Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

Optimizing Educational Data Management: A Comparative Analysis of Traditional vs. Digital Data Collection Methodologies in the School Education Department

Dr. Mubbsher Shahzad
School Education Department, Government of the Punjab, Pakistan
Email: pomubbsher@gmail.com

Dr. Samia Saleem
School Education Department, Government of the Punjab, Pakistan
Email: dr.samiasaleemss@gmail.com

Dr. Haleem
District Local Government KPK, Pakistan
Email: drhaleema@gmail.com

ABSTRACT
Effective educational data management is essential for informed decision making and efficient administrative operations in education systems. However, many education departments still rely on traditional data collection practices such as manual records, spreadsheets, and informal communication channels, which often lead to inefficiencies, data inconsistencies, and reporting delays. This study aimed to explore the challenges associated with traditional data collection methods and examine the potential benefits of digital data collection systems in the School Education Department, Government of the Punjab, Pakistan. A qualitative research design was adopted, and data were collected through semi structured interviews with ten educational administrators, including head teachers, assistant education officers, deputy district education officers, and district education officers (five males and five females). The collected data were analyzed using thematic analysis. The findings revealed that traditional data collection methods create challenges related to manual record keeping, fragmented reporting formats, administrative workload, and data accuracy issues. In contrast, participants highlighted that digital data collection systems can improve efficiency, reduce duplication of reporting, and enhance the reliability of educational data through automated validation and centralized data management. The study suggests that adopting advanced digital tools and integrated data management systems can significantly optimize educational data management and support more effective administrative decision making within the School Education Department.

Keywords: Educational Data Management; Digital Data Collection; Traditional Data Collection; School Education Department; Thematic Analysis; Educational Administration; Google Apps Script.

Introduction

Educational data plays a crucial role in improving governance, monitoring institutional performance, and supporting evidence-based policy decisions in modern education systems. Governments and educational authorities rely on reliable and timely data to

ISSN Online: 3007-3154
ISSN Print: 3007-3146

evaluate school performance, allocate resources, and track progress toward national and international educational goals. As education systems become increasingly complex, effective data management has become a fundamental requirement for efficient educational administration (UNESCO, 2022).

Globally, education systems have increasingly adopted **Education Management Information Systems (EMIS)** and digital data collection platforms to improve the accuracy, accessibility, and reliability of educational data. These systems facilitate the systematic collection, processing, and analysis of information related to students, teachers, infrastructure, and institutional performance. Research indicates that digital data collection tools significantly improve data quality by incorporating automated validation, real time reporting, and integrated databases, thereby supporting more effective policy formulation and educational planning (World Bank, 2021; Abdul Hamid, Saraogi, & Mintz, 2017).

Despite these advancements, many education systems, particularly in developing countries, continue to face challenges related to fragmented data collection practices. Traditional methods such as paper-based reporting, manual data entry, and spreadsheet-based submissions often result in delays, data inconsistencies, and increased administrative workload. The reliance on multiple communication channels and non-standardized reporting formats further complicates the process of compiling and verifying educational data, which can undermine the reliability of information used for decision making (UNESCO, 2023).

In Pakistan, the School Education Department, Government of the Punjab, collects extensive data from schools for monitoring enrolment, attendance, teacher deployment, infrastructure, and academic performance. Although initiatives such as provincial EMIS platforms have been introduced to digitize educational data management, several administrative units still depend on a combination of traditional and semi digital reporting methods. Data is frequently submitted through paper forms, Excel files, and informal communication platforms, which may lead to issues such as data fragmentation, reporting delays, and lack of systematic validation (Government of Pakistan, 2023).

Given the increasing emphasis on digital governance and data driven educational planning, it is essential to evaluate how different data collection approaches influence the effectiveness of educational data management. Understanding the strengths and limitations of traditional and digital methodologies can help identify more efficient systems for managing educational data within administrative structures. Therefore, this study focuses on examining and comparing traditional and digital data collection methodologies in order to optimize educational data management within the School Education Department, Government of the Punjab, Pakistan.

Rationale of the Study

Efficient data management is essential for evidence-based decision making in education systems. Governments increasingly rely on accurate and timely educational data to monitor school performance, allocate resources, and implement policy reforms. However, many education departments in developing countries still rely on fragmented and manual data collection practices, including paper records, spreadsheets, and informal communication channels. Such methods often lead to delays, inconsistencies, and data quality issues, limiting the effectiveness of educational planning and governance (UNESCO, 2023; World Bank, 2022).

