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BRIDGING NUMBERS AND NARRATIVES: HOW DIGITAL LEADERSHIP DRIVES SUSTAINABLE SCHOOL IMPROVEMENT IN PUNJAB'S SECONDARY SCHOOLS

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ABSTRACT

The present study examined the role of digital leadership in facilitating sustainable school improvement in secondary schools of Punjab, Pakistan. An explanatory sequential mixed methods design was used, by combining quantitative trends with qualitative insights for gaining a holistic view of the phenomenon. Four districts, both public and private secondary schools affiliated to Boards of Intermediate and Secondary Education (BISE) in these districts were included in the study. Stratified random sample was used in the quantitative phase to ensure representation in the various sectors. Validated questionnaires, drawn from existing frameworks for digital leadership and sustainable school improvement, were used for data collection. Descriptive statistics, independent t tests, ANOVA, correlation, and multiple regression were used as the analysis methods with significant positive relationships between digital leadership practices and indicators of school improvement. In the qualitative phase, purposive sampling was applied to select schools with a high and a low digital leadership score. Twenty principals and teachers (10 from high scoring and 10 from low scoring schools) were interviewed with semi-structured interviews and thematic analysis was used to analyse the transcripts. Inter-rater reliability was good between two independent coders (Cohen's $\kappa = 0.84$). The quantitative and qualitative results were integrated and presented in conjunction, highlighting the strength of digital leadership's influence as well as how it is helping to achieve sustainable school improvement. The results support a model that suggests five key components leadership vision, technology integration, professional development, adaptability and innovation when coupled together, lead educational transformation in a sustainable manner. The findings of this study have implications for policy and practice.

Keywords: *Digital leadership, educational transformation, professional learning, school improvement, sustainability, technology integration*

1. INTRODUCTION

Digital technologies have rapidly changed the nature of education around the world, impacting teaching, leadership and school organization. In secondary schools, digital leadership has become a key element in leading schools towards sustainable improvement. Digital leadership is the ability of school leaders to effectively and purposefully leverage technology in school administration, instruction,

and other school processes for better educational outcomes (Anderson & Dexter, 2005). Public as well as private Secondary schools are run by Boards of Intermediate and Secondary Education (BISE) in Punjab, Pakistan. The use of digital tools (including technology) is a growing factor in the effectiveness of teaching, engagement of students, and resilience of institutions.

School improvement, which is sustainable, is an ongoing effort to improve the quality of teaching and learning and the efficiency of school operations (Fullan, 2016). Researchers have seen that there is a need for a digital leadership perspective to be integrated with a sustainability perspective, especially following COVID 19, which has given digital platforms a new role in the education process (Harris & Jones, 2020). Leaders need to find creative ways to do this, supply teachers with training, and make sure that the digital resources are accessible fairly. Research shows that successful digital leadership is linked to higher teacher effectiveness, student learning outcomes, and school flexibility (Leithwood et al., 2020).

The mixed method approach was used to gain a deeper understanding of the role digital leadership practices play in achieving sustainable improvements in secondary schools of four districts in Punjab. The research sought to bring together statistical trends and lived experiences of participants to offer a comprehensive understanding of leadership in current digital school contexts.

1.1 Significance of the Study

The outcome of this research is of importance for policy makers, school leaders, and researchers. It presents empirical evidence for the impact of digital leadership on sustainable school improvement and its mixed methods design offers a new way of contributing to the academic conversation. The study provides policy makers with data informed suggestions for digital transformation in secondary schools. It outlines effective methods for school leaders to use technology in the classroom and school administration. The study also has implications for professional development as it identifies some important competencies of digital leaders. Overall, the results show the power of a cohesive leadership, technology and organizational approach to realize lasting improvement.

