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Digital Leadership and Teacher Resilience in Bangladesh's Secondary Schools: The Roles of Technology Self-Efficacy and Professional Learning Culture

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ABSTRACT

This paper explores the role of digital leadership in resilience among teachers in Bangladesh secondary schools in terms of technology self-efficacy and professional learning culture. It was designed as a four-construct reflective survey-based PLS-SEM model whereby four reflective constructs were used: digital leadership, technology self-efficacy, professional learning culture, and teacher resilience. The analysis model was experimented on the 410 full synthetic reactions that were to be demonstrated methodologically. Screening of the data revealed no missing values, out of range values, straight-lining or duplicating patterns. Measurement model was found to have acceptable indicator reliability, internal consistency, convergent validity, discriminant validity and collinearity. Digital leadership brought about great positive impacts on technology self-efficacy, professional learning culture, and teacher resilience. There were also significant positive impacts of technology self-efficacy and professional learning culture on teacher resilience. The structural model attributed 22.3, 22.7, and 43.7, respectively, of the variance in technology self-efficacy, professional learning culture, and teacher resilience. Both moderators were able to pass on important positive indirect impacts amid digital leadership and instructor resilience. The mediation pattern was partial and complementary as the direct effect also mattered. The results show that combining technology-focused direction with supportive leadership that builds confidence and collaborative professional learning environment enables the development of resilience teaching capacity among school leaders. The paper provides a research framework of educational leadership and realistic sustainable school improvement planning.

INTRODUCTION

Digital transformation is now a significant aspect of modern schools (Adeoye *et al.*, 2024). Secondary schools are placing more reliance on digital platforms in terms of instruction, assessment, communication, record management, professional development, and administrative coordination (Debnath, 2024). These developments have broadened the roles of educators and heads of schools. The teachers will have to work with unfamiliar tools, facilitate online and blended courses, adapt to the needs of the changing students, and sustain the quality of instructions in stressful situations (Hossain *et al.*, 2023). Leaders in schools are also supposed to guide, offer resources, motivation and a context where technology can be utilized effectively.

Digital transformation is not only effective when devices are available or the internet service works (Imon, 2024). It is also reliant on leadership behaviour. Digital leadership entails setting a clear vision of the application of technology, upholding innovation, facilitating professional learning, provision of resources and instilling confidence in the teachers. A school can have technological resources and still have poor implementation in case leaders fail to communicate the priorities and offer support practically (Peng *et al.*, 2024). In contrast, transparent and enabling leadership can assist teachers in being more strategic in utilizing scarce resources.

Another major issue of school improvement is teacher resilience. The term resilience is used to describe the ability to respond to disruption, overcome the setbacks, cope with work pressure, and be dedicated to professional duties. The teachers working in secondary schools are often overworked, lack materials, policies change constantly, students have different needs, and teachers have mounting accountability pressures. The digital transformation can make new possibilities, yet it can also cause uncertainty, technical issues, and extra emotional stress (Lukman & Yune, 2025). Strong teachers will be more capable of ensuring continuity in instruction and reacting positively to such difficulties.

The connection between digital managerial and teacher resilience is not likely to be fueled by direct managerial effects (Pribadi *et al.*, 2024). The resiliency of teachers can be improved when the leadership supports their belief in their ability to use technology. Technology self-efficacy is the notion that a teacher believes in the ability to learn, apply and handle digital tools. Teachers who have greater self-efficacy will be more open to experimentation, technical troubleshooting and perseverance on the part of their first failures (Okunlola, 2025). Digital leadership can thus enhance resilience through the establishment of technological confidence.

A second pathway may be through professional learning culture. A school culture that promotes collaborative efforts would facilitate sharing of knowledge and difficulty among teachers, reflection on classroom

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practice, and learning among teachers (Armawi *et al.*, 2021). Professional isolation is minimized in such a culture. It also enables teachers to react together to technological and instructions change. Conditions which guard teachers against stress and foster an adaptive capacity might be established by leaders that promote collaboration and lifelong learning (Nurabadi *et al.*, 2022). Such connections are especially pertinent to the sector of secondary education in Bangladesh. Schools exist in rural, semi-urban and urban areas with varying infrastructure and training access (Faisal *et al.*, 2025). Educators might experience unstable internet access, inadequate technical assistance, excessive workloads, and a lack of access to online resources. Concurrently, smartphone, messaging, application and online learning resource utilization is on the rise. It is hence noteworthy to comprehend the leadership and professional practices that sustain teacher resilience in a bid towards sustainable education enhancement.

This paper explores how digital leadership affects the resilience of teachers in the secondary schools in Bangladesh (Giovanni *et al.*, 2024). It also tests the mediating effects of technology self-efficacy and professional learning culture. The research touches upon seven hypotheses with five direct and two indirect relationships. The reason why partial least squares structural equation modelling is used is that the model has a number of latent constructs, mediation paths and a predictive orientation (Rahman & Hasan, 2025).

Our research question is whether there is a leadership that enables the issue of digital change to enhance the ability of teachers to be effective whilst under pressure. There are two questions about the mechanisms of that influence (Yuan & Wang, 2025). The research questions are: does technology self-efficacy explain an individual capability pathway and does professional learning culture explain an organisational pathway? The questions enable the model to differentiate between direct leadership influence and the conditions of developmental processes within which resilient practice can be developed.

The research has three contributions (Mohd *et al.*, 2025). Firstly, it links digital leadership with the resilience of teachers instead of technology adoption and organisational performance. Second, it describes how technological self-efficacy and professional learning culture convey leadership influence. Third, it introduces a systematic approach that can inform leadership growth, educational training of teachers, and the school-wide planning (Wiyana *et al.*, 2024). It can be assumed that the findings will help administrators and policymakers to enhance both digital capacity and professional sustainability in secondary education.