In the international context, education systems have increasingly adopted digital Education Management Information Systems (EMIS) and automated data collection tools

ISSN Online: 3007-3154
ISSN Print: 3007-3146

to improve efficiency, accuracy, and transparency in educational administration. Digital data collection platforms allow real time validation, automated aggregation, and secure data storage, significantly reducing errors associated with manual data entry. Studies have shown that digital data collection systems enhance data reliability and support faster policy responses compared to traditional methods (Tamim et al., 2021; World Bank, 2022).

In the **Pakistani context**, the School Education Department collects large volumes of administrative and academic data from schools for monitoring attendance, infrastructure, examinations, and policy implementation. Despite ongoing digitization efforts such as EMIS initiatives in several provinces, many districts still depend on mixed data collection approaches that involve manual records, WhatsApp communication, and Excel based reporting. These practices often create challenges related to data fragmentation, delayed reporting, and lack of standardized validation mechanisms, which can undermine the accuracy and usability of educational data (Government of Pakistan, 2023; UNESCO, 2022).

Therefore, there is a growing need to explore more efficient and reliable data collection mechanisms that can improve educational data management within administrative systems. By comparing traditional data collection approaches with digital data collection methodologies, this study aims to provide empirical evidence on how technology driven solutions can enhance data accuracy, efficiency, and accountability in the School Education Department. The findings of this study may support policymakers and educational administrators in designing more effective digital data management systems for improved educational governance.

Research Gap

Recent studies emphasize the importance of digital technologies and Education Management Information Systems for improving data quality, efficiency, and evidence-based decision making in educational administration (UNESCO, 2023; World Bank, 2022). However, much of the existing literature primarily focuses on large scale national EMIS frameworks or technology adoption in educational institutions rather than examining the practical data collection processes used at administrative levels. In many developing countries, including Pakistan, education departments continue to rely on hybrid systems that combine manual reporting, spreadsheets, and informal communication platforms, which often lead to data fragmentation, delays, and limited validation mechanisms.

Despite the growing emphasis on digital transformation in educational governance, empirical comparative studies evaluating traditional and automated data collection methodologies within school education departments remain limited, particularly in the Pakistani context. Therefore, this study aims to address this gap by comparatively examining traditional and digital data collection approaches to determine their effectiveness in improving data accuracy, efficiency, and management within the School Education Department.

Statement of the Problem

Effective governance and evidence-based decision making depend on the timely availability of accurate and structured data. In many public administration systems, however, data collection remains fragmented, slow, and error-prone due to reliance on multiple informal communication channels and heterogeneous data formats. These challenges are particularly evident in district-level administrative systems where

ISSN Online: 3007-3154
ISSN Print: 3007-3146

information is collected from various departments through manual or semi-digital processes. Such practices often result in inefficiencies in data compilation, verification, and reporting.

One of the major issues is data fragmentation, where information is submitted in multiple incompatible formats such as photographs of documents, handwritten forms, spreadsheets, and text messages. Fragmented data sources hinder interoperability and integration, which are essential for digital transformation in public administration systems. Studies on digital governance highlight that lack of system interoperability and standardized data structures is a significant barrier to efficient administrative data management and decision support systems.

Another major concern is latency in data compilation. When administrative data are collected through paper documents, emails, and messaging platforms, officials must manually compile and verify information before it can be used for reporting or policy decisions. Manual data entry and consolidation significantly increase the time required to transform raw information into usable datasets. Research comparing paper-based and digital data collection systems has demonstrated that manual processes substantially increase data processing time and reduce operational efficiency compared with automated digital data collection systems.

In addition to delays, data accuracy and validation problems frequently arise in informal data collection systems. When information is submitted through unstructured channels such as messaging applications or non-validated spreadsheets, there are limited mechanisms to enforce data validation rules, which may lead to inconsistencies such as entering text in numeric fields, missing entries, or incorrect formatting. Modern electronic data capture systems incorporate built-in validation checks and automated logic controls that significantly reduce data entry errors and improve data quality. Without such mechanisms, administrative datasets may suffer from reliability issues that compromise evidence-based decision making.

Furthermore, lack of a secure and auditable record represents a critical governance challenge. Informal communication platforms such as WhatsApp are increasingly used for rapid information exchange within organizations; however, these platforms were not designed for structured data management or institutional accountability. Studies have shown that extracting or managing data from such messaging platforms presents technical and procedural difficulties due to encryption, proprietary data structures, and limited traceability. In contrast, structured digital data collection systems typically maintain audit trails that record who entered or modified data and when those changes occurred, which is essential for ensuring transparency and accountability in organizational data management.

Although tools such as Google Forms are sometimes used to digitize administrative data collection, these basic systems often lack advanced features such as dynamic validation rules, automated notifications, workflow automation, and integration with structured databases. Consequently, administrative units continue to rely on manual verification and compilation processes even after adopting basic digital forms.