1.2 Problem Statement

Many secondary schools in Punjab are facing challenges in achieving digital leadership in their school environments despite the much talked about digital transformation in education. They suffer from resource constraints, limited capacity, inadequate technology readiness, and insufficient training. Such difficulties lead to the inequities between public schools and private schools (Ali et al., 2021). Few previous studies have explored the link between the direct use of technology and direct sustainable school improvement in this context, and even fewer have focused on the direct impact of digital leadership on sustainable school improvement. Furthermore, much of the existing literature is based on quantitative methods and has not been very rich in the understanding of the way leadership practice is associated with long term change. This divide has been a challenge for the creation of effective policies and strategies towards sustainable improvement of secondary education.

1.3 Research Objectives

1. To evaluate the level of digital leadership practices in secondary schools (public and private).
2. To explore the connection between digital leadership and measures of long-term school improvement.
3. To learn about how school leaders and teachers experience and perceive digital leadership practices.

1.4 Research Questions

1. How common are the practices of digital leadership in secondary schools across Punjab?
2. How is digital leadership a factor in school transformation toward sustainability?
3. What are principals and teachers' perceptions of digital leadership practices?

1.5 Research Gaps Identified

There is much literature in the field of technology integration and educational leadership but there are surprisingly little research studies that have combined both

domains and have done so in mixed methods, especially in secondary schools in Punjab. Contrary to the rich insights that qualitative inquiry can provide, most research focuses solely on quantitative data (Dexter, 2011). Further, there are a lack of comparative studies between public and private school, which helps to better understand differences between the sectors in digital leadership practices. The pathways between digital leadership and sustainable school improvement are still poorly understood due to the lack of a statistical analysis that incorporates an in depth thematic investigation. This study aims to overcome these gaps using a sequential explanatory mixed methods design, both breadth and depth of understanding.

2. Literature Review

2.1 Foundations of Digital Leadership

Digital leadership has been identified by researchers as a transformative agent in education that impacts teaching, school management and student outcomes. It is about the thinking of school leaders planning to leverage digital tools to improve learning spaces and/or the efficiency of operations (Anderson & Dexter, 2005). Research has shown that effective digital leadership is linked to improved teaching and learning and student success, and that leaders impact the use of technology in school settings (Leithwood et al., 2020).

ISTE Standards for Education Leaders offers a helpful set of standards, focusing on visionary planning, digital citizenship, and continuous professional learning. School leaders have successfully used these standards to integrate technology effectively, and to bring about sustained improvement (International Society for Technology in Education, 2018). It suggests that leaders who use these kinds of frameworks are more likely to promote innovation and support school adaption (Harris & Jones, 2020).

2.2 Recent Developments (2023–2024)

In this modern era, digital leadership has been conceptualized as a strategic and sustainable practice, not so much a practice of technology use, but one that involves influencing school culture, fostering collaboration and inclusion (Nawaz, 2023). There is also growing support for distributed leadership models where digital responsibilities are shared by leaders, teachers and students, fostering a sense of collective ownership of innovation. Attention has been paid to ethical digitalisation and sustainability over the long term. This wider scope includes instructional leadership, lifelong professional learning, and establishing learning spaces that are technology rich to ensure that students are prepared for the future (Nawaz, 2023).

2.3 Multidimensional Approach to Digital Leadership

This section provides an overview of a multidimensional definition of digital leadership. Digital leadership in education is a multidimensional concept that encompasses technological progress, human resource education and ethics and can be defined as an innovative approach to school improvement that is sustainable in the context of digital technology. There are eight key dimensions, according to Sheninger, (2019), Karakose, (2023), and Nawaz, (2023): visionary leadership, effective technology integration, professional learning, adequate infrastructure, digital equity, data driven decision making, collaboration, and innovation management and responsible digital citizenship. These dimensions, when taken together, support leaders to connect their vision with day-to-day practice, build inclusive and adaptive cultures, tackle inequalities, and harness data to drive ongoing improvement.

