discussions regarding the relationship between technology and student behaviour can be traced through several key theoretical frameworks. The perspective of "disciplinary power" proposed by Foucault (1995) suggests that individuals' awareness of the existence of surveillance mechanisms can influence how they regulate their behaviour. In digital environments, surveillance no longer depends on physical presence but occurs through systems that make individual activities more visible and documented. Meanwhile, Bandura's (1977) Social Cognitive Theory explains that behaviour develops through reciprocal interactions between the environment, cognitive processes, and social experiences (Rumjaun & Narod, 2025). In the context of education, family involvement also plays a central role, as outlined in Parental Involvement Theory, which emphasises the importance of the relationship between schools and parents in supporting student development (Epstein & Sheldon, 2022; Kaur, 2024; Walsh, 2026). When these three perspectives come together in an Islamic educational setting, they create an intriguing conceptual space for understanding how digital technology can interact with religious values and self-regulation to shape student discipline.

A number of studies in recent years have examined the use of digital technology to support educational governance and student monitoring. Studies on learning analytics indicate that digital data can enhance information transparency and help schools monitor student progress more systematically (Ifenthaler & Schumacher, 2016; Williamson, 2017). Other research indicates that digital systems providing real-time information can strengthen communication between schools and families, thereby increasing parental participation in the educational process (Asterhan & Rosenberg, 2015; Enchikova et al., 2026; Lewin, 2015; See et al., 2020). These studies expand our understanding of the importance of access to information in fostering more active engagement frm various educational stakeholders.

On the other hand, research on digital surveillance is growing alongside the increasing use of technology platforms in daily life. Several studies highlight how technology creates new forms of surveillance that influence individuals' awareness of their own behaviour (Volosevici & Isbasoiu, 2025; Zuboff, 2015, 2019). In the field of education, digital surveillance is often examined in relation to compliance with rules, monitoring of learning activities, and institutional control over students' behaviour. Other research explores the relationship between surveillance and character development, including how social environments and moral expectations can encourage individuals to develop stronger self-control (S. M. Livingstone & Blum-Ross, 2020; S. Livingstone & Third, 2017). However, most research still focuses on administrative dimensions and general behaviour. At the same time, its connection to religious self-regulation in the context of Islamic education has not yet been extensively explored empirically.

The literature on Islamic education also shows a growing emphasis on self-regulation as a foundation for character development and student discipline. Various studies suggest that self-regulation plays a role in fostering responsibility, Behavioral consistency, and an individual's ability to maintain compliance with norms without direct supervision (A. Azra, 2019; H. Azra, 2018; Zimmerman, 1989, 2002, 2008). Nevertheless, most studies still view religious self-regulation as a direct outcome of moral education

or religious instruction. Existing studies predominantly examine parental involvement, digital monitoring, learning analytics, and self-regulation as separate domains, while paying limited attention to the interconnected mechanisms through which digital attendance systems may influence student discipline via Behavioral visibility, parental engagement, moral surveillance, and religious self-regulation.

Although the literature on digital governance, parental engagement, and self-regulation continues to expand, several research gaps remain. First, empirical research specifically linking the QR-Code Attendance System to changes in student discipline remains relatively limited. Second, previous studies generally treat technology as an administrative tool without examining the psychological and social mechanisms that explain how such technology influences student behaviour. Third, the relationship between parental digital engagement, digital moral surveillance, and religious self-regulation has rarely been tested within a single integrated model. Fourth, most research has focused on public schools or secular educational settings, so few studies have examined these dynamics in madrasahs, which have strong religious characteristics. Consequently, little is known about how digital attendance systems contribute to student discipline transformation through sequential processes involving Behavioral visibility, parental digital engagement, digital moral surveillance, and religious self-regulation. Previous research has not sufficiently addressed the empirical relationships among these constructs within Islamic educational settings.