Given these challenges, there is a growing need for automated, validated, and integrated data collection systems that can streamline administrative workflows while ensuring data accuracy, timeliness, and traceability. Platforms developed using technologies such as Google Apps Script provide opportunities to build customized data collection solutions that incorporate real-time validation, automated data storage, and notification systems. However, despite the increasing adoption of such tools, limited empirical research has examined their effectiveness compared with traditional administrative data collection

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

practices, particularly in district-level government settings.

Therefore, this study aims to investigate the challenges associated with existing administrative data collection methods and to evaluate the effectiveness of an automated Google Apps Script–based solution in improving data accuracy, efficiency, and accountability within district administration processes.

Research Objectives

To explore the existing data collection practices used in the School Education Department.

To identify the challenges associated with traditional data collection methods in educational administration.

To examine the effectiveness of digital data collection approaches for improving educational data management.

To suggest strategies for optimizing educational data management through digital data collection systems.

Literature Review

Educational data management has become an essential component of effective educational governance and policy development. Accurate and timely data enable administrators and policymakers to monitor institutional performance, allocate resources efficiently, and design evidence-based interventions to improve educational outcomes. Consequently, education systems worldwide have increasingly focused on strengthening data collection and management systems to support decision making processes (UNESCO, 2023).

Traditionally, educational data collection in many administrative systems has relied on paper-based reporting, manual record keeping, and spreadsheet-based submissions. While these methods have been widely used for decades, they often present challenges related to data fragmentation, delays in reporting, and increased risk of human error during data entry and compilation. Research indicates that manual data collection processes can reduce the reliability and timeliness of administrative data, thereby limiting the effectiveness of education management and policy planning (Abdul Hamid, Saraogi, & Mintz, 2017).

With the rapid advancement of digital technologies, many education systems have begun adopting Education Management Information Systems (EMIS) and other digital data collection platforms to improve data quality and administrative efficiency. Digital data collection tools allow institutions to collect, validate, and process data electronically, enabling faster reporting and improved accuracy. Automated validation features and integrated databases help minimize data entry errors and ensure consistency across datasets (World Bank, 2021).

Several studies have highlighted the benefits of digital data systems in enhancing educational data management. Digital platforms enable real time monitoring, centralized databases, and improved accessibility of educational information for administrators and policymakers. Such systems also facilitate transparency and accountability by maintaining structured records and audit trails for data submission and modification (UNESCO, 2022).

Despite these advantages, the transition from traditional to digital data collection methods presents several challenges, particularly in developing countries. Limited technological infrastructure, lack of technical training, and resistance to organizational change often hinder the effective implementation of digital systems. In many contexts, hybrid approaches that combine manual and digital reporting practices continue to exist,

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

which may create inconsistencies and inefficiencies in data management processes (World Bank, 2022).

In Pakistan, efforts have been made to strengthen educational data systems through initiatives such as provincial EMIS platforms. These systems aim to collect and manage data related to student enrollment, teacher deployment, school infrastructure, and academic performance. However, research and policy reports indicate that data collection practices in several administrative units still involve a combination of manual documentation, spreadsheets, and informal communication channels, which may affect the accuracy and timeliness of educational data (Government of Pakistan, 2023).

Given the increasing importance of data driven decision making in education, there is a growing need to examine how different data collection methodologies influence the effectiveness of educational data management. Understanding the strengths and limitations of traditional and digital data collection systems can provide valuable insights for improving administrative data practices in education departments. Therefore, this study contributes to the existing literature by examining the experiences and perspectives of administrators regarding traditional and digital data collection methodologies within the School Education Department.

Theoretical Framework

This study is grounded in theories related to information systems adoption and data management in organizations. One relevant theory is the Technology Acceptance Model (TAM) developed by Fred Davis, which explains that users adopt digital systems when they perceive them as useful and easy to use. In educational administration, digital data collection tools may improve efficiency, reduce manual workload, and enhance the accuracy of administrative data, which encourages their adoption by administrators (Davis, 1989; Venkatesh & Davis, 2000).

Another important perspective is the Information Systems Success Model proposed by William H. DeLone and Ephraim R. McLean. This model explains that the effectiveness of an information system depends on factors such as system quality, information quality, and user satisfaction, which ultimately influence organizational performance and decision making (DeLone & McLean, 2003). In the context of educational data management, digital data collection systems can improve system quality through automated validation, centralized databases, and real time access to information.

These theoretical perspectives provide a foundation for understanding how digital data collection methodologies can enhance educational data management compared to traditional manual data collection practices.

Conceptual Framework

The conceptual framework of this study examines how different data collection methodologies influence educational data management within the School Education Department.

