Horizon J. Hum. & Soc. Sci. Res. 8 (1): 196 – 214 (2026)

Journal of Humanities and Social Sciences Research
www.horizon-JHSSR.com

Conceptual Research Article
*Peer-reviewed* | Open Access

# Interconnected Digital Learner Records and Data Governance in Higher Education: Toward Smart, Evidence-Based Student Management in Vietnam and Singapore

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## ARTICLE INFO

*Article history*
**Received:** 30-Apr-26
Revised: 01-Jun-26
Accepted: 10-Jun-26
**Published:** 15-Jul-26

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**Citation:** Hoàng Ngọc Sơn and Trần Thị Vân Dung (2026). Interconnected Digital Learner Records and Data Governance in Higher Education: Toward Smart, Evidence-Based Student Management in Vietnam and Singapore. Horizon J. Hum. Soc. Sci. Res. 8 (1), 196–214. https://doi.org/10.37534/bp.jhssr.2026.v8.n1.id1366.p196

## ABSTRACT

The rapid digital transformation of higher education has intensified the need for effective educational data governance and integrated learner information systems. Despite significant investments in digital technologies, many higher education and vocational institutions continue to face challenges arising from fragmented databases, limited interoperability, and the persistence of organizational data silos. This study examines the role of interconnected Digital Learner Records (DLRs) as a strategic mechanism for enhancing evidence-based governance, learner support, and institutional decision-making within the context of higher education in Vietnam. Drawing upon Connectivism theory and contemporary data governance frameworks, the study employs an exploratory mixed-methods approach involving surveys of 50 educational administrators, lecturers, and staff members, complemented by in-depth interviews with 15 institutional stakeholders. The findings reveal that fragmented data systems contribute to administrative inefficiencies, duplicated processes, inconsistent information, and reduced capacity for timely intervention and personalized learner support. Building upon these findings, the study proposes a four-pillar governance framework comprising unique learner identifiers, interoperable data architecture, learning analytics dashboards, and accountability-driven data governance mechanisms. Comparative insights from Singapore's digitally integrated educational ecosystem further illustrate how coordinated data infrastructures can support smart governance and learner-centred educational practices. The study contributes to the growing discourse on educational digital transformation by offering a practical roadmap for institutions seeking to transition from fragmented administrative management toward integrated, data-informed, and service-oriented governance models.

**Keywords:** Digital learner records; Educational data governance; Data interoperability; Learning analytics; Higher education management; Digital transformation; Personalized learning; Evidence-based governance; Student information systems; Vietnam; Singapore.

## 1. Introduction

### 1.1. Background and Context of Digital Transformation in Educational Governance

The rapid advancement of digital technologies has fundamentally transformed how educational institutions manage information, deliver services, and support learning. Across the world, higher education institutions are increasingly transitioning from paper-based and fragmented administrative systems toward integrated digital ecosystems that facilitate data-driven decision-making and learner-centred governance (UNESCO, 2021). Within this evolving landscape, educational data has emerged as a strategic institutional resource capable of supporting operational efficiency, enhancing learner engagement, improving accountability, and enabling evidence-based policy formulation (Siemens, 2013).

Digital transformation in education extends beyond the simple digitization of administrative processes or the adoption of online learning platforms. Rather, it represents a comprehensive organizational transformation that requires institutions to rethink how information is collected, managed, integrated, and utilized across various functional units (Gartner, 2020). Educational institutions increasingly recognize that effective governance depends not only on technological infrastructure but also on the ability to generate meaningful insights from interconnected data systems. Consequently, the management of learner information has become a critical component of institutional competitiveness and sustainability in the digital era.

The emergence of learning analytics, educational data mining, and artificial intelligence applications in higher education has further reinforced the importance of integrated data governance systems (Long & Siemens, 2011). These developments have created opportunities for institutions to move beyond retrospective reporting and toward predictive and proactive learner support mechanisms. Through the effective integration of academic, behavioural, financial, and support-service data, institutions can develop a more comprehensive understanding of learner experiences and provide timely interventions that improve educational outcomes.

In many educational institutions, however, learner information remains dispersed across multiple departments and information systems. Academic records, student affairs data, financial information, internship records, library usage data, and extracurricular participation records are often maintained independently by different units, resulting in fragmented information environments. Such fragmentation limits institutional capacity to obtain a holistic understanding of learner development and constrains the effectiveness of evidence-based decision-making processes (Pelz, 2019).

The challenge of fragmented educational data has become increasingly prominent in developing and emerging economies where digital transformation initiatives are progressing rapidly but institutional interoperability standards remain uneven. In these contexts, educational institutions frequently encounter difficulties in integrating information across organizational boundaries, creating inefficiencies that affect administrative operations, learner services, and strategic planning (Nguyễn & Trần, 2022).

### 1.2. Digital Transformation and Educational Data Governance in Vietnam

In Vietnam, digital transformation has become a national priority under the National Digital Transformation Program and related educational modernization initiatives (Bộ Giáo dục và Đào tạo, 2021). The Vietnamese government has emphasized the importance of building digital infrastructure, expanding digital competencies, and developing integrated information systems capable of supporting educational reform and national competitiveness.

The higher education and vocational education sectors have experienced significant investments in information technology systems during the past decade. Many institutions have implemented Learning Management Systems (LMS), Enterprise Resource Planning (ERP) solutions, online registration platforms, and electronic student information systems. Despite these advances, the integration of institutional data remains a persistent challenge. In many cases, individual departments continue to operate separate databases that were developed independently and lack common interoperability standards.

As a result, learner information is frequently duplicated across multiple systems, creating inconsistencies in data quality and reducing administrative efficiency. Updates made in one department may not be reflected in other institutional databases, leading to conflicting records and delays in information sharing. These challenges undermine institutional efforts to provide timely learner support and limit the potential benefits of digital transformation initiatives.

Furthermore, Vietnam's ongoing transition toward greater institutional autonomy has increased the need for accurate, timely, and integrated information to support strategic decision-making. Universities and vocational institutions are increasingly expected to demonstrate accountability, transparency, and measurable outcomes to stakeholders, including government agencies,

employers, students, and society at large. Achieving these objectives requires data governance systems capable of generating reliable evidence for institutional planning and performance evaluation.

Recognizing these challenges, educational policymakers and institutional leaders have begun emphasizing the importance of interoperable digital learner records that can facilitate seamless information exchange across administrative, academic, and support-service functions. Such systems are viewed as essential foundations for the development of smart educational governance and personalized learning pathways.