Based on these gaps, this study aims to examine the relationship between the QR-Code Attendance System, Behavioral Visibility, Parental Digital Engagement, Digital Moral Surveillance, Religious Self-Regulation, and Student Discipline Transformation in madrasahs in Indonesia. Specifically, this study examines how digital attendance systems contribute to student discipline transformation through sequential mediation mechanisms. This study also highlights the importance of family involvement and religious self-regulation in explaining the relationship between technology and the formation of disciplinary behaviour. Theoretically, this study extends the discussion of digital governance and educational surveillance by integrating parental engagement and religious self-regulation into a single empirical model. From a practical perspective, the study's findings are expected to inform madrasah administrators on using digital technology not only to improve administrative efficiency but also to strengthen students' character. From a social perspective, this study offers a more contextual understanding of how technology, family, and religious values interact in shaping a culture of discipline within Islamic educational settings. To gain a systematic understanding of the relationships among these variables, this study employs a quantitative approach using an explanatory survey design and Structural Equation Modelling–Partial Least Squares (SEM-PLS) analysis.

To gain a systematic understanding of the relationships among these variables, this study employs a quantitative approach using an explanatory survey design and Structural Equation Modelling–Partial Least Squares (SEM-PLS) analysis. Building on the theoretical relationships outlined above, the study proposes the following hypotheses to empirically examine the sequential relationships among digital attendance, Behavioral visibility, parental engagement, moral surveillance, religious self-regulation, and student discipline transformation.

H1: The QR-Code Attendance System positively influences Behavioral Visibility.

H2: Behavioral Visibility positively influences Parental Digital Engagement.

H3: Parental Digital Engagement positively influences Digital Moral Surveillance.

H4: Digital Moral Surveillance positively influences Religious Self-Regulation.

H5: Religious Self-Regulation positively influences Student Discipline Transformation.
H6: Behavioral Visibility mediates the relationship between the QR-Code Attendance System and Parental Digital Engagement.
H7: Parental Digital Engagement mediates the relationship between Behavioral Visibility and Digital Moral Surveillance.
H8: Digital Moral Surveillance mediates the relationship between Parental Digital Engagement and Religious Self-Regulation.
H9: Religious Self-Regulation mediates the relationship between Digital Moral Surveillance and Student Discipline Transformation.
H10: Behavioral Visibility, Parental Digital Engagement, Digital Moral Surveillance, and Religious Self-Regulation sequentially mediate the relationship between the QR-Code Attendance System and Student Discipline Transformation.

METHOD

Research Design

This study used a quantitative explanatory survey design (Creswell & Creswell, 2022; Joseph et al., 2024). This approach was chosen because the study's primary objective is to examine hypothesized relationships among variables within a conceptual model that explains student discipline transformation through integrated digital mechanisms involving schools, families, and religious self-regulation. The quantitative approach allows for the systematic measurement of abstract constructs through measurable indicators so that the structural relationships among variables can be empirically tested using Structural Equation Modelling–Partial Least Squares (SEM-PLS) (Hair & Alamer, 2022; Kock & Hadaya, 2018; Sarstedt et al., 2016).

An explanatory survey design was considered appropriate because this study not only seeks to describe the use of the QR-Code Attendance System in madrasahs but also examines how the system is associated with Behavioral Visibility, Parental Digital Engagement, Digital Moral Surveillance, Religious Self-Regulation, and Student Discipline Transformation. Thus, the study focuses on testing the hypothesized direct and serial mediation relationships within the proposed model.

The conceptual model tested consists of six latent constructs, namely the QR-Code Attendance System (QR), Behavioral Visibility (BV), Parental Digital Engagement (PDE), Digital Moral Surveillance (DMS), Religious Self-Regulation (RSR), and Student Discipline Transformation (SDT). The relationships among the variables were tested through five direct hypotheses and five mediation hypotheses that form a series of digital technology-based discipline transformation mechanisms.

Research Setting and Context

The study was conducted at madrasahs in Rembang Regency, Central Java, Indonesia. The region was selected because a number of madrasahs have adopted a QR-code-based digital attendance system integrated with digital communication with parents. These conditions provide a relevant empirical context for examining the relationship between educational technology, family involvement, and students' disciplinary behaviour.

Madrasahs were chosen as the research sites because they possess characteristics that differ from those of public schools. In addition to fulfilling academic functions, madrasahs also serve as institutions for religious character development that instil trustworthiness, responsibility, etiquette, and discipline as integral parts of the educational process. In this context, digital technology may influence not only administrative efficiency but also students' character development.

Selecting Rembang Regency also reflects the diversity of madrasah characteristics, including public and private institutions, providing a relevant

context for examining the implementation of digital attendance systems in Islamic education.