2.4 Perceptions of Sustainability

The concept of sustainability in education has grown to encompass social, economic, cultural and institutional aspects, as well as environmental (Avelar et al., 2019). Different actors have different perceptions of sustainability: school management is concerned with innovative processes and sustainable developments over the long term, staff and students are concerned about equity of access to resources, while policymakers are concerned with resilience and adaptability in crises like the COVID 19 pandemic (Barth & Rieckmann, 2020; Karakose, 2023; Leal Filho et al., 2021). Digital leadership can support the incorporation of these perspectives by creating inclusive and ethical learning spaces. It is linked to technological innovation, involves collaboration with stakeholders, and relies on data-based approaches that make for improvement today

and in the future (Fullan, 2021; Singh et al., 2023).

2.5 Framework for Sustainable School Improvement (SSI)

Schools' ability to continuously improve the quality of teaching and learning over long periods of time and in response to new challenges is called Sustainable School Improvement (SSI). In contrast to a one-off solution, SSI focuses on long-term sustainability, resilience and change at system level (Hargreaves & Fink, 2006). There are multiple dimensions that are interdependent in sustaining educational quality and institutional growth.

2.6 Visionary and Instructional Leadership

The first step to improving in the long term is having leaders who communicate a vision and direction. Leaders match long term school goals to long term priorities and share leadership across staff and stakeholders, making improvement a part of school culture, and not just reliant upon one person (Leithwood & Sun, 2018). Also, sustained professional learning is a critical need. Adaptability to change is fostered by schools that invest in teacher learning, digital literacy, and reflective practice. Professional development builds teachers' capacity, leading to shared responsibility for innovation, and helps ensure that the gains will be sustained over time (Fullan, 2020).

2.7 Curriculum, Pedagogy, and Innovation

Curricula should be flexible, encompassing, and sensitive to future issues for sustainability. Students' learning is through innovative pedagogical approaches such as student-centered learning, the use of digital tools, and practical, hands-on learning, which strengthen their critical thinking and problem solving in an empowering way to face the real world (OECD, 2021). Equity, inclusion and student well-being is also a key element to promote. Addressing the digital divide, promoting gender equality, and working with marginalised groups fosters trust and cohesion in school communities and is therefore conducive to a fair and inclusive environment (UNESCO, 2020).

2.8 Data-Driven Decision-Making

Data play a vital role in monitoring progress and making decisions. Schools that are implementing reforms and continuously assessing their effectiveness have a better shot of maintaining their transformation and adapting to their changing needs (Kane et al., 2014). But the journey to sustainable improvement does not end at the school gates. Engaging parents, communities, businesses and policy makers fosters common ownership and extends resources, ensuring schools are relevant and responsive to societal needs (Epstein, 2018).

2.9 Digital Transformation and Resource Management

Digital innovation and good use of resources are closely connected with sustainability. The appropriate use of technology, backed up by adequate infrastructure and funding, allows schools to keep expanding. Technology leaders who foster ethical tech use and digital citizenship support instructional and organizational sustainability (Karakose, 2023). Another attribute of sustainable schools is resilience. Making adaptability and continuous improvement part of the institution's practice makes it easier to manage uncertainty and crises. Leaders who welcome change and promote innovation ensure progress that's not only sustained, but enhanced over time (AlAjmi, 2022).

2.10 Additional Dimensions of Sustainable School Improvement

I. Culture and Climate

Culture and climate are critical aspects of a school. A positive climate is established when there is a belief of trust, collaboration, inclusion, and shared values, and culture is the underlying beliefs that lead the way in the way people behave (Gruenert & Whitaker, 2015). Teaching and learning are central to the workplace, and leaders play a vital role in fostering an atmosphere in which learning and innovation thrive. Digital leadership plays its part in promoting transparency, communication, and responsible digital practices, which helps to empower teachers and students (Karakose, 2023).

II. Professional Development & Capacity Building

Investment in teacher professional development and institutional capacity is critical for lasting change. Ongoing pedagogical, digital, and leadership training are needed to stay up to date with the demands of the times. Collaborative learning, mentoring, and digital skills are three areas of school focus that contribute to resilience and progress (Fullan, 2020; Leithwood & Sun, 2018). The view of sustainable school improvement as a continuous process is embraced by many scholars, including Fullan (2016). Fullan stressed that it takes systemic change, or leadership commitment, teacher collaboration, and organizational learning. Sustainability is heavily dependent on the capacity of schools to respond to new technology in a digitally focused environment while keeping the quality of the educational experience high. Digital leadership is further suggested to be a contributing factor to this adaptability (Hallinger, 2011).