The study compares two primary approaches:

Traditional Data Collection Methods

Paper forms
Manual Excel reporting
Messaging platforms

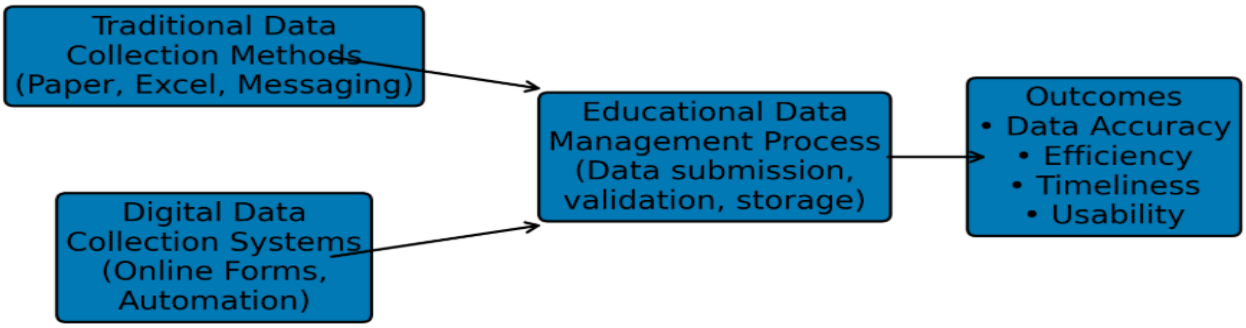
Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

Digital Data Collection Systems
Online forms
Automated data validation
Integrated digital databases
These approaches influence the educational data management process, including data submission, validation, storage, and compilation. The effectiveness of these processes ultimately affects key administrative outcomes such as data accuracy, reporting efficiency, timeliness, and usability of data for decision making.



Methodology

Research Design and Paradigm

This study adopts a qualitative research design to explore the experiences and perceptions of educational administrators regarding traditional and digital data collection practices within the School Education Department. Qualitative research is appropriate for examining complex administrative processes and understanding participants' perspectives in their real organizational contexts (Creswell & Creswell, 2018).
The study is grounded in the interpretivist research paradigm, which assumes that social realities are constructed through individuals' experiences and interpretations. Within this paradigm, the research seeks to understand how education administrators perceive the effectiveness, challenges, and implications of different data collection methodologies in educational data management (Lincoln & Guba, 1985; Merriam & Tisdell, 2016).
The research lens guiding this study is that of digital transformation in educational administration, focusing on how technological tools influence administrative practices, data accuracy, and decision-making processes. This lens enables the study to examine how digital data collection systems can improve the efficiency and reliability of educational data management compared to traditional methods.

Participants and Sampling

The participants of the study consist of educational administrators working within the School Education Department. The study includes representatives from different administrative levels to obtain diverse perspectives on data collection and management processes.
The participants include:
Head Teachers (male and female)
Assistant Education Officers (AEOs)
Deputy District Education Officers (Dy. DEOs)
District Education Officers (DEOs)

ISSN Online: 3007-3154
ISSN Print: 3007-3146

A **purposive sampling strategy** is employed to select participants who are directly involved in the collection, reporting, and management of educational data. Purposive sampling allows the researcher to obtain information rich insights from individuals who possess relevant experience and knowledge related to the research topic (Patton, 2015). Including both male and female participants ensures broader representation of administrative perspectives within the education system.

Data Collection Method

Data will be collected through **semi-structured interviews**, which allow the researcher to explore participants' experiences while maintaining flexibility to probe deeper into emerging themes. Semi structured interviews are widely used in qualitative studies because they facilitate in depth understanding of participants' perceptions and allow researchers to capture detailed explanations of administrative practices and challenges (Kvale & Brinkmann, 2015).

An **interview protocol** will be developed based on the research objectives, focusing on topics such as:

Existing data collection practices in the School Education Department
Challenges associated with traditional data collection methods
Experiences with digital data collection tools
Perceived benefits and limitations of digital systems
Suggestions for improving educational data management

Each interview will be conducted individually and will last approximately **30–45 minutes**. With participants' consent, interviews will be **audio recorded and later transcribed** for analysis to ensure accuracy of the collected data.

Data Analysis

The collected qualitative data will be analyzed using **thematic analysis**, which is a widely used method for identifying, analyzing, and interpreting patterns within qualitative data. Thematic analysis allows researchers to systematically organize interview data into themes that represent key ideas and experiences shared by participants (Braun & Clarke, 2006; Braun & Clarke, 2021).