Research Sites

The study was conducted in 25 madrasahs, comprising 23 Madrasah Tsanawiyah (MTs) and 2 Madrasah Aliyah (MA). The participating institutions were MTs Miftahul Huda Kaliori, MTs Miftahul Huda Sarang, MTs Miftahul Huda Sedan, MTs Miftahul Ulum, MTs Mu'allimin Mu'allimat, MTs Nahjatus Sholihin, MTs Nurul Huda Gunem, MTs Nurul Huda Kragan, MTs Nurussalam Mubarok, MTs Riyadlotut Thalabah, MTs SA Raudlatul Falah, MTs Sain Al Anwar 4, MTs Sunan Bonang Lasem, MTs Sunan Bonang Sarang, MTs Tauhidiyah, MTs Tri Bakti, MTs Umar Fatah, MTs Walisongo, MTsN 1 Rembang, MTsN 2 Rembang, MTsN 3 Rembang, MTsN 4 Rembang, MTsN 5 Rembang, MAN 1 Rembang, and MAN 2 Rembang.

Participants and Data Sources

The study population consisted of students actively using the QR-Code Attendance System at the participating madrasahs. Proportionate stratified random sampling was applied based on educational level, namely Madrasah Tsanawiyah (MTs) and Madrasah Aliyah (MA), to ensure representation across the two educational levels.

A total of 436 students participated in the study, comprising 248 MTs students (56.9%) and 188 MA students (43.1%). All respondents met the inclusion criteria, namely: (1) being registered as active students at madrasahs that implement the QR-Code Attendance System, (2) having used the system for at least one semester, and (3) having access to the digital communication system used by the school to convey attendance information.

Because the participants were secondary-school students, participation was voluntary and preceded by an explanation of the research objectives, participation procedures, and confidentiality provisions. All students willingly agreed to participate, while parents or guardians also provided oral consent. Parents expressed positive acceptance of the QR-Code Attendance program and supported their children's participation in the study.

Table 1. Characteristics of research participants

Characteristics	Category	Frequency (n)	Percentage (%)
Primary Respondents	Students	436	100.0
Educational Level	MTs	248	56.9
	MA	188	43.1
Gender	Male	211	48.4
	Female	225	51.6
Type of Institution	Public Madrasah	176	40.4
	Private Madrasah	260	59.6
Experience Using QR-Code Attendance	6–12 Months	158	36.2
	More than 12 Months	278	63.8

Data Collection Procedures

Data collection was conducted over four months, from January to April 2026. Data were collected using a structured questionnaire developed based on a synthesis of Digital Governance, Disciplinary Power, Parental Involvement Theory, Social Cognitive Theory, and the concept of Religious Self-Regulation in Islamic education.

The research instrument used a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). All indicators underwent

content validation by experts in Islamic education, educational technology, and quantitative research methodology before being distributed to respondents. The instrument was also pilot-tested before the main survey to assess preliminary reliability. The pilot-test reliability results are reported separately from the main sample's measurement model. The instrument comprised six latent constructs, each measured by eight items, for a total of 48 items. The constructs were the QR-Code Attendance System (QR), Behavioral Visibility (BV), Parental Digital Engagement (PDE), Digital Moral Surveillance (DMS), Religious Self-Regulation (RSR), and Student Discipline Transformation (SDT). Each construct was represented by eight questionnaire items.

Questionnaires were distributed in person and via the digital platforms used by each madrasah. Before completing the questionnaire, respondents received an explanation regarding the research objectives, their rights to participate, and guarantees of data confidentiality (Anjaria, 2022; Koo & Yang, 2025).

Data Analysis

Data analysis was conducted using a Partial Least Squares-based Structural Equation Modeling (SEM-PLS) approach via SmartPLS. The PLS-SEM approach was chosen because it is suitable for testing predictive models involving multiple latent constructs and mediation relationships (Hair & Alamer, 2022; Sarstedt et al., 2016).

The analysis was conducted in two main stages. The first stage evaluated the measurement model, including outer loadings, Cronbach's alpha, rho_A, composite reliability, Average Variance Extracted (AVE), the Fornell–Larcker criterion, and the Heterotrait–Monotrait Ratio (HTMT). Outer loading values above 0.70, reliability coefficients above 0.70, AVE above 0.50, and HTMT below 0.90 were used as assessment criteria. Because all study variables were collected through self-report questionnaires, common method bias was assessed using the full collinearity VIF procedure. VIF values below 3.3 were used as the criterion for indicating the absence of critical common method bias.