Digital leadership and professional development have been given lots of attention. The school leaders are important facilitators for teacher training and development to enable teachers to learn to foster the use of technology in their teaching. (Dexter, 2011) Research has shown that teacher PD boosts teacher confidence and competence in the use of digital tools, leading to better teaching and learning (Harris & Jones, 2020). Digital leadership is more challenging in developing countries like Pakistan. Progress is hindered by limited infrastructure, inadequate funding and urban-rural disparities (Ali et al., 2021). In other settings, research has demonstrated the need to adjust leadership practices to local contexts and constraints (Hallinger, 2011). Thus, it is crucial to study digital leadership in specific socio-economic and cultural contexts.

For quantitative studies, the impact and prevalence of digital leadership have been estimated. For example, statistical methods like correlation and regression have shown strong associations between the role of leadership and school improvement (Leithwood et al., 2020). It is important to note however that these studies do not always explain the mechanism(s) and/or context(s) of the studies.

Qualitative research provides a lot more detail about the experiences of educators. Researchers have gained insight into how school leaders cope, how they plan and work, and how they foster a culture of innovation (Dexter, 2011) through interviews and case studies. The research findings of these studies show that "Vision, Communication and collaboration" are essential for successful leadership.

Qualitative and quantitative paradigms are becoming increasingly separated, as their convergence has been achieved through "mixed methods" research. Mixed methods research offers a more comprehensive view of complex phenomena in education, by drawing on statistical trends and incorporating thematic insights (Creswell & Plano Clark, 2018). This has been especially successful for digital leadership in identifying the scale and impact of digital leadership and how it works.

However, further research is required that is specifically focused on secondary education and digital leadership and sustainability. Most studies have examined these concepts individually, leaving a lack of understanding about the combined effect. Besides, comparative studies between public and private schools are limited and particularly in such an environment as Punjab.

This research tackles these gaps with a sequential explanatory mixed method design. It brings together quantitative and qualitative data to provide a more complex picture about the impact of digital leadership practices on sustainable school improvement. The results validate current theory and offer context specific information which can guide policy and practice in other contexts.

3. Research Methodology

3.1 Design and Approach

For this research, the sequential explanatory mixed methods design was used. The data collection and analysis were done in two phases, quantitative data collection and analysis, to make sense of the quantitative data, followed by qualitative interviews. This approach provided a comprehensive understanding. The quantitative phase led to detecting patterns, relationships and differences in digital leadership practices. During the qualitative phase, the researchers gathered information about participants'

experience and perceptions to help explain the statistical data.

3.2 Population and Sample

The study included public and private secondary schools of four districts in Punjab affiliated to the Boards of Intermediate and Secondary Education (BISE). The choice of these districts was intended to reflect a variety of contexts: varying degree of infrastructure, resources and institutional practice. The respondents of the study were the school principals and secondary school teachers because they are directly involved in leadership and instruction that is impacted by the digital integration. Incorporating the two gave a more comprehensive view from administrative and teacher viewpoints.

Stratified random sampling was used in the quantitative phase. The schools were stratified (public and private) and within each stratum the participants were randomly selected. This reduced the possibility of bias and increased generalisability of the results. In the quantitative phase, 300 individuals participated (100 principals and 200 teachers) representative of the various school types.

Purposive sampling was used for the qualitative phase. The quantitative analysis yielded a subset of schools to be selected for further analysis based on digital leadership score. High and low digital leadership score schools were selected to provide divergent views. Of these schools, 20 respondents were chosen for in depth interviews (10 principals and 10 teachers). Half were from high scoring schools and half were from low scoring schools.