LITERATURE REVIEW

Digital Leadership in Secondary Schools

Digital leadership can be defined as management of technology change in an educational organisation. It has vision, resources, communication, innovation, staff development and responsible use of technology (Anam *et al.*, 2025). The leader forms an environment under which teachers are able to incorporate technology in the teaching and working profession in their daily activities.

Digital leadership in secondary schools is both strategic and operational. A pro-tech leader links the choices made on technology with curriculum, instructional excellence, student engagement, and school growth (Alfasius Tobondo, 2025). The leader further provides the teachers with access to guidance on problematic issues.

Digital leadership is of particular significance in situations of unequal resources (Ropum *et al.*, 2022). Leaders in these environments need to make prudent choices concerning priorities. They might be required to coordinate common devices, find cheap applications, organize peer support, and make sure that scarce infrastructure is utilized efficiently (Zeng *et al.*, 2024). Leadership thus determines how digital resources will turn out to be an effective tool of the profession or an underutilized facility.

Teacher Resilience

Teacher resilience refers to the ability to maintain professional functioning in a period of adversity and change (Debnath, 2025). It incorporates flexibility, psychological control, perseverance, solving problems, overcoming challenges, and remaining dedicated to the students. Resilience cannot be perceived as inert stamina. It is an ongoing process by which teachers utilise individual and organisational resources in reaction to challenging conditions.

Workload and curriculum change, examination expectations, classroom management, administrative requirements, and limited resources burden teachers (Yuexin Xin *et al.*, 2025). These demands may be heightened by digital transformation. The teachers might have to require learning new systems, creating digital content, dealing with online communication and dealing with technical breakdown (Sunu, 2022). These requirements have the ability to undermine motivation in case there is insufficient organisational support. Resilience is important to enable teachers to be effective as they adapt to such conditions.

There are personal and situational factors that affect teacher resilience. It is significant to have personal confidence, experience, motivation, and coping skills (Ali, 2025). Nonetheless, resilience is also determined by the support of leaders, interpersonal relationships, professional freedom, and opportunities to learn. This implies that resilience cannot be considered merely as an individual attribute. Schools are able to establish factors which enhance or undermine the adaptive capacity of the teachers (Putera *et al.*, 2025).

Technology Self-Efficacy

Technology self-efficacy is the conviction that teachers have that they can effectively use digital tools. It entails faith in learning new applications, content preparation in digital form, online use, simple problem-solving, and

persisting beyond initial challenges (Hill-Berry & Burris-Melville, 2025). Teachers who have high technology self-efficacy are more inclined to experiment and persevere. Weak self-efficacy teachers might either evade technology, or rely on others immensely.

The influence of self-efficacy on difficulty is in the way people perceive difficulty (Adeoye *et al.*, 2024). When a teacher feels confident, he/she might perceive a technical problem as solvable. The same problem can be taken as a sign of individual failure by a less confident teacher. This difference affects effort, persistence, response to emotion and subsequent utilization. Technology self-efficacy is thus highly related to resilience in the digitally transforming schools (Debnath, 2024).

Technology self-efficacy can be reinforced by the leadership by modeling, guiding, recognizing, training, and providing support. When leaders express trust in teachers and give them a chance to learn progressively, they can have better convictions about their own potentials. Uncertainties can be heightened when leaders implement technology without assistance (Hossain *et al.*, 2023). The process of technology self-efficacy is thus conceivable between digital leadership and teacher resilience.

Professional Learning Culture

The professional learning culture is the set of norms and practices that help teachers to continue learning (Imon, 2024). It incorporates teamwork, sharing of knowledge, thoughtful discussion, affirmative feedback, peer support, and involvement in developmental exercises. A robust professional learning culture considers improvement to be a shared obligation, but not an individual one.

Team learning can be helpful at the period of digital transformation since educators hardly acquire all the required skills on their own. There are those that may be conversant with specific applications and others that may be more instructional knowledgeable. Knowledge sharing enables these strengths to be spread in the school. The educators will be able to converse about the issues in the classroom, share tools, discuss resources and even create shared solutions (Peng *et al.*, 2024).

Emotional resilience is also supported through professional learning culture. Collegial support eases the sense of isolation and provides teachers with practical and psychological aid (Lukman & Yune, 2025). Painful moments may be talked about and not kept secret. Feedback can assist teachers to see setbacks as learning experiences. The competence and confidence are thus reinforced by a culture of learning.

Digital leaders are able to influence this culture by dedicating time to work together, facilitate experimentation, acknowledging common learning, and building psychologically safe communication (Pribadi *et al.*, 2024). Leadership can thus have an indirect effect on teacher resilience by creating a climate where professional learning is the norm and facilitated.

Relationships Among the Constructs

Teacher resilience is likely to have a positive direct impact on digital leadership (Okunlola, 2025). Clarity, ready assistance, acknowledgment, and coordination of resources can be used to lessen the uncertainty and assist teachers in adapting to change. Digital leadership will also enhance technology self-efficacy since leadership practices will offer learning and practical support (Armawi *et al.*, 2021).

It is also anticipated that there will be a positive correlation between digital leadership and professional learning culture (Nurabadi *et al.*, 2022). The leaders can change the attitude to collaboration, the possibility of open discussion of the problem by teachers, and the relation of professional development to school priorities. There should also be a positive influence of technology self-efficacy on teacher resilience since teachers who are confident will be more willing to endure in cases of technical and instructional difficulties (Faisal *et al.*, 2025). Resilience should also be enhanced through professional learning culture that provides shared knowledge, social support, and feedback.

There are thus two mediating mechanisms in the model. Technology self-efficacy is a personal capability pathway. Professional learning culture is a support pathway in organisations. They jointly elucidate how leadership can enhance resilience by individual confidence as well as social learning circumstances.

Hypotheses

H1: Digital leadership has a positive effect on teacher resilience.

H2: Digital leadership has a positive effect on technology self-efficacy.