The second stage involved evaluating the structural model, including Variance Inflation Factor (VIF), coefficient of determination (R^2), effect size (f^2), Standardized Root Mean Square Residual (SRMR), predictive relevance (Q^2), path coefficients, and bootstrapping with 5,000 subsamples. Hypothesis testing was conducted using path coefficients (â), t-statistics, and p-values. A hypothesis was considered supported if $t > 1.96$ and $p < 0.05$.

Out-of-sample predictive performance was additionally assessed using the PLSpredict procedure in SmartPLS. The analysis considered Q^2_predict and prediction-error measures, including Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE), and compared the PLS-SEM prediction errors with the linear model (LM) benchmark. Direct, specific indirect, and serial mediation effects were assessed using bootstrapping with 5,000 subsamples, including their bootstrap confidence intervals.

■ RESULT AND DISCUSSION

Measurement Model Evaluation

The measurement model demonstrates strong indicator reliability and convergent validity. All outer loading values exceed the recommended threshold of 0.70, with values ranging from 0.876 to 0.910 across the six constructs. The reliability coefficients are also consistently high, with Cronbach's alpha ranging from 0.959 to 0.967, rho_A from 0.960 to 0.967, and composite reliability from 0.966 to 0.972. Average Variance Extracted (AVE) ranges from 0.779 to 0.812, indicating that each construct explains a substantial proportion of the variance in its indicators.

Table 2. Measurement model: outer loadings, reliability, and convergent validity

Construct	Indicator Loading Range	Cronbach's Alpha	rho_A	Composite Reliability	AVE
Behavioral Visibility (BV)	0.891–0.910	0.967	0.967	0.972	0.811
Parental Digital Engagement (PDE)	0.884–0.908	0.965	0.966	0.971	0.805
Digital Moral Surveillance (DMS)	0.882–0.910	0.967	0.967	0.972	0.812
Religious Self-Regulation (RSR)	0.876–0.892	0.960	0.961	0.967	0.783
QR-Code Attendance System (QR)	0.892–0.904	0.966	0.966	0.971	0.807
Student Discipline Transformation (SDT)	0.876–0.896	0.959	0.960	0.966	0.779

The results in Table 2 indicate that all constructs satisfy the criteria for internal consistency and convergent validity. DMS has the highest AVE (0.812), whereas SDT has the lowest (0.779); both substantially exceed the 0.50 criterion. The consistently high reliability coefficients indicate that the indicators provide stable measurement of their respective latent constructs.

Discriminant Validity

Discriminant validity was assessed using the Fornell–Larcker criterion and the Heterotrait–Monotrait ratio (HTMT). The square root of the AVE for each construct exceeds its correlations with the other constructs, with diagonal values ranging from 0.882 to 0.901. The strongest inter-construct correlations are observed between PDE and DMS (0.769), BV and PDE (0.766), and QR and BV (0.753). These values remain below the corresponding square roots of AVE, indicating adequate empirical distinctiveness among the constructs. The HTMT assessment also remained below the 0.90 threshold, supporting discriminant validity.

Model Fit

The model-fit assessment yields mixed but interpretable results. The saturated model produces an SRMR of 0.026, below the commonly used 0.08 criterion, whereas the estimated model yields an SRMR of 0.116 and an NFI of 0.936. The estimated model also produces d_ULS = 15.777 and d_G = 0.693. The estimated SRMR therefore indicates some discrepancy between the empirical and model-implied correlations. This result is considered alongside measurement quality, structural relationships, and predictive assessment rather than treated as evidence of model invalidity, particularly because PLS-SEM primarily aims to explain variance and predict rather than reproduce a covariance matrix.

Structural Model Evaluation

The structural model indicates meaningful explanatory power across the endogenous constructs. The model explains 56.7% of the variance in Behavioral Visibility ($R^2 = 0.567$), 58.6% in Parental Digital Engagement ($R^2 = 0.586$), 59.1% in Digital Moral Surveillance ($R^2 = 0.591$), 55.1% in Religious Self-Regulation ($R^2 = 0.551$), and 29.9% in Student Discipline Transformation ($R^2 = 0.299$; adjusted $R^2 = 0.298$). Thus, the model explains the intermediate mechanisms substantially better than the final disciplinary outcome.

The relatively lower R^2 for SDT indicates that factors beyond the sequential mechanism tested here influence discipline transformation.