### 1.3. Lessons from Singapore's Educational Digital Ecosystem

While Vietnam continues to strengthen its educational digital transformation agenda, Singapore provides a valuable regional benchmark for understanding how integrated educational data systems can support institutional effectiveness and learner development.

Singapore's Smart Nation initiative has placed digital governance at the centre of national development strategy, including within the education sector (Smart Nation Singapore, 2023). The country's educational institutions have benefited from coordinated investments in digital infrastructure, national digital identity frameworks, and interoperable information systems that facilitate secure data sharing across educational levels and government agencies.

One notable example is the implementation of Singapore's Student Learning Space (SLS), a national online learning platform that supports data-informed teaching and learning practices. The platform enables educators and administrators to monitor learner engagement, assess learning progress, and develop targeted interventions based on real-time information (Ministry of Education Singapore, 2023).

Moreover, Singapore's emphasis on integrated data governance extends beyond technological infrastructure to include robust regulatory frameworks governing privacy, security, accountability, and ethical data use. This combination of technological and institutional readiness has enabled educational organizations to leverage learner data more effectively while maintaining public trust and regulatory compliance.

Although Vietnam and Singapore differ significantly in terms of economic development, institutional capacity, and technological maturity, both countries share a commitment to educational modernization and digital transformation. Consequently, Singapore's experience offers useful insights for Vietnamese institutions seeking to develop interoperable learner record systems and strengthen evidence-based governance practices.

Rather than replicating Singapore's model directly, Vietnamese educational institutions may adapt relevant principles concerning interoperability, data governance standards, learner analytics, and institutional coordination to fit local contexts and resource constraints.

### 1.4. Research Gap and Problem Statement

A growing body of international scholarship has examined digital transformation, educational data governance, learning analytics, and student information systems (Long & Siemens, 2011; Siemens, 2013; UNESCO, 2021). Existing studies generally emphasize the importance of integrated data infrastructures for supporting learner success, institutional effectiveness, and strategic decision-making.

However, several gaps remain evident within the current literature.

First, many studies focus primarily on technological implementation while paying comparatively limited attention to organizational governance challenges associated with data interoperability and cross-departmental coordination. Technical solutions alone cannot resolve issues arising from fragmented institutional cultures, inconsistent data standards, and unclear accountability structures.

Second, relatively few studies examine digital learner record systems within the context of vocational and higher education institutions in developing countries, particularly in Southeast Asia. Much of the existing literature is concentrated in North America, Europe, and Australia, where technological and regulatory environments differ substantially from those found in emerging economies.

Third, there remains limited research exploring how interconnected digital learner records can function as strategic governance tools rather than merely administrative repositories. Although educational institutions collect substantial amounts of learner information, many continue to struggle with transforming data into actionable intelligence that supports personalized learning and proactive intervention.

Finally, comparative discussions between Vietnam and leading regional digital education ecosystems such as Singapore remain relatively scarce in the scholarly literature. Understanding how different governance approaches influence institutional effectiveness may provide valuable insights for future educational reform efforts.

Addressing these gaps requires a more comprehensive examination of how learner data can be governed, integrated, and utilized to support institutional

objectives and learner success within rapidly evolving educational environments.

### 1.5. Research Objectives and Significance of the Study

In response to the challenges identified above, this study investigates the role of interconnected Digital Learner Records (DLRs) as a foundation for effective educational data governance in higher education and vocational institutions. The study seeks to examine the consequences of data fragmentation, identify barriers to interoperability, and propose a conceptual framework capable of supporting smart, evidence-based learner management.

Specifically, the study pursues three objectives:

1. To examine the current challenges associated with fragmented learner information systems and organizational data silos within higher education and vocational institutions.
2. To analyze the implications of data fragmentation for administrative efficiency, learner support services, and institutional decision-making.
3. To propose an interconnected digital learner record framework that integrates data governance principles, interoperability mechanisms, and learner-centred management strategies.

The significance of this study extends across theoretical, practical, and policy dimensions. Theoretically, it contributes to emerging discussions on educational data governance by integrating Connectivism theory with contemporary governance frameworks. Practically, it provides institutional leaders with a roadmap for improving interoperability and strengthening evidence-based management practices. From a policy perspective, the study offers recommendations that may support national efforts to modernize educational administration and advance digital transformation objectives within Vietnam and similar educational contexts.

Ultimately, the study argues that interconnected digital learner records should be viewed not merely as administrative tools but as strategic institutional assets capable of supporting personalized learning, informed decision-making, and sustainable educational development in the digital age.

## 2. Theoretical Foundation and Literature Review

### 2.1. Conceptualizing Digital Learner Records in Contemporary Higher Education

The increasing digitalization of higher education has transformed the nature of learner information management from a predominantly administrative function into a strategic component of institutional governance. Traditionally, student records were maintained as isolated repositories of demographic, academic, and administrative information. Their primary purpose was to support enrolment management, academic progression, certification, and regulatory compliance. However, the emergence of digital technologies, learning analytics, and data-driven governance has expanded the role of learner records beyond administrative documentation toward comprehensive institutional intelligence systems (Williamson, 2017).

Digital Learner Records (DLRs) may be defined as integrated digital repositories that consolidate learner-related information across multiple institutional domains, including academic performance, learning engagement, behavioural indicators, financial records, support services, extracurricular activities, and career development pathways. Unlike conventional student record systems, DLRs emphasize interoperability, real-time updating, and analytical capabilities that support evidence-based decision-making (Ifenthaler & Yau, 2020).

The significance of DLRs has grown considerably as higher education institutions increasingly operate in environments characterized by rapid technological change, evolving labour market demands, and heightened expectations for accountability and learner success. Contemporary educational institutions are expected not only to manage information efficiently but also to leverage institutional data to improve educational quality, optimize resource allocation, and personalize learner experiences (UNESCO, 2021).

Within this context, learner records are increasingly viewed as strategic institutional assets rather than passive administrative archives. Their value lies not merely in storing information but in enabling institutions to generate actionable insights that support planning, intervention, and continuous improvement. Consequently, the effectiveness of digital learner record systems depends largely on their capacity to facilitate data integration, interoperability, and governance across organizational boundaries.