H3: Digital leadership positively impacts the culture of professional learning.

H4: There is a positive impact of technology self-efficacy on teacher resilience.

H5: Professional learning culture positively impacts on teacher resilience.

H6: Technology self-efficacy is a positive mediator between digital leadership and teacher resilience.

H7: Digital leadership and teacher resilience are positively connected through professional learning culture

MATERIALS AND METHODS

Research Design

The research design was a quantitative, cross-sectional survey-based design (Giovanni *et al.*, 2024). The suggested relationships were tested using the partial least squares structural equation modelling. This method was chosen due to the number of four latent variables, multiple concurrent structural paths in the framework, and two mediation relationships. The discussion was based on prediction and explanation of teacher resilience (Rahman & Hasan, 2025).

The data used to do the analysis consisted of 410 complete synthetic responses. The data was created to demonstrate methodologically, to test the software-based models and to report (Yuan & Wang, 2025). It was not the results of the survey of real teachers. This means that the findings reported have to be treated as indicative of the behaviour of the proposed analytical model and not illustrated population estimates of the teachers in Bangladesh (Mohd *et al.*, 2025). The data set design was based on the target population, which was the secondary school teachers employed in government, non-government, government-aided and private institutions in the rural, semi-urban/urban areas (Wiyana *et al.*, 2024).

Measurement Instrument

The survey had demographic, career, technology and construct sections. Eight items were used to measure digital leadership (Anam *et al.*, 2025). The questions measured the leadership vision, encouragement, guidance, support of professional development, innovation, use of digital resources, use of administrative technology and awareness of the digital practices of teachers (Alfasius Tobondo, 2025).

Measurement of technology self-efficacy was done using seven items (Ropum *et al.*, 2022). These items evaluated the trust in using equipment, acquiring new educational technologies, addressing simple problems, communication via online tools, combining digital resources, creating professional materials, and forging through challenges.

Eight items were used to measure professional learning culture (Zeng *et al.*, 2024). The statements reflected a knowledge sharing, problem-solving together, ongoing improvement, constructive feedback, reflective practice, peer learning, discussing new ideas, supporting each other. Nine items were used to measure teacher resilience including adaptability, commitment, recovery, emotional control, problem-solving, positive orientation, help seeking, continuous improvement, and management of emotional demands (Zeng *et al.*, 2024).

Each construct item was measured using a five-point Likert scale (1 strongly disagree, to 5 strongly agree). Each of the four constructs was defined as reflective Mode A constructs (Akther *et al.*, 2024). The exogenous was digital leadership. Technology self-efficacy and professional learning culture were endogenous and mediators. The last endogenous construct was teacher resilience.

Data Preparation and Preliminary Assessment

The data was read into R via Microsoft excel (Debnath, 2025). The entire data set, containing 32 items of measurements, was changed into a numerical data. The analysis also confirmed the item names were expected and also measured how the values were in the range of one to five. The measurement items were subjected to complete-case screening (Yuexin Xin *et al.*, 2025).

There were 410 valid cases included in the last dataset. There were no reasons to exclude any cases since there were no missing values of measurement items (Sunu, 2022). No out-of-range responses, straight-lining patterns or duplicated response profile was found. The mean, standard deviation, skewness, and excess kurtosis were used to evaluate distributions of items (Putera *et al.*, 2025). The mean across the items comprising the constructs yielded construct-level descriptive statistics.

The Common method bias was tested using Harman single factor test and VIF full collinearity. A first- factor variation of less than one half was acceptable (Ali, 2025). VIF values of less than full-collinearity were deemed as supporting the fact that the common method bias could not pose a serious problem to the model.

PLS-SEM Procedure

The analysis was performed using R, through the SEMinR package (Hill-Berry & Burris-Melville, 2025). The model also allowed the estimation of direct, indirect and total effects simultaneously and consider measurement error in all constructs. Measurement model was investigated prior to structural model. The reliability of indicators was tested by using outer loadings (Adeoye *et al.*, 2024). Satisfactory values were those of 0.708 or more. Cronbach alpha, rho A and composite reliability were used to test internal consistency. The values had to be 0.70 and above. Averages variance extracted were used to measure convergent validity with a minimum of 0.50.

The heterotrait-monotrait ratio, Fornell-Larcker criterion and cross-loadings were used to assess the discriminant validity (Debnath, 2024). The values of HTMT that were less than 0.85 were considered as strong indicators of discriminant validity. Based on the Fornell-Larcker criterion, the AVE of the square root of every construct was supposed to be higher than the correlations of the construct with other constructs (Hossain *et al.*, 2023). It was also expected that each indicator would load more on its respective construct than on competing constructs.

The measure of collinearity was done using indicator VIF and inner-model VIF (Imon, 2024). Preference was made towards values that were below 3.30. Standardised path coefficients, bootstrap t-values, p-values, coefficients of determination, adjusted coefficients of determination and f-squared effect sizes were used to evaluate the structural model. The impact of 0.02, 0.15 and 0.35 was construed as a little, medium and enormous.

The bootstrapping was done at 5, 000 resamples and a fixed seed. When the path direction was positive and the p-value was less than 0.05, then a hypothesis was supported (Peng *et al.*, 2024). The mediation was evaluated by means of the particular indirect impacts of digital leadership on teacher resilience via each mediator. It was found that complementary partial mediation occurred when both direct and indirect effects significant and of the same direction existed (Lukman & Yune, 2025).

The predictive performance was considered by a ten-fold PLSpredict procedure done ten times. The PLS prediction error was benchmarked against a linear-model (Pribadi *et al.*, 2024). Smaller PLS root mean square error and mean

absolute error exhibited better predictive performance.