4. Data Collection

Structured questionnaires and semi-structured interview guides were used to gather data. The questionnaire was designed on existing models of digital leadership and sustainable school development. It covered dimensions such as visionary leadership, technology integration, professional development, data-driven decision-making, and institutional adaptability. The amount and impact of digital leadership practices and their effects on school improvement were measured using Likert items. The instrument was reviewed with the experts in educational leadership and research methods for clarity and relevance.

The semi structured interview guide was used to discuss the experiences, perceptions and difficulties of digital leadership, with probes and follow up questions used to follow up on interesting topics.

Collection of data took place in two stages. Questionnaires were sent to selected participants face to face or electronically (as participants wished). Instructions were given clearly and confidentiality was assured to encourage honest answers. The completed questionnaires were checked for completeness prior to analysis.

Second, selected participants were interviewed onsite or through videoconferencing, as available. An interview averaged between 30 and 45 minutes each. All interviews were audio-recorded with participants' permission. Nonverbal cues and context were also captured in field notes.

4.1 Reliability and Validity

The internal consistency of the quantitative instrument was measured by Cronbach's alpha. The overall reliability was greater than 0.70 which is acceptable. The reliabilities of sub scales of the various aspects of digital leadership and sustainable school improvement were also good.

Several approaches were used to validate the instrument. Based on the expert review, content validity has been obtained. The factor analysis was used to explore the construct validity, and items were found to be consistent with the intended dimensions. Small group testing for wordings and clarity was undertaken.

Trustworthiness for the qualitative component was accomplished by focusing on credibility, transferability, dependability, and confirmability. Credibility was strengthened by adequate time spent with participants, and member checking (i.e., reviewing interpretations with participants). Transferability was enhanced by the use of detailed explanations of context and participants, which allows the reader to evaluate the transferability of the results to other contexts. An audit trail of all steps of data collection and analysis was kept to ensure dependability. Reflexivity and systematic documentation of decisions were achieved to ensure confirmability. The thematic analysis was conducted

independently by two coders and was seen to have a high level of interrater reliability (κ = 0.84).

5. Data Analysis

Data was analysed quantitatively in SPSS. Descriptive statistics were obtained; independent t test, ANOVA, correlation, and multiple regression were performed. These analyses were used to summarize the data, test for group differences, and explore relationships and predictive effects. Thematic analysis was used for qualitative data analysis, consisting of coding, categorizing, and identifying themes based on the data. Through this process, meaning making and patterns were created from the narratives presented by the participants.

5.1 Integration

Joint displays were used to integrate quantitative and qualitative results, allowing for comparisons and synthesis of results from both phases. Integration offered insights into how statistical trends became evident in actual lived experiences, not just the scale of the impact of digital leadership but how it can help lead towards sustainable school improvement.

5.2 Descriptive Results

Descriptive data was analysed to describe the data. The means and the standard deviations for important variables are summarized in Table 1. Digital leadership had a mean of 3.78 with an SD of 0.64, representing a high level of digital leadership practices. Sustainable school improvement was an average of 3.81 (SD = 0.60), which was also high. Technology integration and professional development was a little lower but still good, indicating that technology is widely used in the schools, but needs more attention to professional development and capacity building.

Table 1. Descriptive Statistics of Key Variables (N = 300)

Variable	Mean	SD	Interpretation
Digital Leadership	3.78	0.64	High
Technology Integration	3.65	0.70	Moderate to High
Professional Development	3.59	0.68	Moderate
Data-Driven Decision Making	3.52	0.72	Moderate
Sustainable School Improvement	3.81	0.60	High

These results align with previous research indicating that digital leadership contributes to improved teaching and organizational effectiveness (Leithwood et al., 2020). The moderate standard deviations suggest that participants' responses were consistent.

5.3 Comparison of Public and Private Schools

Independent t-tests were conducted to compare public and private schools. Table 2 presents the results. Private schools scored higher on both digital leadership and sustainable school improvement, and the differences were statistically significant ($p < .05$). Effect sizes (Cohen's d = 0.48 for digital leadership, 0.42 for improvement) were small to medium, indicating that the differences are not only statistically significant but also educationally meaningful. This likely reflects disparities in resources and flexibility (Ali et al., 2021).