### 2.2. Connectivism Theory and Educational Data Networks

The theoretical foundation of this study is anchored in Connectivism, a learning theory proposed by Siemens (2005) and further developed by Downes (2012). Connectivism emerged in response to the limitations of traditional learning theories in explaining knowledge creation and learning processes within highly networked digital environments.

According to Connectivism, learning occurs through the creation and maintenance of connections among individuals, information sources, technologies, and communities. Knowledge is distributed across networks rather than residing solely within individual learners, and the capacity to identify, access, and utilize relevant information becomes more important than the possession of static knowledge itself (Siemens, 2005).

The relevance of Connectivism extends beyond learning processes and offers valuable insights into contemporary educational governance. Educational institutions can be conceptualized as complex information networks comprising interconnected actors, systems, and processes. Within these networks, learners, lecturers, administrators, departments, and digital platforms function as nodes that generate, exchange, and utilize information.

From a Connectivist perspective, the value of learner data increases when information flows effectively across organizational networks. Conversely, fragmented information systems restrict knowledge creation and impede institutional learning. Data silos effectively disrupt network connectivity by limiting the exchange of information between organizational units, thereby reducing the institution's capacity to develop comprehensive understandings of learner needs and institutional performance.

Siemens (2013) further argues that learning analytics and educational data systems represent practical manifestations of Connectivist principles. By integrating data from multiple sources, educational institutions can identify patterns, relationships, and emerging trends that would otherwise remain invisible within isolated databases. These capabilities enable institutions to move from reactive administrative practices toward proactive and adaptive governance models.

Consequently, Connectivism provides an appropriate theoretical lens for examining the role of interconnected digital learner records in supporting institutional intelligence, collaborative decision-making, and learner-centred educational governance.

### 2.3. Educational Data Governance Theory

The growing importance of institutional data has generated significant scholarly interest in educational data governance. Data governance refers to the collection of policies, standards, processes, and accountability mechanisms that ensure data quality, security, accessibility, and appropriate use within organizations (DAMA International, 2017).

Within higher education, data governance encompasses not only technical management but also organizational structures and institutional cultures that influence how information is collected, shared, interpreted, and utilized. Effective governance frameworks seek to ensure that data remains accurate, reliable, secure, and accessible to authorized stakeholders while complying with legal and ethical obligations.

The Data Management Body of Knowledge (DAMA-DMBOK) identifies several core dimensions of effective data governance, including:

- Data quality management;
- Data architecture and integration;
- Metadata management;
- Data security and privacy;
- Data stewardship and accountability;
- Data lifecycle management (DAMA International, 2017).

These dimensions are particularly relevant to higher education institutions because learner information is distributed across numerous operational functions. Without appropriate governance mechanisms, institutions often experience duplication, inconsistency, and fragmentation of data resources.

Research suggests that data governance maturity significantly influences institutional decision-making effectiveness (Khatri & Brown, 2010). Educational organizations possessing strong governance frameworks are more likely to produce reliable evidence, support strategic planning, and implement successful digital transformation initiatives.

Furthermore, educational data governance has become increasingly important due to rising concerns regarding privacy, cybersecurity, and ethical data use. Regulatory frameworks such as the General Data Protection Regulation (GDPR) in Europe have reinforced the importance of transparency, accountability, and learner consent in the management of educational information (European Parliament & Council, 2016).

Consequently, the governance of digital learner records requires institutions to balance competing priorities involving accessibility, interoperability, privacy, and security. Effective governance frameworks provide the institutional foundation necessary for transforming fragmented data systems into strategic assets that support organizational learning and continuous improvement.

### 2.4. Learning Analytics and Evidence-Based Decision-Making

One of the most significant developments in contemporary educational management has been the emergence of Learning Analytics (LA). Learning Analytics

refers to the measurement, collection, analysis, and reporting of learner-related data for the purpose of understanding and optimizing learning processes and educational environments (Long & Siemens, 2011).

The development of learning analytics has been driven by advances in educational technologies that generate large volumes of digital data regarding learner behaviour and engagement. Examples include learning management systems, online assessments, digital libraries, student support platforms, and virtual learning environments.

Learning analytics enables educational institutions to identify patterns associated with learner success, retention, engagement, and progression. Through predictive modelling and data visualization techniques, institutions can detect early warning signs of academic risk and implement timely interventions to support learners (Ferguson, 2012).

Research demonstrates that learning analytics can contribute to several institutional objectives, including:

- Improved student retention and completion rates;
- Enhanced academic advising;
- Personalized learning pathways;
- Resource optimization;
- Institutional performance monitoring (Ifenthaler & Yau, 2020).

However, the effectiveness of learning analytics depends fundamentally upon the availability of integrated, high-quality data. Fragmented information systems limit analytical capabilities by preventing institutions from constructing comprehensive learner profiles. As a result, many institutions struggle to realize the full benefits of learning analytics despite significant investments in digital infrastructure.

The relationship between learning analytics and digital learner records is therefore highly complementary. While DLRs provide the integrated data foundation, learning analytics transforms these data into actionable insights capable of informing institutional decision-making and learner support strategies.

Consequently, the implementation of interconnected digital learner records represents a critical prerequisite for evidence-based educational governance and advanced analytical applications.

## 2.5. Student Information Systems and Institutional Interoperability

Student Information Systems (SIS) constitute the technological backbone of learner data management within higher education institutions. These systems are designed to support administrative functions such as admissions, registration, academic records management, financial administration, and reporting.

Historically, SIS platforms were developed primarily to automate administrative processes rather than facilitate institutional intelligence or cross-functional data integration (Picciano, 2012). As a result, many institutions continue to operate multiple independent systems that lack interoperability and share information inefficiently.

Interoperability refers to the ability of different information systems to exchange, interpret, and utilize data consistently across organizational contexts. According to the Institute of Electrical and Electronics Engineers (IEEE), interoperability is essential for ensuring seamless communication among heterogeneous information systems.

In educational settings, interoperability enables learner information to flow across administrative, academic, financial, and support-service functions without requiring repeated data entry or manual reconciliation. Interoperable systems improve efficiency, enhance data quality, and reduce administrative burden while supporting more comprehensive learner support services.

Contemporary approaches to interoperability increasingly rely upon Application Programming Interfaces (APIs), cloud-based architectures, common metadata standards, and unique learner identifiers. These technologies enable institutions to connect specialized systems while preserving operational flexibility (DAMA International, 2017).

The literature consistently identifies interoperability as a critical success factor in educational digital transformation. Institutions that fail to establish integrated information ecosystems frequently encounter challenges related to data duplication, inconsistent reporting, and limited analytical capabilities (Williamson, 2017).