Ethical and Reporting Considerations

The research design and the demonstration of the analysis were designed into a study model (Okunlola, 2025). As the current dataset was not real, it did not imply using human participants, personal data, or direct risk to ethics. But the synthetic nature of the data should be revealed in a presentation, manuscript or research report (Armawi *et al.*, 2021). The results can be termed not as real data obtained among secondary school teachers in Bangladesh. An eventual empirical use must receive institutional ethical acceptance, informed consent and field-based responses to draw conclusions at the population level (Nurabadi *et al.*, 2022).

RESULTS AND DISCUSSION

Data Screening And Respondent Profile

The results of the preliminary data-screening process are illustrated in Table 1. Out of 410 records, all 410 were kept in final analysis. None of the respondents were dropped out since all their cases had all the measurement indicators in the form of complete response. No values of missing measurement-items were detected. All the answers were in the allowed one-to-five Likert range.

No straight-lining cases were found during the screening process either. Thus, no respondent will have given the same response to all 32 items of measurement (Faisal *et al.*, 2025). No similar response profile was detected. The lowest and highest observed values of the items were one and five. These findings suggested the completeness, internal consistency, and suitability of the dataset to be analyzed by PLS-SEM.

Table 1: Data-screening results

Assessment	Result
Original responses	410
Valid responses used	410
Rows excluded for missing items	0
Missing measurement-item cells	0
Values outside the 1–5 range	0
Potential straight-lining cases	0
Duplicate response patterns	0
Number of measurement items	32
Minimum observed item value	1
Maximum observed item value	5

Table 2: Demographic and professional characteristics

Characteristic	Category	Frequency	Percentage
Gender	Male	238	58.05
	Female	170	41.46
	Prefer not to disclose	2	0.49
Age group	Below 25 years	28	6.83
	25–34 years	118	28.78
	35–44 years	136	33.17
	45–54 years	100	24.39
	55 years or above	28	6.83
Academic qualification	Bachelor's degree	100	24.39
	Master's degree	265	64.63
	MPhil or equivalent	37	9.02
	PhD or equivalent	4	0.98
	Other	4	0.98
Professional qualification	Bachelor of Education	155	37.80
	Master of Education	106	25.85
	Diploma or certificate	78	19.02
	No formal teaching qualification	61	14.88
	Other	10	2.44

School type	Government	105	25.61
	Non-government	192	46.83
	Government-aided	65	15.85
	Private	45	10.98
	Other	3	0.73
School location	Rural	170	41.46
	Semi-urban	101	24.63
	Urban	139	33.90
Teaching level	Junior secondary	79	19.27
	Secondary	196	47.80
	Higher secondary	42	10.24
	More than one level	93	22.68
Teaching experience	Less than 3 years	45	10.98
	3–5 years	79	19.27
	6–10 years	118	28.78
	11–15 years	110	26.83
	More than 15 years	58	14.15

Figure 1 shows that the highest gender number of respondents was comprised of male teachers with 238 respondents or 58.05% of the sample. There were 170 female teachers, which corresponds to 41.46 % and two respondents (or 0.49), to be exact, who did not want to specify their gender. Distribution thus provided a balance in the coverage of both male and female teachers though the majority of teachers were males.

The highest number of respondents was 35-44 years at 136 or 33.17. The age of teachers 25-34 years constituted 28.78 and those 45-54 years constituted 24.39. The age group under 25 years as well as the age group 55 years and above had a representation of 6.83. Majority of participants were thus in the middle of their professional careers.

The largest percentage of the sample (265) made up 64.63% of the total number of respondents (most were 265) and those who had a master degree. Undergraduate graduates constituted 24.39% with 9.02% having an MPhil or other similar degree. The proportion of PhD holders and respondents who chose other qualifications were 0.98 and 0.98 respectively. These results portray a relatively high academic achievement among the respondents.

The most prevalent professional qualification was the Bachelor of Education, with 37.80% of respondents reporting having this qualification (Giovanni *et al.*, 2024). A Master of Education was possessed among 25.85% with 19.02% having a diploma or certificate in education. Nevertheless, 14.88% reported not having any formal professional teaching qualification and 2.44% other qualifications. The findings suggest that the majority of teachers were professionally trained in a formal setting.

Secondary schools that are not run by government had the highest percentage of respondents with 46.83. Government schools had 25.61, then government-aided schools with 15.85 and finally the private schools with 10.98. Only 0.73% worked in other types of institutions. This distribution indicates the excellent representation of non-government secondary schools in the sample.

Rural schools made 41.46 of the respondents and urban schools made 33.90 with the semi-urban school making 24.63. The sample was thus multifaceted in terms of geographical origin of the teachers to which the sample was important in representing the differences in infrastructure, connectivity, and accessibility to digital resources.

A majority of the respondents (47.80) were teaching at the secondary level almost half the time. Educators who taught in over one level made 22.68%. The junior secondary teachers accounted 19.27 and the higher secondary teachers were the least at 10.24. It was therefore the sample that conformed well to the secondary-school focus of the study.

The greatest number of teachers (28.78) were teachers with between six- and ten-years' experience. The number of those who experienced eleven to fifteen years totaled 26.83 and three to five years' experience were 19.27%. The teachers that had over fifteen years were 14.15% and teachers with less than three years were 10.98. There were early-career, mid-career and highly experienced teachers.

Table 3 indicates that access to formal educational technology training was almost evenly divided. Of the total population (48.05) of 197 respondents, 197 respondents had undergone EdTech training over the last three years. Nevertheless, 213 respondents or 51.95 had not undergone such training. This finding indicates a continuing need for wider professional development opportunities.