Table 2. Independent Sample t-test for Public and Private Schools with Effect Size

Variable	Public (M)	Private (M)	t-value	p-value	Cohen's d
Digital Leadership	3.61	3.92	3.45	.001	0.48
Sustainable School Improvement	3.70	3.89	2.98	.003	0.42

5.4 Correlations

Correlation analysis revealed a strong positive relationship between digital leadership and sustainable school improvement ($r = 0.72$, $p < .01$). This indicates that schools with higher

digital leadership scores tended to have better improvement outcomes, supporting the centrality of leadership in driving sustainable change (Fullan, 2016).

Table 3. Correlation Matrix

Variable	1	2
1. Digital Leadership	1.00	
2. Sustainable School Improvement	0.72**	1.00

Note: $p < .01$

5.5 Regression Analysis

Multiple regression was performed to examine whether digital leadership predicts sustainable school improvement. The model was significant ($F(1, 298) = 184.96$, $p < .001$) and explained approximately 50% of the variance ($R^2 = 0.502$, adjusted $R^2 = 0.500$). Table 4 shows that digital leadership was a strong predictor ($\beta = 0.71$, $p < .001$). Thus, leadership practices—especially technology integration and professional development—significantly influence long-term school success. This finding aligns with Harris and Jones's (2020) conclusions about leadership's role in educational transformation.

Table 4. Regression Analysis (N = 300)

Predictor	B	SE	Beta	t-value	p-value
Digital Leadership	0.68	0.05	0.71	13.60	.000

Note: $R^2 = 0.502$, adjusted $R^2 = 0.500$

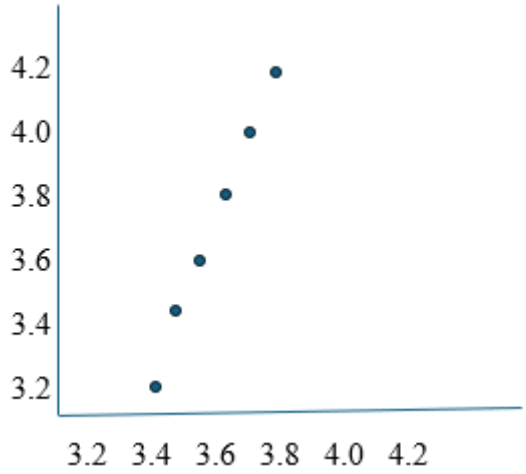

Figure 1 showing a scatter plot with a regression line. It visually confirms the positive linear relationship: as digital leadership goes up, so does sustainable school improvement.

5.6 Qualitative Results

The qualitative analysis revealed deeper and more in-depth results. Interviews were transcribed and two coders independently analyzed the transcripts and demonstrated high interrater reliability (Cohen's $\kappa = 0.84$). There were several predominant themes that emerged: leadership vision, digital infrastructure, professional capacity, collaborative practices, and implementation challenges.

The need for a leadership vision was constantly identified. Teachers felt supported and informed by principals; they also felt they had the opportunity to participate in decision making in schools with a strong digital leadership. But obstacles were also often cited, including a lack of resources, inadequate training, and unwillingness to change, especially in public schools.

There were significant differences between high and low digital leadership schools. The proactive

leadership, continuous professional development, and strategic use of data were characteristics of high performing schools. The structural and operational constraints were a problem for low performing schools. Direct quotations from participants clearly showed how leadership practices impacted teaching and engagement. The findings from the quantitative and qualitative research were integrated. The findings from the quantitative and qualitative studies were combined.

A single view was obtained by integrating both data sources. The findings converged: what the numbers showed was consistent with participants' narratives. For instance, quantitative findings of a positive school performance gap between private and public schools were confirmed by qualitative evidence of improved school facilities, higher levels of autonomy, and leadership support in private schools.