Therefore, the development of interoperable digital learner records should be viewed not merely as a technical initiative but as a strategic institutional investment supporting governance, accountability, and learner success.

## 2.6. Digital Transformation in Higher Education

Digital transformation has emerged as a central theme within contemporary higher education research and policy discourse. Unlike technology adoption initiatives focused solely on infrastructure, digital transformation involves fundamental changes in organizational culture, governance structures, business

processes, and stakeholder relationships (Bond et al., 2018).

Universities increasingly operate within environments characterized by technological disruption, global competition, demographic shifts, and changing learner expectations. These conditions have accelerated the need for institutions to leverage digital technologies in support of educational quality, operational efficiency, and strategic adaptability.

According to UNESCO (2021), successful digital transformation requires institutions to develop integrated ecosystems that align technological capabilities with organizational objectives and learner needs. Technology alone cannot generate transformation; rather, meaningful change depends upon leadership, governance, workforce capabilities, and institutional culture.

Several scholars have emphasized the importance of data-driven governance as a defining characteristic of digitally mature institutions (Selwyn, 2019). In these environments, institutional decisions are increasingly informed by integrated data sources, predictive analytics, and continuous performance monitoring mechanisms.

Nevertheless, digital transformation remains uneven across higher education systems. Many institutions continue to encounter barriers related to funding limitations, technological fragmentation, organizational resistance, and insufficient governance capacity. These challenges are particularly pronounced in developing contexts where digital infrastructure and institutional resources vary significantly.

Consequently, strengthening digital learner record systems represents a practical strategy for advancing broader digital transformation objectives while enhancing institutional effectiveness and learner support capabilities.

### 2.7. Singapore's Educational Data Ecosystem as a Regional Benchmark

Singapore provides one of the most advanced examples of educational digital transformation in Southeast Asia. Guided by the national Smart Nation initiative, Singapore has developed a highly integrated digital ecosystem that emphasizes interoperability, digital identity, data governance, and innovation across public sectors, including education (Smart Nation Singapore, 2023).

The Ministry of Education (MOE) has invested extensively in digital infrastructure, educational technologies, and data-informed teaching and learning initiatives. A notable example is the Student Learning Space (SLS), a nationwide online learning platform that supports curriculum delivery, learner engagement, and educational analytics (Ministry of Education Singapore, 2023).

Singapore's educational ecosystem demonstrates several governance principles relevant to this study.

First, the country has established strong interoperability frameworks that facilitate secure information exchange across institutions and government agencies.

Second, educational data governance is supported by comprehensive regulatory structures emphasizing privacy, accountability, cybersecurity, and ethical data use.

Third, digital platforms are integrated into broader national strategies promoting lifelong learning, workforce development, and skills-based education.

Fourth, institutional decision-making increasingly utilizes analytics and evidence-based approaches to support learner development and policy evaluation.

While Vietnam's educational system differs significantly in scale, governance structure, and resource availability, Singapore's experience illustrates how coordinated governance frameworks can enhance the effectiveness of educational data systems. Importantly, Singapore's success reflects not only technological sophistication but also institutional commitment to interoperability, governance, and continuous capacity building.

These lessons provide valuable reference points for Vietnamese institutions seeking to strengthen digital learner record systems and advance smart educational governance.

### 2.8. Conceptual Framework for the Present Study

Drawing upon Connectivism Theory, Educational Data Governance Theory, Learning Analytics, Student Information Systems literature, and evidence from digital transformation initiatives, this study conceptualizes interconnected digital learner records as the central mechanism linking data generation, data governance, and institutional decision-making.

The proposed framework assumes that:

1. Interoperable learner records serve as the foundational infrastructure for educational data integration.
2. Effective governance mechanisms ensure data quality, security, accountability, and trust.
3. Learning analytics transforms integrated data into actionable insights.
4. Evidence-based decision-making enhances learner support, institutional effectiveness, and educational outcomes.
5. Digital transformation succeeds when technological innovation is aligned with governance capacity and organizational culture.

Through this framework, digital learner records are positioned not merely as administrative repositories but as strategic institutional assets capable of supporting smart, learner-centred governance within higher education and vocational education environments.

## 3. Research Methodology

### 3.1. Research Design

This study employed an exploratory mixed-methods research design to examine the challenges associated with fragmented learner data management and to identify strategic approaches for developing interconnected Digital Learner Record (DLR) systems in higher education and vocational institutions. Mixed-methods approaches are particularly suitable for investigating complex organizational phenomena because they combine the breadth of quantitative inquiry with the depth of qualitative exploration (Creswell & Plano Clark, 2018).

The rationale for adopting a mixed-methods design was based on the multidimensional nature of educational data governance. While quantitative data were necessary to assess the prevalence of data fragmentation, procedural duplication, and administrative inefficiencies, qualitative data provided deeper insights into organizational practices, institutional barriers, and stakeholder perceptions that could not be adequately captured through surveys alone.

The study was conducted in two complementary phases. The first phase involved a quantitative survey administered to educational administrators, lecturers, and staff members involved in learner management processes. The second phase consisted of semi-structured interviews with key stakeholders responsible for academic administration, student affairs, and information technology management. The integration of both data sources facilitated triangulation and strengthened the credibility of the findings (Fetters et al., 2013).

The methodological approach was guided by the study's objective of examining how data fragmentation affects institutional governance and how interconnected learner record systems may contribute to more effective, evidence-based educational management.

### 3.2. Research Context

The study was conducted within the context of higher education and vocational education institutions in Vietnam, where digital transformation has become an important national priority under the educational modernization agenda (Bộ Giáo dục và Đào tạo, 2021).

Although many institutions have implemented digital administrative systems, Learning Management Systems (LMS), and electronic student information systems, significant challenges remain regarding interoperability, data integration, and cross-departmental information sharing. These challenges create barriers to effective learner management and limit the ability of institutions to utilize data strategically for decision-making and learner support.

The study therefore focused specifically on institutional practices related to learner record management, data governance, and information-sharing processes among functional departments.

### 3.3. Quantitative Phase

#### *3.3.1. Survey Participants*

The quantitative component involved a survey of 50 respondents who were directly engaged in learner management and administrative processes within higher education and vocational education institutions.

Participants were selected using purposive sampling, a non-probability sampling technique frequently employed in exploratory organizational research where respondents possess specialized knowledge relevant to the research objectives (Patton, 2015).