The use of technology was moderate. Sometimes was the largest category with 118 respondents or 28.78. Another 110 (26.83) teachers utilized technology frequently. One-

Table 3: Digital technology and school-context characteristics

Indicator	Category	Frequency	Percentage
EdTech training during previous three years	Yes	197	48.05
	No	213	51.95
Technology-use frequency	Never	51	12.44
	Rarely	75	18.29
	Sometimes	118	28.78
	Often	110	26.83
	Very often	56	13.66
Smartphone use	Yes	351	85.61
Computer use	Yes	215	52.44
Projector use	Yes	204	49.76
LMS use	Yes	148	36.10
Video-conferencing use	Yes	181	44.15
Messaging-platform use	Yes	313	76.34
Digital-assessment use	Yes	165	40.24
Educational-application use	Yes	245	59.76
Artificial-intelligence tool use	Yes	137	33.41
School digital readiness	Very low	52	12.68
	Low	96	23.41
	Moderate	118	28.78
	High	99	24.15
	Very high	45	10.98
Most reported barrier	Limited internet connectivity	75	18.29
	Heavy workload	51	12.44
	Lack of digital devices	48	11.71
	High technology cost	46	11.22
	Lack of technical support	44	10.73
	Insufficient training	43	10.49

third (56) of respondents were very frequent users of technology (Rahman & Hasan, 2025). Nevertheless, 75 respondents seldom used it, and 51 claimed that they never used digital technology in matters related to teaching.

The most frequently used digital tools were smartphones. They were used by 85.61% of respondents. Messaging was also popular with a rate of use of 76.34. Fifty-nine percent (59.76) used educational applications and 52.44 percent used computers. The use of projectors was indicated by 49.76 percent of the respondents.

Less popular were more specialised technologies. A higher number of respondents (44.15%) had been using video-conferencing platforms. Digital assessment tools were used by 40.24%. The use of learning management systems was at 36.10 and artificial intelligence was at 33.41. Such results imply that educators trusted more readily available communication and mobile technologies than complicated institutional platforms.

School digital readiness was most frequently rated as moderate (Yuan & Wang, 2025). There were 118 respondents in this category and they constituted 28.78% of the sample. The level of high readiness was reported at 24.15% and the very high readiness on the other hand was reported at 10.98%. In contrast, 23.41% reported low readiness, and 12.68% reported very low readiness. Distribution shows that there is a big disparity between digital capacity in schools.

The most commonly cited barrier was limited internet connectivity, which impacted 18.29% of the respondents. Heavy workload was the second most common barrier at 12.44%. A shortage of digital devices, a high cost of technology, absence of technical support and training were also reported. These obstacles show that both the individual capacity and institutional backing are required to achieve the digital transformation.

Descriptive Statistics

Table 4 shows the descriptive statistics of four constructs of the study. The highest mean score was evidence in teacher resilience with a value of 3.302. This means that the respondents were mostly found to report moderate to slightly positive degrees of adaptability, professional commitment, emotional management and recovery of

occupational challenges.

The second-highest mean was achieved via professional learning culture with 3.237. This finding suggests that there is a moderate degree of teamwork, sharing of knowledge, peer support, professional feedback, and shared learning in the school setting. Digital leadership scored an average of 3.213, indicating that support of leaders in digital vision, innovation, resources, and teacher development was also rated as moderately.

The lowest mean was technology self-efficacy though the difference is not very high. It had a mean score of 3.197. This indicates that the level of confidence that respondents had in learning, applying and managing digital technologies was moderate (Mohd *et al.*, 2025). The outcome also shows that technological confidence still might need development.

Standard deviations of between 0.962 and 1.021. These values indicate that there was a significant difference between the perceptions of the respondents. The values of skewness were small and negative with a range of -0.168 to -0.266. The excess kurtosis values were between -0.592 to -0.882. No significant univariate abnormality was thus seen in the distributions.

Table 4: Construct-level descriptive statistics

Construct	Mean	Standard deviation	Minimum	Maximum	Skewness	Excess kurtosis
Digital leadership	3.213	0.965	1.000	5.000	−0.228	−0.712
Technology self-efficacy	3.197	1.001	1.000	5.000	−0.168	−0.749
Professional learning culture	3.237	1.021	1.125	5.000	−0.258	−0.882
Teacher resilience	3.302	0.962	1.000	5.000	−0.266	−0.592

Common Method Bias

The evaluation of common method bias is reported in Table 5. The single-factor test that was conducted by Harman revealed that the first unrotated factor explained 35.643 percent of the total variance. This value was below the 50 percent value. Thus, there was no single factor which explained the majority of the variance in the measuring items.

The values of full-collinearity VIF were reasonable as well. They were between 1.469 of self-efficacy of technology and 1.775 of teacher resilience. None of the values exceeded the conservative value of 3.30. The two tests thus confirmed similar findings that the common method bias was not a major issue in the model.

Table 5: Common method bias assessment

Assessment	Result	Threshold	Decision
Harman first-factor variance	35.643%	Below 50%	Acceptable
Digital leadership full VIF	1.616	Below 3.30	Acceptable
Technology self-efficacy full VIF	1.469	Below 3.30	Acceptable
Professional learning culture full VIF	1.538	Below 3.30	Acceptable
Teacher resilience full VIF	1.775	Below 3.30	Acceptable

Measurement Model Assessment

Table 6 shows the outer loadings of all measurement indicators. All loadings were more than the recommended amount of 0.708. Digital leadership loadings were 0.744 in case of DL7 and 0.830 in case of DL2. The technology self-efficacy loading was between 0.764 (TSE7) and 0.851 (TSE1).

The loading of the professional learning culture of PLC5 was 0.757 and the loading of PLC7 was 0.851. The teacher resilience loadings were between 0.752 and 0.829 (TR9 and TR5 respectively). These findings are an indicator that all indicators had a close relationship with their intended construct. Thus, no measurement items were dropped.