School climate, teacher–student relationships, peer influence, family conditions, institutional disciplinary practices, and individual differences may contribute to the remaining unexplained variance. Accordingly, Religious Self-Regulation represents an important proximal mechanism but should not be interpreted as the sole determinant of student disciplinary transformation.

Table 3. Structural model evaluation

Structural Path	R^2 of Endogenous Construct	f^2	Blindfolding Q^2
QR → BV	0.567	1.309	0.456
BV → PDE	0.586	1.418	0.469
PDE → DMS	0.591	1.444	0.476
DMS → RSR	0.551	1.228	0.428
RSR → SDT	0.299	0.428	0.231

The effect-size results indicate that the hypothesized predictors substantially contribute to their endogenous constructs. The strongest effect is observed for PDE→ DMS ($f^2 = 1.444$), followed by BV → PDE ($f^2 = 1.418$), QR → BV ($f^2 = 1.309$), and DMS→RSR ($f^2 = 1.228$). The RSR→SDT relationship has the smallest effect ($f^2 = 0.428$), although it remains substantial. These results indicate that the proposed sequential mechanism is not only statistically significant but also substantively relevant in explaining the intermediate relationships.

The blindfolding Q^2 values are positive for all endogenous constructs, ranging from 0.231 to 0.476, indicating predictive relevance within the sample. DMS has the highest Q^2 value (0.476), whereas SDT has the lowest (0.231). These findings provide evidence of predictive relevance, but they do not, by themselves, establish out-of-sample predictive performance.

Common Method Bias and Collinearity Assessment

Because all constructs were measured using student self-reports, the possibility of common method bias was considered explicitly. The SmartPLS 3 workflow used in this study provides inner- and outer-model VIF statistics rather than a separate automated full-collinearity CMB procedure. The inner VIF values were 1.000 for all structural relationships, indicating no collinearity concern among the predictor constructs in the structural model. However, these values are interpreted specifically as structural collinearity diagnostics and are not presented as a dedicated full-collinearity test for common method bias. Given the single-source nature of the data, common method bias therefore remains a methodological consideration. It is acknowledged as a limitation rather than being claimed to have been eliminated.

Predictive Assessment

To complement the in-sample predictive relevance assessment, PLSpredict was conducted to examine the model's out-of-sample predictive performance. The resulting Q^2_predict values were positive for all endogenous constructs: BV = 0.566, PDE = 0.348, DMS = 0.249, RSR = 0.133, and SDT = 0.143. The corresponding RMSE values were 0.661, 0.811, 0.870, 0.935, and 0.929, respectively, while the MAE values were 0.533, 0.675, 0.729, 0.795, and 0.799.

The positive Q^2_predict values indicate that the model has out-of-sample predictive relevance across all endogenous constructs. Predictive performance is strongest for BV and comparatively weaker for RSR and SDT. These findings complement the structural results by showing that the proposed model retains predictive information beyond estimating the

structural relationships. Nevertheless, because the available PLSpredict output does not provide a clearly identified linear-model benchmark in the reported results, no claim is made that the PLS-SEM model consistently outperforms the linear benchmark. This conservative interpretation avoids overstating the predictive evidence.

Hypothesis Testing

Bootstrapping with 5,000 subsamples was used to assess the significance of the hypothesized structural relationships. All five direct hypotheses were supported. As shown in Table 4, the QR-Code Attendance System is strongly and positively related to Behavioral Visibility ($\beta = 0.753$, $t = 40.209$, $p < 0.001$), supporting H1. Behavioral Visibility positively relates to Parental Digital Engagement ($\beta = 0.766$, $t = 37.572$, $p < 0.001$), supporting H2. Parental Digital Engagement positively relates to Digital Moral Surveillance ($\beta = 0.769$, $t = 36.493$, $p < 0.001$), supporting H3. Digital Moral Surveillance positively relates to Religious Self-Regulation ($\beta = 0.742$, $t = 33.802$, $p < 0.001$), supporting H4. Finally, Religious Self-Regulation positively relates to Student Discipline Transformation ($\beta = 0.547$, $t = 17.645$, $p < 0.001$), supporting H5.