The survey participants included:

- Academic administrators;
- Student affairs personnel;
- Faculty-level management staff;
- Academic advisors;
- Lecturers involved in student support activities;
- Administrative personnel responsible for learner records.

These individuals were selected because they routinely interact with institutional information systems and possess practical knowledge regarding data management challenges and governance processes.

#### *3.3.2. Survey Instrument*

A structured questionnaire was developed to examine perceptions regarding:

- Data accessibility;
- Information-sharing practices;
- Administrative efficiency;
- Data quality;
- Interoperability challenges;
- Institutional readiness for digital governance.

The instrument consisted primarily of closed-ended questions using categorical response options and five-point Likert-type scales to assess perceptions of organizational and technological barriers.

The questionnaire was organized into four thematic dimensions:

1. Operational efficiency;
2. Data quality and reliability;
3. Technical infrastructure and interoperability;
4. Organizational culture and governance.

The survey focused on identifying recurring patterns rather than generating statistically generalizable findings.

#### *3.3.3. Quantitative Data Analysis*

Quantitative data were analyzed using descriptive statistical techniques. Frequencies and percentages were calculated to summarize participant responses and identify prevailing trends concerning learner data management practices.

Given the exploratory nature of the study and relatively small sample size, the analysis emphasized descriptive interpretation rather than inferential statistical testing. The objective was to identify key governance challenges and operational bottlenecks that could inform the development of a conceptual governance framework.

### 3.4. Qualitative Phase

#### *3.4.1. Interview Participants*

To complement the survey findings, semi-structured interviews were conducted with 15 stakeholders occupying leadership, administrative, and technical roles within educational institutions.

Participants were selected using purposive sampling based on their direct involvement in learner management and institutional information systems.

#### *3.4.2. Interview Protocol*

The interviews explored:

- Experiences managing learner information;
- Challenges related to data accessibility;
- Perceptions regarding interoperability;
- Institutional barriers to digital transformation;
- Opportunities for improving learner support through integrated records.

Each interview followed a semi-structured format that allowed participants to discuss issues relevant to their professional responsibilities while ensuring consistency across interview sessions.

#### *3.4.3. Qualitative Data Analysis*

Interview data were analyzed using thematic analysis following the procedures proposed by Braun and Clarke (2006). Responses were reviewed repeatedly, coded according to recurring themes, and subsequently organized into broader categories reflecting governance challenges and institutional barriers.

The analysis focused on identifying patterns associated with data quality, organizational culture, system interoperability, and learner support processes.

The thematic analysis revealed that data fragmentation is influenced not only by technological limitations but also by organizational culture, institutional routines, and varying levels of digital readiness among staff.

### 3.5. Validity, Reliability, and Trustworthiness

Several measures were undertaken to enhance the credibility and trustworthiness of the study. First, methodological triangulation was achieved through the integration of quantitative and qualitative data sources, allowing findings from one method to be corroborated by evidence from another (Creswell & Plano Clark, 2018).

Second, participant selection focused on individuals possessing direct experience with learner management systems and institutional governance processes. This ensured that responses were grounded in practical operational realities.

Third, recurring themes identified during qualitative analysis were compared against survey findings to assess consistency and convergence. The substantial alignment observed between quantitative trends and qualitative narratives strengthened confidence in the overall findings.

Given the exploratory nature of the study and the purposive sampling approach employed, the results should not be interpreted as statistically representative of all higher education and vocational institutions in Vietnam. Instead, the findings provide contextually grounded insights that contribute to understanding common challenges associated with educational data governance and digital learner record management.

### 3.6. Ethical Considerations

Participation in both the survey and interview phases was voluntary. Respondents were informed of the purpose of the study and assured that their responses would remain confidential and be used solely for academic research purposes.

No personally identifiable information was included in the analysis or reporting of findings. Interview quotations were anonymized, and institutional identities were withheld to protect participant confidentiality.

The study adhered to fundamental principles of research ethics, including informed consent, confidentiality, voluntary participation, and responsible

data management (American Educational Research Association, 2018).

The quantitative and qualitative data collected through the survey and interview phases provided the empirical basis for examining learner data fragmentation, interoperability challenges, and governance practices within higher education and vocational institutions. The findings derived from these analyses are presented and discussed in the Findings and Discussion section.

### 3.7. Summary of the Methodological Approach

This study employed an exploratory mixed-methods design to investigate challenges associated with learner data fragmentation and the potential role of interconnected Digital Learner Records (DLRs) in supporting educational data governance. Quantitative survey data and qualitative interview data were collected from stakeholders directly involved in learner management, academic administration, and information systems operations. The integration of both data sources enabled methodological triangulation and provided a comprehensive understanding of technical, organizational, and governance-related issues affecting learner information management.

The methodological approach was designed to generate contextually grounded evidence regarding current institutional practices and challenges while informing the development of a conceptual framework for interconnected learner record governance. The empirical findings derived from the survey and interview analyses are presented and discussed in the following section.

## 4. Findings and Discussion

### 4.1. Operational Consequences of Fragmented Learner Data Systems

The quantitative findings reveal that fragmented learner data systems continue to create substantial operational inefficiencies within higher education and vocational institutions. Survey respondents consistently reported delays in information retrieval, duplicated administrative procedures, and concerns regarding the reliability of learner records. These findings support the broader literature suggesting that data fragmentation remains one of the principal barriers to effective educational governance and institutional decision-making (DAMA International, 2017; Williamson, 2017).

As shown in Table 1, more than four-fifths of respondents (82%) reported that generating inter-departmental reports requires more than three working days. This finding suggests that information required for decision-making remains distributed across disconnected systems and organizational units. Such delays reduce institutional agility and may hinder timely responses to learner needs, particularly in situations requiring rapid intervention.

The prevalence of manual data re-entry (75%) further demonstrates the persistence of duplicated administrative processes. Rather than benefiting from automated data exchange, many institutions continue to rely on repetitive manual procedures that consume staff time and increase the likelihood of human error. Similar challenges have been documented in higher education systems undergoing digital transformation where interoperability remains limited (Bond et al., 2018).

The finding that 68% of respondents perceived significant data obsolescence is particularly concerning. Educational institutions increasingly depend upon accurate and timely information to support learner advising, retention initiatives, and strategic planning. When institutional records are outdated, decisions may be based on incomplete or inaccurate evidence, thereby reducing their effectiveness. This observation aligns with data governance scholarship emphasizing the critical role of data quality and timeliness in organizational performance (Khatri & Brown, 2010).