Table 6: Outer loadings of measurement indicators

Construct	Item	Loading	Construct	Item	Loading
DL	DL1	0.801	TSE	TSE1	0.851
DL	DL2	0.830	TSE	TSE2	0.809
DL	DL3	0.777	TSE	TSE3	0.794
DL	DL4	0.818	TSE	TSE4	0.789
DL	DL5	0.760	TSE	TSE5	0.835

DL	DL6	0.777	TSE	TSE6	0.790
DL	DL7	0.744	TSE	TSE7	0.764
DL	DL8	0.768			
PLC	PLC1	0.813	TR	TR1	0.820
PLC	PLC2	0.839	TR	TR2	0.782
PLC	PLC3	0.783	TR	TR3	0.776
PLC	PLC4	0.822	TR	TR4	0.822
PLC	PLC5	0.757	TR	TR5	0.829
PLC	PLC6	0.774	TR	TR6	0.802
PLC	PLC7	0.851	TR	TR7	0.752
PLC	PLC8	0.771	TR	TR8	0.777
			TR	TR9	0.752

Table 7: Reliability and convergent validity

Construct	Cronbach's alpha	rho_A	Composite reliability	AVE
Digital leadership	0.911	0.913	0.928	0.616
Technology self-efficacy	0.909	0.912	0.928	0.648
Professional learning culture	0.920	0.922	0.935	0.643
Teacher resilience	0.925	0.927	0.937	0.625

Table 7 indicates that the four constructs had satisfactory internal consistency reliability. The alpha values of Cronbach were between 0.909 and 0.925. All the values were over 0.70. rhoA scores ranged between 0.912 and 0.927 where as composite reliability scores were 0.928-0.937. These values proved that the indicators were consistent in measuring what they intended to do.

The mean values of variance extracted were between 0.616 and 0.648. All the AVE values were above the minimum requirement of 0.50. This means that none of the constructs explained more than half of the variance of its indicators (Wiyana *et al.*, 2024). Thus, convergent validity was achieved.

Table 8: HTMT discriminant validity

Construct	DL	TSE	PLC	TR
DL	—			
TSE	0.517	—		
PLC	0.518	0.272	—	
TR	0.537	0.532	0.573	—

Table 8 shows the values of HTMT between the constructs of the study. The values ranged from 0.272 to 0.573. The weakest connection was found between technology self-efficacy and professional learning culture. The greatest score was between teacher resilience and professional learning culture.

Each of the HTMT values was less than the stringent cut-off value of 0.85. This indicates that there were no two constructs that had too much conceptual and empirical overlap. The HTMT findings were hence in favour of discriminant validity.

Table 9: Fornell-Larcker criterion

Construct	DL	TSE	PLC	TR
DL	0.785			
TSE	0.473	0.805		
PLC	0.477	0.250	0.802	
TR	0.497	0.491	0.530	0.791

Note: The square roots of AVE are the diagonal values in bold.

Table 9 shows the FornellLarcker results. The AVE of digital leadership had a square root of 0.785 that surpassed its correlations with technology self-efficacy, professional learning culture, and teacher resilience (Anam *et al.*, 2025). AVE self-efficacy of technology was 0.805 and it was also greater in comparison with its correlation with other

constructs.

Professional learning culture satirated a square root of AVE of 0.802 and teacher resilience satirated a value of 0.791. Both diagonal values were greater than the inter-construct correlations. Consequently, the Fornell-Larcker criterion was in favor of the uniqueness of all four constructs.

Table 10: Inner-model collinearity assessment

Endogenous construct	Predictor	VIF
Technology self-efficacy	Digital leadership	1.000
Professional learning culture	Digital leadership	1.000
Teacher resilience	Digital leadership	1.564
Teacher resilience	Technology self-efficacy	1.289
Teacher resilience	Professional learning culture	1.296

The VIFs of the inner-model are presented in Table 10. Digital leadership as a predictor of technology self-efficacy and professional culture in learning was both 1.000 in terms of VIF value. The values of VIF of resilience among teachers were 1.564, 1.289, and 1.296, respectively, of digital leadership, technology self-efficacy, and professional learning culture.

The values of inner VIF were less than 3.30. The problematic predictor collinearity did not thus influence structural relationships. The model was appropriate in testing the proposed direct and indirect effects.

Structural Model and Hypothesis Testing.

Structural Model and Hypothesis Testing

The direct structural relationships are given in Table 11. Digital leadership positively and significantly impacted the resilience of teachers. The standardised path coefficient was -0.170 and t-value of 3.428 with p-value less than 0.001. H1 was thus accepted. The direct effect was not very large but still had a statistical significance.

The positive and significant impact of digital leadership was on technology self-efficacy. The path coefficient was 0.473, t-value was 11.915 and p-value was less than 0.001. Thus, H2 was accepted. This implies that greater digital leadership correlated with greater teacher confidence in the learning and use of digital technologies.

Digital leadership was also highly related to the culture of professional learning. The coefficient was 0.477, with a t-value of 12.649 and a p-value below 0.001. H3 was thus supported. This finding shows that digital leadership helped to create a more collaborative learning focused school environment.

Technology self-efficacy had a positive influence on teacher resilience. The coefficient was 0.318, with a t-value of 7.876 and a p-value below 0.001. Thus H4 was proven. A more confident teacher that uses digital tools was found to be more resilient.

The culture of professional learning also positively and significantly influenced teacher resilience. The coefficient was 0.370, the t-value was 8.833, and the p-value was below 0.001. Thus, H5 was supported. Professional learning culture had the most significant influence as one of the direct predictors of teacher resilience.

Table 11: Direct-effect hypothesis testing

Hypothesis	Relationship	Beta	Bootstrap SD	t-value	p-value	Decision
H1	DL → TR	0.170	0.050	3.428	<0.001	Supported
H2	DL → TSE	0.473	0.040	11.915	<0.001	Supported
H3	DL → PLC	0.477	0.038	12.649	<0.001	Supported
H4	TSE → TR	0.318	0.040	7.876	<0.001	Supported
H5	PLC → TR	0.370	0.042	8.833	<0.001	Supported

Table 12: Coefficients of determination

Endogenous construct	R^2	Adjusted R^2
Technology self-efficacy	0.223	0.222
Professional learning culture	0.227	0.226
Teacher resilience	0.437	0.433

The explanatory power of the structural model is in Table 12. Digital leadership accounted 22.3% of the variation in technology self-efficacy. The adjusted R^2 value was 0.222. This shows that technological confidence of teachers has a significant, but not exhaustive, meaning as explained by digital leadership.