The qualitative data also provided insights into the "why" for the existence of some of the quantitative relationships. Based on the regression analysis, professional development was a significant predictor, and the interviews showed that ongoing professional development led to an increase in teachers' confidence and adaptability regarding digital tools.

The overall findings from the integration of the findings agree that digital leadership is a relational and a structural process that influences organizational outcomes as well as individual behaviors and attitudes.

6. Research Findings

Several important results were obtained from this study. First, the level of digital leadership practices in the sampled secondary schools was relatively high, especially in the aspects of visionary leadership and digital technology integration. But, professional development and data driven decision making need to be addressed. Sustainable school improvement was also a rated high indicator, indicating that schools show consistent improvement over time in instructional quality, adaptability and student engagement.

Second, the digital leadership and sustainable improvement outcomes of the private schools were greater than the outcomes of the public schools, thus emphasizing the importance of resources, infrastructure, and autonomy.

Third, digital leadership was found to be positively related to school improvement with the digital leadership predicting approximately half the variance in sustainable improvement. Professional development and technology integration had a significant impact.

Fourth, qualitative data enriched the analysis. The effective enablers identified were clear leadership vision, collaboration and teacher support. The culture of innovation and shared responsibility was seen in the strong digital leadership exhibited by schools. The resources and training were issues at lower scoring schools.

7. Discussion

The results are consistent with and confirm previous studies. The very positive connection between digital leadership and school improvement is consistent with previous research by Leithwood et al. (2020). It reiterates the fact that digital leadership is more than being technologically adept, it is about having a vision, a culture and capacity. (Sheninger, 2019)

This difference between private schools and public schools is like research that has reported on differences in resources and flexibility (Ali et al., 2021). Private schools tend to have superior technology systems and more training than public schools, which are constrained in structures. This discovery suggests that a leveling playing field is needed.

The predictors were technology integration and professional development. This supports Fullan's (2020) proposed continuous building of capacity and collaborative learning as a condition for sustainable change. Digital leadership enables teachers to use new teaching approaches and boost student engagement.

The qualitative results added depth to the understanding of the role of leadership vision and school culture. The participants' experiences reinforced those of Harris and Jones (2020), who pointed to the importance of leadership in overcoming digital transformation and being resilient.

This study also contributes to the knowledge of sustainability in education. School improvement is an multi-dimensional process that involves the following: Instructional quality, Organisational adaptability and Stakeholder engagement.

Digital leadership is key to addressing evolving demands in schools. Sustainability is not a one-off action but one that involves leadership, technology and organizational practices (Hargreaves & Fink, 2006).

One of the strengths of the mixed methods approach was its use. Validity was enhanced by convergence across phases. The qualitative data helped to understand the causal mechanisms of the quantitative relationships, that is, how the leadership practices affected student behaviors, engagement and institutional outcomes.

There were challenges too: particularly in resource limited areas. There are real obstacles in the form of inadequate infrastructure, lack of training, and unwillingness to change. This information could point to interventions, and policy supports that are needed.

8. Conclusion

Digital leadership is one of the key factors for sustainable school development in secondary education. It has an impact on teaching and learning, teacher professional development and organisational flexibility. It is the close relationship found in this study that reinforces the important role of leadership in the process of long-term educational transformation.

Context is important and especially the difference between public and private schools. It indicates the need for equitable allocation of resources and capacity building for all schools to experience digital transformation. The key dimensions delineated technology integration and professional development offer meaningful advice to policy makers and school leaders.

The correlation of the quantitative and qualitative results shows digital leadership is a comprehensive process: strategic, cultural and relational. Improvement will be sustainable not only through the adoption of technology but also through the creation of human capacity and culture. This multi-dimensional view demands for a reform of education of an extensive scope.

Finally, the findings of this study offer empirical insights into the role of digital leadership in school improvement for sustainability. It emphasizes the importance of the leadership practices to be consistent with technological innovation and organizational development for long term success. These reflections can guide policy decision makers, school leaders and stakeholders to make strategic plans, invest in ongoing professional learning and develop partnerships to support adaptive and sustainable schools.

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