Moreover, 72% of respondents reported frequent inconsistencies across organizational units. Such inconsistencies are characteristic of "data silo" environments in which departments maintain separate

**Table 1** Operational Performance and Resource Waste in Learner Data Governance (N = 50)

| Indicator | Observation | Percentage | Interpretation |
|---|---|---|---|
| Time required to compile inter-departmental reports | Over 3 working days | 82% | Reflects inefficiency in retrieving data from fragmented systems |
| Manual data re-entry tasks | Frequent (Daily/Weekly) | 75% | Evidence of procedural duplication and administrative resource waste |
| Data deviation/obsolescence | Significant (Impending task execution) | 68% | Warns of the low reliability of current record systems |
| Information inconsistency across units | Frequent data conflicts occur | 72% | Reflects the existence of "data silos" |

***Note.*** Data were obtained from survey responses of administrators, academic staff, and personnel involved in learner management processes. Percentages represent respondents reporting the presence of the stated condition.

databases with limited synchronization mechanisms. From a Connectivist perspective, these silos disrupt information flows across institutional networks, thereby reducing the organization's collective capacity to generate and utilize knowledge effectively (Siemens, 2005).

Collectively, these findings indicate that fragmented learner data systems are not merely technical shortcomings but organizational challenges that directly affect institutional efficiency, communication, and governance.

### 4.2. Factors Contributing to Data Bottlenecks and Governance Challenges

To better understand the underlying causes of operational inefficiencies, respondents were asked to assess factors contributing to data bottlenecks within their institutions.

The results presented in Table 2 reveal that respondents perceive both technical and organizational barriers as contributing to fragmented learner information systems.

The most significant challenge identified was the absence of common API gateways between departmental systems (88%). APIs play a critical role in enabling interoperability among information systems by facilitating secure and automated data exchange. Without such mechanisms, institutions remain dependent on manual data transfers and isolated databases. This finding supports previous research emphasizing interoperability as a prerequisite for successful educational digital transformation (Ifenthaler & Yau, 2020).

A substantial proportion of respondents (80%) also highlighted inconsistencies in data standards and information structures. Variations in data templates, naming conventions, and field definitions create barriers to integration even when technical connectivity exists. Educational data governance literature consistently identifies standardization as a foundational requirement for data quality and interoperability (DAMA International, 2017).

In addition, 76% of respondents identified unclear procedural responsibilities regarding data updating and verification. This finding demonstrates that technological solutions alone cannot resolve governance challenges. Effective data management requires clearly defined accountability structures specifying who is responsible for maintaining, validating, and authorizing institutional data. Similar observations have been reported in studies of digital governance within public-sector organizations (Khatri & Brown, 2010).

Interestingly, organizational culture emerged as a significant but comparatively less prominent factor (64%). Respondents reported continued reliance on personal spreadsheets and informal information management practices. Such behaviours often develop when users lack confidence in institutional systems or perceive centralized platforms as cumbersome. As Selwyn (2019) notes, digital transformation is ultimately a socio-technical process in which organizational culture can either facilitate or impede technological innovation.

These findings suggest that learner data fragmentation arises from a combination of technological limitations, governance weaknesses, and cultural factors. Consequently, addressing data bottlenecks requires an integrated approach encompassing infrastructure modernization, governance reform, and organizational capacity building.

### 4.3. Data Integration and Institutional Decision-Making Capacity

One of the central assumptions underpinning this study is that effective learner management depends upon timely access to integrated information. Respondents were therefore asked to assess the perceived relationship between data integration and institutional decision-making capability.

The findings reveal a striking contrast between current and anticipated governance capabilities. Respondents perceived fragmented data environments as providing relatively weak decision-support capacity, with effectiveness estimated below 35%. In such environments, decision-making frequently depends on delayed reports, incomplete information, and professional intuition rather than comprehensive evidence.

**Table 2** Assessment of Factors Contributing to Learner Data Bottlenecks (5-Point Likert Scale)

| Dimension | Indicator | Agreement (%) |
|---|---|---|
| Technical Infrastructure | Software systems across departments lack a common API gateway | 88% |
| Coordination Procedures | Lack of specific regulations on data update and verification responsibilities between units | 76% |
| Data Standardization | Data templates are inconsistent in format and information field structures | 80% |
| Capacity and Culture | Reluctance to share data and reliance on personal storage tools (Excel) | 64% |

***Note.*** Percentages indicate respondents who agreed or strongly agreed that the factor significantly contributes to data fragmentation and governance challenges.

These observations correspond closely with the concerns raised in learning analytics research. Long and Siemens (2011) argue that institutions possessing fragmented data systems are unable to develop meaningful predictive insights because critical information remains dispersed across organizational boundaries. Consequently, institutional leaders may overlook emerging learner risks until problems become severe.

Conversely, respondents estimated that interconnected learner data systems could support decision-making effectiveness exceeding 90%. While this figure reflects perceptions rather than measured outcomes, it demonstrates widespread recognition of the potential benefits associated with integrated data environments.

The findings also reinforce the theoretical assumptions of Connectivism. According to Siemens (2005), the value of knowledge networks depends upon the quality and accessibility of connections among information nodes. Interconnected learner records enhance these connections by facilitating information exchange across departments, thereby improving institutional awareness and responsiveness.

A useful regional comparison can be observed in Singapore's educational data ecosystem. Through coordinated investments in interoperability, digital identity systems, and learning analytics infrastructure, Singapore has progressively strengthened its capacity for evidence-based educational governance (Ministry of Education Singapore, 2023; Smart Nation Singapore, 2023). Although Vietnam's educational context differs significantly, the comparison illustrates how integrated information environments can support more proactive and learner-centred decision-making.

Taken together, the findings suggest that improving interoperability is not solely a technical objective but a strategic governance priority capable of enhancing institutional effectiveness, learner support, and long-term educational outcomes.

### 4.4. Qualitative Perspectives on Learner Data Fragmentation

While the survey findings revealed the prevalence of operational inefficiencies and governance challenges, the qualitative interviews provided deeper insights into how these challenges are experienced by stakeholders responsible for learner management and institutional administration. The interviews highlighted recurring concerns regarding information delays, incomplete learner profiles, interoperability limitations, and organizational resistance to centralized data systems.