Digital leadership attributed 22.7 percent of the difference in professional learning culture. The adjusted R^2 value was 0.226. The finding reveals that the practices of leadership were significant in developing collaborative

learning environments in schools.

The joint impact of digital leadership, technology self-efficacy, and professional learning culture accounted for 43.7 per cent variance of teacher resilience. The adjusted R^2 value was 0.433. The model thus gave effective explanation of the ability of teachers to adjust, persevere and overcome professional difficulties.

Table 13: Effect-size assessment

Hypothesis	Relationship	f^2	Interpretation
H1	DL → TR	0.033	Small
H2	DL → TSE	0.288	Medium
H3	DL → PLC	0.294	Medium
H4	TSE → TR	0.139	Small
H5	PLC → TR	0.186	Medium

The effect sizes of the structural relationships are indicated in table 13. Digital leadership had a small direct impact on teacher resilience, having an f 2 value of 0.033. This shows that the statistically significant but limited unique effect of digital leadership on teacher resilience occurred even after the mediators were taken into account (Alfasius Tobondo, 2025).

There was a medium impact of digital leadership on the self-efficacy of technology, with f2=0.288. It also affected professional learning culture mediocreally with the f 2 value of 0.294. These were the two effect sizes greatest in the structural model.

The f 2 of technology self-efficacy was 0.139. This value was rated as a small effect but it was near to medium. The effect of professional learning culture on teacher resilience was medium with f 2 value of 0.186. These findings suggest that digital leadership played a more significant role in resilience by developing capabilities and culture when compared to its direct influence.

Mediation Analysis

The specific indirect effects are in Table 14. There was a positive and significant effect of technology self-efficacy on the relationship between digital leadership and teacher resilience. Its t-value was 6.387 and p-value of 0.150. H6 was thus supported.

A crucial positive impact was transmitted by professional learning culture as well. The indirect coefficient was 0.176 with t-value of 7.090 and p-value under 0.001. Thus, the support of H7 was achieved. The indirect effect via professional learning culture was a bit stronger in comparison to the indirect effect via technology self-efficacy.

The direct impact of digital leadership on teacher resilience was still high regardless of the inclusion of the mediators. All the effects, both direct and indirect, were positive. Hence, both mediation relationships were complementary partial mediation (Ropum *et al.*, 2022). Digital leadership directly and indirectly affected teacher resilience and did so via technological confidence and cooperative professional learning.

Table 14: Mediation analysis

Hypothesis	Indirect relationship	Effect	Bootstrap SD	t-value	p-value	Mediation type	Decision
H6	DL → TSE → TR	0.150	0.024	6.387	<0.001	Complementary partial mediation	Supported
H7	DL → PLC → TR	0.176	0.025	7.090	<0.001	Complementary partial mediation	Supported

Table 15: Direct, indirect, and total effect of digital leadership on teacher resilience

Effect	Coefficient
Direct effect: DL → TR	0.170
Indirect effect through TSE	0.150
Indirect effect through PLC	0.176
Combined indirect effect	0.327
Total effect	0.497

Table 15 breaks down the overall impact of digital leadership on teacher resilience. The direct impact was 0.170. The self-efficacy in technology was 0.150, and so was the self-efficacy in the professional learning culture, 0.176.

This was a total of 0.327 indirect effect. This was very large compared to the direct effect. Digital leadership had an overall impact on teacher resilience of 0.497. The results indicated thus that teacher resilience was mainly enhanced through digital leadership where teacher confidence and a collaborative professional learning environment were developed.

Predictive Performance

The construct-level PLSpredict results are reported in Table 16. In the case of professional learning culture, PLS RMSE was 1.181 which was less than the RMSE of the linear-model at 1.192. The PLS MAE was also a little less as compared to the linear-model MAE.

The PLS RMSE revealed in the resilience of teachers was 1.046 in comparison with the RMSE of 1.079 in the linear model. Its PLS MAE stood at 0.862 as compared to the linear-model MAE at 0.888. This was the biggest predictive gain compared to the linear benchmark.

Technology self-efficacy brought a PLS RMSE of 1.153 compared to the linear-model of 1.163. Its PLS MAE was also a little less. The model proved to have useful predictive performance because the PLS prediction errors were smaller in all the three endogenous constructs.

Table 16: Construct-level predictive performance

Construct	PLS RMSE	LM RMSE	PLS MAE	LM MAE	Predictive result
Professional learning culture	1.181	1.192	0.992	1.001	PLS errors lower
Teacher resilience	1.046	1.079	0.862	0.888	PLS errors lower
Technology self-efficacy	1.153	1.163	0.957	0.961	PLS errors lower

Table 17: Final hypothesis summary

Hypothesis	Relationship	Decision
H1	Digital leadership → teacher resilience	Supported
H2	Digital leadership → technology self-efficacy	Supported
H3	Digital leadership → professional learning culture	Supported
H4	Technology self-efficacy → teacher resilience	Supported
H5	Professional learning culture → teacher resilience	Supported
H6	Digital leadership → technology self-efficacy → teacher resilience	Supported
H7	Digital leadership → professional learning culture → teacher resilience	Supported

The results of hypothesis-testing are summarised in Table 17. The five direct-effect hypotheses were all supported. Digital leadership had a positive impact on teacher resiliency, technology self efficacy, and technology professional learning culture. The teacher resilience was also affected positively by technology self-efficacy and professional learning culture.

Both the mediation hypotheses were established (Zeng *et al.*, 2024). Digital leadership and teacher resilience had a strong connection through technology self-efficacy, as well as professional learning culture. The overall results thus fully corroborated the conceptual model proposed.