The analysis will follow the six-step process proposed by Braun and Clarke:

Familiarization with the data through repeated reading of interview transcripts
Generating initial codes from meaningful segments of data
Searching for themes by grouping related codes
Reviewing themes to ensure consistency and relevance
Defining and naming themes that represent key patterns in the data
Producing the final interpretation of findings

This systematic approach enables the researcher to identify significant themes related to the effectiveness, challenges, and opportunities of traditional and digital data collection methodologies in educational administration.

Ethical Considerations

Ethical principles will be carefully followed throughout the research process. Participants will be informed about the purpose of the study and their voluntary participation. Informed consent will be obtained prior to conducting interviews. Participants' identities and responses will remain confidential, and the collected data will be used solely for research purposes.

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www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

Trustworthiness of the Study

To ensure the rigor and quality of qualitative research, the concept of **trustworthiness** proposed by Guba was adopted. Trustworthiness in qualitative research is commonly assessed through four criteria: credibility, dependability, transferability, and confirmability (Lincoln & Guba, 1985).

Credibility refers to the accuracy and authenticity of the findings from the participants' perspectives. In this study, credibility will be enhanced through the use of semi structured interviews, which allow participants to express their experiences in detail. Additionally, interview data will be carefully transcribed and repeatedly reviewed to ensure that participants' views are accurately represented in the analysis (Creswell & Poth, 2018).

Dependability relates to the consistency and stability of the research process over time. To ensure dependability, the study will follow a systematic research procedure including clearly defined interview protocols, detailed documentation of the data collection process, and transparent coding procedures during thematic analysis. Maintaining a clear record of research procedures helps ensure that the study can be examined and understood by other researchers (Nowell et al., 2017).

Transferability refers to the extent to which the findings of the study can be applied to similar contexts. In this research, transferability will be supported by providing detailed descriptions of the research setting, participants, and data collection procedures. Such contextual information enables readers to determine whether the findings may be applicable to other educational administrative settings (Merriam & Tisdell, 2016).

Confirmability ensures that the findings are based on the participants' responses rather than researcher bias. In this study, confirmability will be strengthened by maintaining accurate interview transcripts and systematically linking themes to participants' statements during thematic analysis. This transparent analytical process helps ensure that interpretations are grounded in the collected data (Braun & Clarke, 2021).

By applying these strategies, the study aims to maintain methodological rigor and ensure that the findings provide credible and meaningful insights into educational data management practices within the School Education Department.

Interview Protocol

A **semi-structured interview protocol** was developed to guide the data collection process in alignment with the research objectives. The protocol was designed to explore participants' experiences and perceptions regarding traditional and digital data collection practices in the School Education Department. Semi structured interviews allow flexibility for participants to elaborate on their responses while ensuring that the discussion remains focused on the key research objectives (Kvale & Brinkmann, 2015).

Each interview will begin with a brief introduction explaining the purpose of the study and assuring participants of confidentiality. Participants will also be informed that their participation is voluntary and that they may withdraw from the interview at any time. With participants' consent, interviews will be audio recorded and later transcribed for analysis.

The following guiding questions will be used during the interviews:

What methods are currently used in your office or school for collecting and reporting educational data?

What challenges do you experience when using traditional data collection methods such as paper forms, spreadsheets, or messaging platforms?

Have you used any digital systems or online tools for data collection and reporting? If yes, how effective do you find these systems?

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

In your experience, how do digital data collection systems compare with traditional methods in terms of efficiency and accuracy?
What improvements or changes would you suggest to enhance educational data management in the School Education Department?
These questions are intended to generate detailed insights into current data collection practices, challenges associated with traditional methods, and perceptions regarding the effectiveness of digital data collection systems. Follow up questions will be asked where necessary to obtain deeper understanding and clarification of participants' responses.

DATA ANALYSIS

The qualitative data obtained from semi-structured interviews were analyzed using thematic analysis. Following the approach proposed by Braun and Clarke (2006), the interview transcripts were carefully reviewed and coded to identify meaningful patterns in the data. Initial codes were generated from participants' responses, which were subsequently grouped into categories and broader themes. The analysis process allowed the researcher to systematically interpret participants' experiences regarding traditional and digital data collection practices within the School Education Department. The results of this analysis are presented in the following tables and thematic descriptions.