The interview findings reveal remarkable consistency across stakeholder groups. Departmental leaders unanimously reported delays and duplication in information flows between administrative units. These findings reinforce the survey evidence indicating that fragmented systems continue to hinder organizational coordination and institutional responsiveness.

**Table 3** Perceived Relationship Between Data Integration and Institutional Decision-Making Capacity

| Data Environment | Decision Support Capacity | Governance Implications |
|---|---|---|
| Fragmented Data (Current) | Low (Under 35%) | Decisions based on intuition or outdated reports, highly susceptible to strategic errors |
| Interconnected Data (Expected) | High (Over 90%) | Decisions based on real-time evidence, enabling timely intervention |

***Note.*** Percentages reflect respondents' perceptions regarding the effectiveness of decision support under different data environments and do not represent measured statistical outcomes.

**Table 4** Profile of In-Depth Interview Participants and Key Themes Explored (N = 15)

| Participant Category | Number | Primary Discussion Themes | Major Findings |
|---|---|---|---|
| Department Leadership (Academic Affairs, Student Affairs, Finance) | 03 | Inter-departmental data connectivity strategies; Procedural barriers; Data accountability | 100% confirmed data overlap and lag across units |
| Faculty Leadership and Student Management Assistants | 04 | Grassroots management realities; Difficulties receiving records; Accuracy of current rosters | 85% reported creating separate Excel files because the central system lags |
| Academic Advisors / Homeroom Lecturers | 05 | Access to learner information; Using data for counseling; Need for in-depth data fields | 92% cited a lack of psychological and skill data required for early intervention |
| IT Systems Administrators | 03 | Software interoperability; API standards; Infrastructure and data security realities | 100% admitted current systems are "silos" lacking automated interfaces |

***Note.*** Interview participants were selected through purposive sampling based on their direct involvement in learner management, institutional administration, and information systems operations. Percentages represent the proportion of participants within each category reporting the identified issue.

Particularly noteworthy is the widespread reliance on parallel record-keeping systems. Approximately 85% of faculty-level administrators reported maintaining independent spreadsheets to compensate for delays in the official information system. Although such practices are often intended to improve efficiency at the local level, they frequently contribute to further fragmentation by creating multiple versions of the same information. Similar phenomena have been documented in studies of organizational digital transformation, where informal workarounds emerge when users perceive formal systems as insufficiently responsive to operational needs (Selwyn, 2019).

The findings also highlight significant limitations in the scope of learner information available to academic advisors. Nearly all advisors interviewed emphasized that existing records provide predominantly administrative and academic information while offering limited insight into learners' psychological wellbeing, personal challenges, competencies, or employability skills. This observation is particularly important because contemporary learner support models increasingly emphasize holistic approaches that consider cognitive, behavioural, emotional, and social dimensions of learner development (Ifenthaler & Yau, 2020).

From a learning analytics perspective, the absence of such information restricts institutions' ability to identify at-risk students and develop proactive intervention strategies. Long and Siemens (2011) argue that meaningful learning analytics depend upon comprehensive learner profiles that extend beyond traditional academic indicators. Consequently, fragmented and incomplete records not only limit administrative efficiency but also constrain institutional capacity to support learner success.

The unanimous acknowledgment among IT administrators that current systems operate as isolated "silos" further underscores the need for interoperability-focused reforms. These findings align closely with international literature identifying interoperability as one of the most persistent challenges in educational information management (DAMA International, 2017; Williamson, 2017).

### 4.5. Thematic Analysis of Organizational and Technological Barriers

To further examine stakeholder perceptions, interview responses were coded and analyzed using thematic analysis. Three dominant themes emerged: system latency, data quality limitations, and organizational barriers to digital transformation.

The first theme, system latency, demonstrates that the value of institutional data depends not only on accuracy but also on timeliness. Delayed updates undermine the reliability of information and may lead to inappropriate administrative actions. In rapidly changing educational environments, even accurate information loses value if it is not available when decisions must be made.

This finding supports educational data governance research emphasizing timeliness as a critical dimension of data quality (Khatri & Brown, 2010). Effective governance therefore requires not only data collection mechanisms but also processes ensuring continuous synchronization across institutional systems.

The second theme concerns data quality and learner-centred information. Participants consistently emphasized that existing learner records contain predominantly static demographic and academic information while omitting critical indicators related to wellbeing, competencies, aspirations, and behavioural engagement.

These observations are particularly relevant in the context of contemporary higher education, where institutions increasingly seek to provide personalized learning experiences. According to Siemens (2013), educational institutions must move beyond transactional record management toward integrated information

**Table 5** Thematic Coding Matrix of Interview Findings

| Theme | Representative Codes | Illustrative Statement | Analytical Interpretation |
|---|---|---|---|
| System Latency | "Slow updates," "Old data," "Roster mismatch," "Wrong notices" | "The Academic Office authorized a leave last month, but this month the faculty still invites them to class meetings because the system hasn't updated." | Timeliness of information is compromised, reducing institutional responsiveness |
| Data Quality | "Missing information," "Only static info," "Don't know student thoughts," "Need more skills" | "I only know where the student is from and their grades; there is nowhere in the record indicating they are in a psychological crisis." | Existing records lack learner-centered data fields supporting personalization |
| Organizational Barriers | "Excel habit," "Afraid of system errors," "Reluctant to share," "Manual processes" | "Many hesitate to input to the central system for fear of making unfixable errors, keeping a separate Excel file just to be safe." | Organizational culture and digital readiness remain barriers to system integration |

***Note.*** Themes emerged through inductive coding of interview transcripts. Illustrative statements are anonymized excerpts selected to represent recurring viewpoints expressed by participants.

ecosystems capable of supporting learner development throughout the educational journey. The interview findings suggest that many current systems remain insufficiently developed to support these objectives.

The third theme highlights the importance of organizational culture in digital transformation initiatives. Although technological limitations remain significant, participant narratives indicate that behavioural and psychological factors also influence the effectiveness of information systems.

Resistance to centralized data management, concerns regarding system reliability, and continued reliance on informal work practices illustrate that digital transformation is fundamentally a socio-technical process rather than a purely technological undertaking (Bond et al., 2018). Consequently, successful implementation of interconnected learner record systems requires institutional change management strategies alongside technological investments.