Table 4. Direct effects

Hypothesis	Structural Path	β	t-value	p-value	Decision
H1	QR → BV	0.753	40.209	<0.001	Supported
H2	BV → PDE	0.766	37.572	<0.001	Supported
H3	PDE → DMS	0.769	36.493	<0.001	Supported
H4	DMS → RSR	0.742	33.802	<0.001	Supported
H5	RSR → SDT	0.547	17.645	<0.001	Supported

As shown in Table 4 and Figure 1, the direct effects establish a coherent sequential relationship from digital attendance to behavioral visibility, parental engagement, moral surveillance, religious self-regulation, and disciplinary transformation. The coefficient magnitudes are particularly notable for the upstream relationships, suggesting that the digital attendance system is most strongly associated with discipline transformation through a sequence of intermediate social and regulatory mechanisms rather than an isolated technological effect.

Mediation Analysis

The mediation analysis provides further evidence that the relationship between digital attendance and discipline transformation operates through interconnected mechanisms. As presented in Table 5, all five mediation hypotheses were statistically significant. Behavioral Visibility mediates the relationship between the QR-Code Attendance System and Parental Digital Engagement ($\beta = 0.577$, $t = 25.298$, $p < 0.001$), supporting H6. Parental Digital Engagement mediates the relationship between Behavioral Visibility and Digital Moral Surveillance ($\beta = 0.589$, $t = 23.428$, $p < 0.001$), supporting H7. Digital Moral Surveillance mediates the relationship between Parental Digital Engagement and Religious Self-Regulation ($\beta = 0.571$, $t = 21.964$, $p < 0.001$), supporting H8. Religious Self-Regulation mediates the relationship between Digital Moral Surveillance and Student Discipline Transformation ($\beta = 0.406$, $t = 13.889$, $p < 0.001$), supporting H9.

Most importantly, the complete serial mediation from the QR-Code Attendance System to Student Discipline Transformation through Behavioral Visibility, Parental Digital Engagement, Digital Moral Surveillance, and Religious Self-

Regulation is significant (β = 0.180, t = 10.102, p < 0.001), with a bootstrap confidence interval of 0.147–0.217. Because the confidence interval does not include zero, the indirect serial effect is statistically supported. Thus, H10 is supported.

Table 5. Hypothesis-Based mediation effects

Hypothesis	Mediation Path	β	t-value	p-value	Decision
H6	QR → BV → PDE	0.577	25.298	<0.001	Supported
H7	BV → PDE → DMS	0.589	23.428	<0.001	Supported
H8	PDE → DMS → RSR	0.571	21.964	<0.001	Supported
H9	DMS → RSR → SDT	0.406	13.889	<0.001	Supported
H10	QR → BV → PDE → DMS → RSR → SDT	0.180	10.102	<0.001	Supported

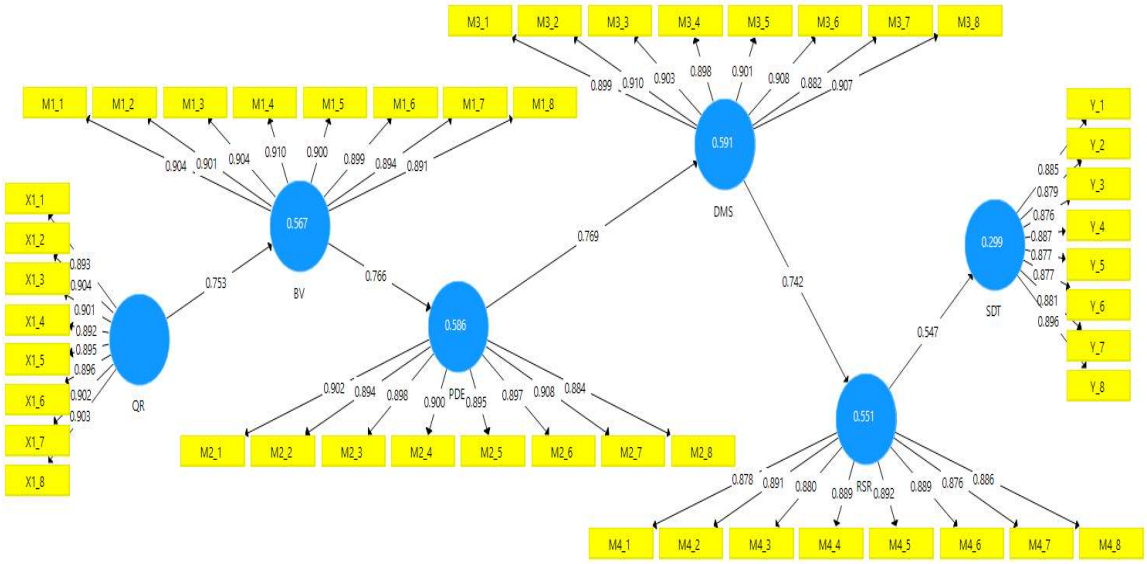


Figure 1. Structural model of the hypothesized relationships among study variables, standardized path coefficients, and explained variance (R^2)