Table1: *Initial Codes from Interview Data*

Participant Quote (Key Idea)	Initial Code
Data maintained in manual registers at schools	Manual record keeping
Same data requested again through Excel or WhatsApp	Data duplication
Reporting through multiple channels	Multiple reporting systems
Schools send data in different formats	Data format inconsistency
Pictures of registers sent for reporting	Unstructured data submission
Difficulty compiling data from various formats	Data compilation challenges
Information received incomplete or inconsistent	Data inconsistency
Staff verifying data manually	Manual data verification
Administrative workload due to repeated reporting	Administrative burden
Delay in preparing reports	Reporting delays
Errors in manual data entry	Data entry errors
Lack of standardized reporting system	Lack of standardization
Need for centralized digital platform	Centralized data system need
Digital forms could improve reporting	Digital reporting efficiency
Automated validation could reduce mistakes	Automated validation
Digital systems save time	Time efficiency of digital tools
Digital platforms improve data accuracy	Improved data accuracy
Need for integrated data management system	Integrated data management
Digital systems support decision making	Data driven decision support
Digital transformation in educational administration	Digital transformation

Table 1 presents the initial codes generated from participants' interview responses during the first stage of thematic analysis. These codes represent key issues identified in the data, including manual record keeping, reporting duplication, fragmented reporting formats, and perceived advantages of digital data collection systems. The coding process

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

helped organize participants' responses into meaningful analytical units for further thematic development.

Tale2: *Thematic Analysis: Codes, Categories, and Themes*

Initial Codes	Category	Theme
Manual record keeping	Traditional reporting practices	Challenges of Traditional Data Collection Methods
Data duplication	Repeated reporting	Challenges of Traditional Data Collection Methods
Multiple reporting systems	Fragmented data reporting	Challenges of Traditional Data Collection Methods
Data format inconsistency	Inconsistent reporting formats	Challenges of Traditional Data Collection Methods
Unstructured data submission	Informal reporting channels	Challenges of Traditional Data Collection Methods
Data compilation challenges	Difficulty organizing information	Administrative Burden of Data Management
Manual data verification	Verification workload	Administrative Burden of Data Management
Reporting delays	Slow reporting process	Administrative Burden of Data Management
Administrative burden	Increased staff workload	Administrative Burden of Data Management
Data entry errors	Data quality issues	Data Quality and Accuracy Issues
Data inconsistency	Reliability concerns	Data Quality and Accuracy Issues
Lack of standardization	Weak data management system	Data Quality and Accuracy Issues
Centralized data system need	Integrated data systems	Benefits of Digital Data Collection Systems
Digital reporting efficiency	Improved reporting process	Benefits of Digital Data Collection Systems
Automated validation	Error reduction	Benefits of Digital Data Collection Systems
Time efficiency of digital tools	Faster reporting	Benefits of Digital Data Collection Systems
Improved data accuracy	Reliable data management	Benefits of Digital Data Collection Systems
Integrated data management	System integration	Benefits of Digital Data Collection Systems
Data driven decision support	Better administrative decisions	Benefits of Digital Data Collection Systems
Digital transformation	Technology adoption in administration	Benefits of Digital Data Collection Systems

Table 2 illustrates the analytical relationship between the identified codes, their corresponding categories, and the broader themes that emerged from the thematic

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

analysis. Through this process, individual codes derived from interview responses were grouped into conceptual categories, which were subsequently organized into four major themes reflecting the challenges of traditional data collection and the perceived benefits of digital data management systems.

Table 3. ***Themes, Sub-themes, codes, and representative participant quotes derived from thematic analysis***

Theme	Sub-theme	Codes	Representative Quote
Challenges of Traditional Data Collection Methods	Manual record keeping	Paper registers, manual documentation	"At the school level we maintain many registers manually for attendance, enrollment, and examination records." (P1)
	Data duplication across reporting channels	Repeated reporting, multiple submissions	"The same data is requested again through Excel sheets or WhatsApp groups by higher offices." (P1)
	Fragmented reporting formats	Different formats, unstructured submissions	"Some schools send pictures of registers, some send Excel files, and sometimes the information is written in simple messages." (P2)
Administrative Burden of Educational Data Management	Difficulty compiling data	Data compilation challenges	"Data often comes through paper reports, Excel sheets, and WhatsApp messages which takes time to organize." (P5)
	Manual verification of data	Data checking workload	"Sometimes the information is incomplete or inconsistent and staff members must verify it manually." (P3)
	Increased administrative workload	Reporting burden	"Managing data from different sources increases the workload for administrative staff." (P5)
Data Quality and Accuracy Issues	Data entry errors	Manual errors, reporting mistakes	"When data is reported manually there is always a possibility of mistakes." (P3)
	Inconsistent reporting	Data discrepancies	"Different schools send data in different formats which makes verification difficult." (P2)
Benefits of Digital Data Collection Systems	Centralized data management	Unified platform, integrated data system	"A centralized digital system would ensure that everyone works with the same verified data." (P4)
	Automated	Error reduction	"Digital forms with validation

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

Theme	Sub-theme	Codes	Representative Quote
	validation		can reduce reporting mistakes." (P2)
	Efficiency and faster reporting	Time saving, streamlined reporting	"If the data is entered in a digital system once, it would save time and reduce duplication." (P6)

Table 3 summarizes the major themes and sub-themes identified during the analysis and provides representative participant quotes to support the findings. The inclusion of participant statements strengthens the credibility of the qualitative analysis by demonstrating how the themes were grounded in the experiences and perspectives of educational administrators.