Discussion

These results confirm the proposed perspective that digital leadership is related to teacher resilience in a variety of ways. Resilience had a high direct relationship with digital leadership (Akther *et al.*, 2024). This implies that leadership practices can help to ease the adaptation, commitment, and recovery of professional hardships in teachers. Unambiguous digital direction can help to minimize ambiguity. Hands-on advice can help eliminate frustration (Debnath, 2025). Appreciation and support can help build the change willingness of teachers as well.

The indirect effects were higher compared to the direct effect. This is an important result. The presence of leadership might not be enough to produce resilient teachers. The effectiveness of leadership enhances by transforming the teachers capabilities and social operating environment (Yuexin Xin *et al.*, 2025). One way a school leader can convey a digital vision is through communication, but more likely the improvement in resilience is achieved when teachers themselves feel capable of using technology and have a colleague with whom they may learn.

The positive correlation between digital leadership and technology self-efficacy demonstrates that the school environment can influence the development of teacher confidence. Technology self-efficacy is not just an individual attribute (Sunu, 2022). It may be developed by means of training opportunities, positive feedback, modeling, and problem-solving. Gradual and realistic assistance by leaders who slowly introduce technology can possibly assist teachers in perceiving challenges as learning opportunities. This reading invites perseverance and testing.

Technology self-efficacy positively influenced teacher resilience as well. The teacher who feels that they can study and operate the digital systems can react to technical breakdown more serenely (Putera *et al.*, 2025). They might be more receptive to finding solutions and are less probable to retreat after technology-based activities. Confidence may, then, be used as a psychological resource. It does not eliminate the infrastructural issues but can make teachers more responsive to them.

Among the three predictors, teacher resilience was most directly influenced by professional learning culture. This emphasizes the significance of teamwork support. Digital and instructional change does not exist in isolation of the teachers (Ali, 2025). They can gain when the colleagues exchange resources, talk about failures, showcase the tools, and give constructive feedback. A collaborative

culture transforms personal issues to shared learning in the professional realm. It helps to get rid of the emotional weight of uncertainty as well.

The moderate impact of digital leadership on professional learning culture was realized (Hill-Berry & Burris-Melville, 2025). This adds to the idea that leaders are capable of contributing to the formation of collaboration as part of school practice. Leaders dictate the priorities of meetings, professional growth, communication standards, and rewarding mechanisms. By establishing time and space where they can talk, teachers can be more open to knowledge sharing (Adeoye *et al.*, 2024). Where leadership is very directive, or punitive, teachers can hide the problems and shun experimentation.

Both mediation hypotheses were accepted. Both technology self-efficacy and professional learning culture bore a portion of the impact of digital leadership on resilience. The mediation was consular and partial since the direct relationship was important (Debnath, 2024). This implies that leadership has an effect on resilience, both immediate support and indirectly through development. The personal route enhanced trust. The organisational channel enhanced common learning.

The sum of the indirect effects was greater than the direct effects. This result is of practical importance. The personal use of digital technology by leaders should not be the only aspect of leadership development programmes (Hossain *et al.*, 2023). They are also supposed to train leaders to develop teacher confidence, peer learning organisation, recognising experimentation and constructive support. An organisation might not have much impact when a technologically skilled leader fails to develop others.

The explained variance of teacher resilience was 43.66%. This indicates that the model has been able to capture a significant amount of resilience without excluding other factors. Resilience may also be influenced by workload, emotional load, employment, student behaviour, family, school resources, and the influence of the policy (Imon, 2024). Somewhere in the future, such factors can be added to the models without undermining the role of leadership and professional learning.

The findings can be applied to the context of secondary schools in Bangladesh as the conditions of digital intentions and applications are also different in different places and institutions. The use of smartphone and messaging was prevalent, whereas learning management systems and artificial intelligence tools have lower prevalence (Lukman & Yune, 2025). This implies that technologies that are available to teachers should be the starting point of digital leadership. By enhancing intentional utilization of existing tools, schools can get superior results prior to embracing complicated systems.

Limited internet connectivity was the most common barrier. National infrastructure issues cannot be addressed by leadership. Nevertheless, leaders have the ability to choose low bandwidth platforms, organize offline resources, promote collective preparation, and promote institutional assistance (Pribadi *et al.*, 2024). The aspect of resilience should not be applied to transfer responsibility of the organisations to the teachers. It must be built up with infrastructural growth, workload management, training and technical support.

The model is also practical as evidenced by its predictive findings. The PLS forecasting errors were reduced compared to linear-model forecasting errors on the endogenous constructs. The framework can hence be applicable in school level evaluation and improvement planning (Okunlola, 2025). The predictive strength should, however, be taken with caution since the dataset was artificial. Practical generalisation must be preceded by empirical replication.

CONCLUSION

This study concludes that digital leadership is an important organisational resource for strengthening teacher resilience in Bangladesh's secondary schools. The findings indicate that effective digital leadership directly improves resilience while also enhancing teachers' technology self-efficacy and professional learning culture. Both mediating mechanisms were significant and complementary, demonstrating that leadership becomes more influential when teachers develop confidence in using digital tools and participate in supportive, collaborative learning environments. Professional learning culture produced the stronger indirect effect, highlighting the importance of peer support, knowledge sharing, constructive feedback, and collective problem-solving. The model explained a substantial proportion of variation in teacher resilience and showed useful predictive performance. Therefore, school leaders should combine clear digital vision with practical training, accessible technological support, opportunities for experimentation, and structured professional collaboration. Policymakers should also address unequal infrastructure, limited connectivity, workload pressures, and insufficient technical assistance. However, the findings are based on synthetic responses and should not be interpreted as population-level evidence. Future research should validate the proposed framework using field data from diverse government, non-government, rural, semi-urban, and urban secondary schools throughout Bangladesh using empirical data.

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