The findings indicate that student discipline transformation in madrasahs does not emerge from digital technology alone. Instead, it develops through a sequential process in which technological visibility is linked to family engagement, moral oversight, religious self-regulation, and ultimately disciplinary behavior. The structural model provides empirical support for this sequence: QR→ BV (β = 0.753), BV→ PDE (β = 0.766), PDE →DMS (β = 0.769), DMS →RSR (β = 0.742), and RSR→SDT (β = 0.547). The significant full serial mediation (β = 0.180; 95% bootstrap CI [0.147, 0.217]) further indicates that the relationship between digital attendance and discipline transformation operates through the combined functioning of these mechanisms.

The strong relationship between the QR-Code Attendance System and Behavioral Visibility shows that digital attendance can turn attendance information into a more continuous, visible representation of student behavior. This interpretation aligns with digital governance perspectives in which data infrastructures do

more than record activities; they can also organize visibility and shape behavioral expectations (Selwyn, 2019; Williamson, 2017). From a Foucauldian perspective, visibility is central to disciplinary power because the possibility of observation can encourage individuals to regulate their conduct (Foucault, 1995). However, this interpretation has an important conceptual boundary in the present study. Digital visibility represents an externally organized condition of observation, whereas religious self-regulation involves an internal moral orientation. Therefore, the QR system can help explain the production of behavioral visibility but cannot, by itself, explain the religious meaning of self-regulation.

The relationship between Behavioral Visibility and Parental Digital Engagement (â = 0.766) indicates that the educational value of attendance data extends beyond school administration when information becomes accessible to families. This finding aligns with parental engagement perspectives that emphasize communication and access to information as key conditions for family participation (Epstein & Sheldon, 2022; See et al., 2020). The result suggests that behavioral visibility becomes more consequential when it creates an informational bridge between the madrasah and parents. Thus, the mechanism is not simply technological monitoring but converting school-generated information into opportunities for parental involvement.

The strong relationship between Parental Digital Engagement and Digital Moral Surveillance (â = 0.769) further suggests that parental involvement may extend from receiving information toward active moral oversight. This result broadly aligns with research showing that parental monitoring is associated with adolescent behavioral regulation, although its effects vary by the form and intensity of monitoring. For example, Hernandez et al. (2024) and Hu and Wang (2022) show that different forms of parental monitoring may produce different behavioral associations. The comparatively strong coefficient here may reflect a structured school–family environment in which attendance information is explicitly linked to behavioral and moral expectations.

The relationship between Digital Moral Surveillance and Religious Self-Regulation (â = 0.742) represents a particularly important contribution of the study. Existing research has generally examined monitoring in relation to behavioral control or general self-regulation. This finding extends the discussion into an Islamic educational context by positioning religious self-regulation as an internal mechanism associated with digitally supported moral oversight. This interpretation aligns with research linking external monitoring to self-regulatory outcomes (Bandzeladze et al., 2019; Padilla-Walker et al., 2016). Nevertheless, the finding should not be interpreted as evidence that surveillance automatically produces muraqabah. External observation and internal awareness of divine observation are conceptually distinct. Instead, the result suggests that, within the madrasah context, digitally supported moral oversight may provide an external condition that reinforces religious self-regulation.

Religious self-regulation is positively related to student discipline transformation (â = 0.547), supporting the proposition that internal regulation is an important proximal mechanism of disciplined behavior. This finding aligns with Social Cognitive Theory, which identifies self-regulation as a key mechanism through which individuals guide and maintain behavior (Bandura, 1977). Related empirical research also suggests that internal self-control is more closely linked to behavioral outcomes than external monitoring alone (Hu & Wang, 2022). The present findings therefore support a distinction between external and internal regulation: digital systems and social monitoring may increase visibility and accountability, but

sustainable discipline appears more closely connected to developing internal regulatory capacity.