Table4: *Themes and Sub-Themes Derived from Thematic Analysis*

Theme	Sub-Themes
Challenges of Traditional Data Collection Methods	Manual record keeping in schools
	Data duplication across multiple reporting channels
	Fragmented reporting formats (paper, Excel, WhatsApp)
	Unstructured data submission
Administrative Burden of Educational Data Management	Difficulty compiling data from multiple sources
	Manual verification of submitted data
	Increased workload for administrative staff
	Delays in preparing reports
Data Quality and Accuracy Issues	Data entry errors in manual systems
	Inconsistent reporting formats
	Lack of standardized data validation mechanisms
	Reliability issues in reported data
Benefits of Digital Data Collection Systems	Centralized digital data management
	Automated validation and error reduction
	Faster data reporting and processing
	Improved data accuracy and reliability
	Support for data driven administrative decisions

Table 4 provides a concise summary of the key themes and related sub-themes identified through thematic analysis. This table offers an overview of the main analytical findings of the study and highlights the core issues related to traditional data collection challenges and the potential advantages of digital data management systems within the School Education Department.

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

Data Analysis and Findings

The interview data collected from ten participants including head teachers, assistant education officers, deputy district education officers, and district education officers were analyzed using thematic analysis. The analysis revealed four major themes and several related sub-themes that explain the challenges and opportunities associated with educational data collection practices in the School Education Department.

Theme 1: Challenges of Traditional Data Collection Methods

Participants reported several challenges associated with traditional data collection practices. These challenges mainly related to manual record keeping, fragmented reporting channels, and inconsistent data submission formats.

Manual Record Keeping in Schools

Several participants explained that schools still maintain a large number of registers manually, which requires significant time and effort.

Participant P1 stated:

"At the school level we maintain many registers manually for attendance, enrollment, and examination records." (P1)

Similarly, Participant P6 explained:

"Schools already maintain manual registers, which require regular updating and checking by school staff." (P6)

Data Duplication Across Multiple Reporting Channels

Participants indicated that the same data is often required through multiple channels such as WhatsApp groups, Excel sheets, and official reports.

Participant P1 commented:

"Later the same information is requested again through Excel sheets or WhatsApp groups by higher offices." (P1)

Participant P6 also noted:

"The same data is requested again through different reporting formats which makes the process repetitive." (P6)

Fragmented Reporting Formats

Participants highlighted that data is submitted in different formats, making compilation difficult.

Participant P2 explained:

"Some schools send pictures of registers, some send Excel files, and sometimes information is written in simple messages." (P2)

Similarly, Participant P7 stated:

"When data comes in different formats it becomes difficult to standardize and compile the information." (P7)

Theme 2: Administrative Burden of Educational Data Management

Another key theme identified in the analysis was the administrative burden associated with compiling and verifying educational data.

Difficulty Compiling Data from Multiple Sources

Participants reported that data received from multiple schools often requires additional effort to compile and organize.

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

Participant P5 stated:
"Data often comes through paper reports, Excel sheets, and WhatsApp messages, which takes time to organize." (P5)
Participant P8 explained:
"At the district level we receive large amounts of data from many schools which requires significant effort to compile." (P8)

Manual Verification of Submitted Data
Participants emphasized that staff often need to manually verify the accuracy of submitted data.
Participant P3 explained:
"Sometimes the information is incomplete or inconsistent, and staff members must verify it manually." (P3)
Participant P8 similarly stated:
"Staff members have to check and verify the data before preparing official reports." (P8)

Increased Workload for Administrative Staff
Participants also reported that repeated reporting processes increase the workload for administrators.
Participant P5 stated:
"Managing data from different sources increases the workload for administrative staff." (P5)
Participant P2 added:
"Compiling information from several schools takes considerable time and effort." (P2)

Theme 3: Data Quality and Accuracy Issues
Participants highlighted concerns related to the reliability and accuracy of manually reported data.

Data Entry Errors in Manual Systems
Participants indicated that manual reporting often leads to errors.
Participant P3 explained:
"When data is reported manually, there is always a possibility of mistakes." (P3)
Participant P10 stated:
"Manual reporting increases the chances of errors during data entry." (P10)

Inconsistent Reporting Formats
Participants also noted that inconsistent reporting formats affect data reliability.
Participant P2 stated:
"Different schools send data in different formats which makes verification difficult." (P2)
Participant P9 added:
"Sometimes different sources report different figures, which creates confusion." (P9)

Theme 4: Benefits of Digital Data Collection Systems
Participants expressed positive perceptions regarding the use of digital systems for educational data management.

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

Centralized Digital Data Management

Participants emphasized the importance of centralized digital systems.

Participant P4 explained:

"A centralized digital system would ensure that everyone works with the same verified data." (P4)

Participant P9 also stated:

"A unified digital platform would improve the reliability of administrative data." (P9)

Automated Validation and Error Reduction

Participants believed that digital systems could reduce errors through automated validation.

Participant P2 commented:

"Digital forms with validation can reduce reporting mistakes." (P2)

Participant P10 explained:

"Automated systems help ensure that data is entered correctly." (P10)

Faster Reporting and Improved Efficiency

Participants reported that digital systems could significantly improve efficiency.

Participant P6 stated:

"If the data is entered in a digital system once, it would save time and reduce duplication." (P6)

Participant P5 explained:

"Digital systems can make data management faster and more organized." (P5)

Discussion

The findings of this study highlight several challenges associated with traditional data collection practices within the School Education Department. Participants reported that manual record keeping, fragmented reporting formats, and repeated data submission through multiple channels increase administrative workload and create inefficiencies in educational data management. These findings support previous research indicating that manual and unstructured data collection systems often lead to delays, duplication of work, and difficulties in data compilation (Abdul Hamid, Saraogi, & Mintz, 2017; UNESCO, 2023).

The study also identified concerns related to data quality and reliability. Participants noted that inconsistent reporting formats and manual data entry may result in errors and discrepancies in educational data. Similar findings have been reported in earlier studies which suggest that traditional data collection systems lack standardized validation mechanisms, making them more vulnerable to inaccuracies (UNESCO, 2022).

In contrast, participants perceived digital data collection systems as more efficient and reliable. Features such as centralized databases, automated validation, and standardized reporting formats were considered beneficial for improving data accuracy and reducing administrative workload. These findings are consistent with previous studies indicating that digital data management systems enhance efficiency and support data driven decision making in education systems (World Bank, 2021; World Bank, 2022).

Overall, the findings suggest that adopting integrated digital data collection systems could significantly improve educational data management by enhancing accuracy, efficiency, and administrative coordination within the School Education Department.

Dialogue Social Science Review (DSSR)
www.thedssr.com

ISSN Online: 3007-3154
ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 4 No. 3 (March) (2026)

Conclusion

This study explored the experiences of educational administrators regarding traditional and digital data collection practices within the School Education Department. The findings revealed that traditional data collection methods are associated with several challenges, including manual record keeping, fragmented reporting formats, administrative workload, and potential data inaccuracies. These issues can affect the efficiency and reliability of educational data management.

In contrast, participants highlighted the potential benefits of digital data collection systems, particularly in improving data accuracy, reducing duplication of work, and facilitating faster reporting processes. The adoption of centralized digital platforms with standardized reporting formats and automated validation mechanisms may therefore enhance the effectiveness of educational data management.

Overall, the study suggests that strengthening digital data collection systems can contribute to more efficient, accurate, and transparent educational data management within the School Education Department.

Recommendations

Based on the findings of the study, the following recommendations are proposed:

The School Education Department should **shift from traditional manual reporting to standardized digital data collection systems** to reduce errors, duplication, and reporting delays.

A **centralized digital data management system** should be implemented to ensure consistent and reliable data reporting across schools and administrative offices.

Training programs should be provided to educational administrators and school staff to enhance their capacity to use digital data management tools effectively.

The use of **Google Apps Script** is recommended as a powerful data collection solution, as it enables advanced features such as **automated data collection, real time dashboards, automated calculations, and workflow automation**, which can significantly improve the efficiency and accuracy of educational data management.

Policymakers should encourage **digital transformation in educational administration** to support efficient and data driven decision making.

Limitations of the Study

This study has several limitations that should be acknowledged. First, the research was conducted with a **small sample of ten participants**, which may limit the broader generalization of the findings. Second, the study was carried out within the **specific context of the School Education Department in Lahore,** and therefore the results may not fully represent other regions or educational administrative settings. Finally, the study relied on **semi structured interviews**, which reflect participants' perceptions and experiences rather than objective measurement of data management systems. Future research may include larger samples and mixed methods approaches to provide more comprehensive insights.

Future Directions

Future research may explore the implementation and effectiveness of digital data management systems in different districts of the School Education Department. Comparative studies across provinces or education systems may provide deeper insights into best practices for educational data management. Additionally, future studies may examine the impact of advanced digital tools such as automated dashboards and

ISSN Online: 3007-3154
ISSN Print: 3007-3146

integrated data platforms on administrative efficiency and data driven decision making in education.

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