The serial mediation result provides the study's central theoretical contribution. The significant pathway QR '! BV '! PDE '! DMS '! RSR '! SDT indicates that digital attendance becomes educationally meaningful not because technology directly transforms discipline, but because attendance information enters a sequence of social and moral processes. The complete indirect pathway (â = 0.180) is smaller than the individual upstream relationships, which is theoretically plausible because the effect is transmitted through multiple stages. The bootstrap confidence interval [0.147, 0.217] nevertheless confirms that the complete indirect pathway is statistically distinct from zero.

The explanatory and predictive results reinforce this interpretation while also defining its limits. The model explains substantial variance in the intermediate constructs, particularly DMS (R^2 = 0.591), PDE (R^2 = 0.586), BV (R^2 = 0.567), and RSR (R^2 = 0.551). In contrast, SDT has an R^2 of 0.299, indicating that the proposed mechanism explains only part of disciplinary transformation. This finding is important because it prevents an overly technological interpretation of the results. Student discipline is embedded in broader educational and social environments, including school climate, teacher–student relationships, peer groups, family circumstances, institutional practices, and individual characteristics.

The PLS-predict results provide additional evidence that the model retains predictive relevance beyond its explanatory relationships. Positive Q^2_predict values were obtained for all endogenous constructs, although predictive performance varied across outcomes. Behavioral Visibility showed the strongest predictive performance, whereas Religious Self-Regulation and Student Discipline Transformation showed comparatively lower Q^2_predict values. The model should therefore be viewed as a theoretically informed predictive framework rather than as a complete predictive system for student discipline.

The findings also require caution regarding common method bias. The study relies on a single student-reported questionnaire, which may create shared-method variance. The inner VIF values of 1.000 indicate no structural collinearity among the predictor constructs, but they should not be interpreted as a dedicated full-collinearity CMB test. Accordingly, the possibility of common method bias is acknowledged rather than dismissed. Future research should strengthen the design by using multiple data sources, such as school attendance records, parent reports, teacher assessments, and longitudinal behavioral observations.

Practically, the findings suggest that madrasah administrators should not treat digital attendance as an isolated administrative technology. Its educational value appears to depend on how attendance information is connected to timely parental engagement, constructive moral guidance, and opportunities for religious self-regulation. Therefore, implement digital monitoring as part of a broader educational process rather than as a substitute for teacher–student relationships, parental interaction, or moral education.

At the same time, the findings should not be interpreted as evidence that digital surveillance automatically produces discipline or religious internalization. The cross-sectional design identifies statistically significant associations but cannot establish temporal causality or demonstrate that external monitoring necessarily becomes internal religious consciousness. The relatively modest explanatory power for Student Discipline Transformation also indicates that important determinants remain outside the present model. Future longitudinal and multi-source

studies should examine whether the observed sequence remains stable over time and whether behavioral visibility is actually transformed into durable internal self-regulation.

CONCLUSION

This study shows that student discipline transformation in madrasah is more complex than implementing digital technology alone. The QR-Code Attendance System serves as an initial trigger that enhances Behavioral Visibility, strengthens Parental Digital Engagement, fosters Digital Moral Surveillance, and promotes Religious Self-Regulation, contributing to Student Discipline Transformation. The full serial mediation confirms that sustainable discipline develops through the interaction of technology, family involvement, moral oversight, and religious awareness rather than through administrative control alone.

The findings suggest that madrasah administrators should design digital attendance systems with timely attendance information, accessible attendance records, and simple channels for parental feedback and follow-up, so attendance data can stimulate constructive family involvement rather than serve solely as administrative records. Technology should therefore integrate family engagement and religious values to support sustainable disciplinary practices. Nevertheless, the cross-sectional design and reliance on respondents' perceptions limit causal interpretation. Future research should employ longitudinal and cross-institutional designs and consider additional factors such as school climate, teacher moral leadership, spiritual well-being, and digital trust.

DECLARATION OF GENERATIVE AI USAGE IN THE WRITING PROCESS

Artificial intelligence tools, including ChatGPT, DeepL, and Grammarly Premium, were used solely to assist with translating the manuscript into English and improving language quality, identifying and reducing redundancy, grammatical errors, and stylistic inconsistencies to enhance the clarity and readability of the manuscript. The authors retain full responsibility for the content, interpretation, analysis, arguments, and final version of the manuscript.

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