### 4.6. Integrated Discussion: From Data Silos to Smart Educational Governance

When the quantitative and qualitative findings are considered collectively, a consistent pattern emerges. The principal challenge confronting learner management is not merely the absence of technology but the lack of integration among existing technological, organizational, and governance structures.

The findings strongly support the assumptions of Connectivism Theory. Siemens (2005) argues that learning and knowledge creation occur through networks of interconnected nodes. Within educational institutions, learner information systems represent important organizational nodes that support information exchange and decision-making. When these nodes operate independently, the institutional knowledge network becomes fragmented, limiting the organization's capacity to respond effectively to learner needs.

Similarly, the findings reinforce the central propositions of Educational Data Governance Theory. Respondents identified deficiencies in interoperability, accountability, standardization, and data stewardship—all dimensions recognized as foundational components of effective data governance frameworks (DAMA International, 2017). The evidence therefore suggests that many of the observed inefficiencies arise from governance shortcomings rather than technological inadequacies alone.

The study's findings also align closely with international learning analytics research. Effective learning analytics requires integrated, high-quality data capable of generating actionable insights regarding learner progression, engagement, and risk factors (Long & Siemens, 2011; Ferguson, 2012). Fragmented systems impede these capabilities by restricting access to comprehensive learner profiles and reducing the accuracy of institutional intelligence.

A useful regional benchmark can be found in Singapore's educational data ecosystem. Through sustained investments in interoperability frameworks, digital identity infrastructure, educational analytics, and governance mechanisms, Singapore has developed a more integrated approach to educational data management (Ministry of Education Singapore, 2023; Smart Nation Singapore, 2023). Although differences in scale, resources, and institutional contexts must be acknowledged, Singapore demonstrates how coordinated governance structures can transform educational data into a strategic institutional resource.

The Vietnamese context presents both challenges and opportunities. The widespread adoption of digital technologies within universities and vocational institutions provides a foundation upon which more integrated governance systems may be developed. However, the findings indicate that technological investments alone will be insufficient unless accompanied by interoperability standards, governance reforms, organizational capacity building, and cultural adaptation.

Ultimately, the evidence suggests that Digital Learner Records should be reconceptualized as strategic governance infrastructure rather than merely administrative repositories. Interconnected learner records have the potential to support evidence-based decision-making, enhance learner support services, improve institutional accountability, and facilitate personalized educational pathways. Achieving these outcomes, however, requires a coordinated approach that integrates technology, governance, organizational culture, and stakeholder engagement.

The findings presented in this study therefore provide a compelling rationale for the development of an interconnected Digital Learner Record framework capable of supporting smart, learner-centred, and evidence-based educational governance. The proposed framework and associated strategic recommendations are presented in the following section.

## 5. Proposed Interconnected Digital Learner Record Governance Framework and Strategic Recommendations

### 5.1. Rationale for an Interconnected Digital Learner Record Governance Framework

The findings of this study reveal that fragmented learner information systems generate significant

operational inefficiencies, compromise data quality, and limit the ability of educational institutions to provide timely and personalized learner support. The evidence further demonstrates that these challenges stem not only from technological limitations but also from governance weaknesses, organizational culture, and inadequate interoperability mechanisms.

Drawing upon Connectivism Theory (Siemens, 2005), Educational Data Governance Theory (DAMA International, 2017), and contemporary Learning Analytics literature (Long & Siemens, 2011), this study proposes an Interconnected Digital Learner Record Governance Framework (IDLRGF) designed to support learner-centred, evidence-based, and digitally enabled educational governance.

The proposed framework conceptualizes learner information as a strategic institutional asset that should be governed through integrated technological, organizational, and policy mechanisms. Rather than viewing learner records as static administrative repositories, the framework positions them as dynamic knowledge infrastructures that facilitate institutional learning, personalized intervention, and continuous improvement.

The framework responds directly to the major challenges identified in the empirical findings, including:

- Data silos and fragmented information systems;
- Inconsistent data standards and structures;
- Delayed information updates;
- Limited learner-profile information;
- Weak interoperability across institutional units;
- Organizational resistance to centralized data management.

The proposed framework seeks to address these deficiencies through a multi-layered governance architecture integrating technology, policy, institutional processes, and stakeholder engagement.

## 5.2. Core Components of the Proposed Framework

The Interconnected Digital Learner Record Governance Framework consists of five mutually reinforcing components.

### *5.2.1. Component 1: Unified Learner Data Architecture*

At the centre of the framework is a unified learner data architecture that consolidates information from academic, administrative, financial, behavioural, and support-service systems into a single interoperable ecosystem.

This architecture should facilitate real-time synchronization of learner information across departments while preserving institutional autonomy and functional specialization. Through common metadata standards and Application Programming Interfaces (APIs), institutional systems can exchange information seamlessly without requiring repeated manual data entry.

The objective is not necessarily to replace existing systems but to establish interoperability mechanisms enabling coordinated data exchange.

This component directly addresses the challenges of duplication, inconsistency, and reporting delays identified in Tables 1 and 2.

### *5.2.2. Component 2: Educational Data Governance Layer*

The second component involves the establishment of formal governance structures that define accountability, ownership, and responsibility for institutional data.

Consistent with DAMA-DMBOK principles (DAMA International, 2017), governance structures should include:

- Data stewardship roles;
- Data quality standards;
- Information verification procedures;
- Data lifecycle management policies;
- Security and privacy regulations;
- Audit and compliance mechanisms.

The findings demonstrate that many existing challenges arise from unclear responsibilities regarding data updating and verification. Consequently, governance mechanisms are essential for ensuring consistency, reliability, and trust in institutional information systems.

### *5.2.3. Component 3: Learner-Centred Data Enrichment*

A key finding of this study was the limited scope of information available within existing learner records. Academic advisors repeatedly emphasized the absence of psychological, behavioural, competency, and employability-related information required for meaningful learner support.

The framework therefore advocates the expansion of learner records beyond traditional demographic and academic variables.

Potential categories include:

- Learning engagement indicators;
- Competency development records;

- Career readiness profiles;
- Extracurricular participation;
- Psychological wellbeing indicators;
- Skills certification records;
- Internship and workplace learning experiences.

Such enriched profiles would support holistic learner development while enabling more personalized educational interventions (Ifenthaler & Yau, 2020).

#### *5.2.4. Component 4: Learning Analytics and Decision Support Systems*

Integrated learner records become significantly more valuable when combined with analytical capabilities.

The fourth component therefore focuses on the deployment of learning analytics and institutional intelligence systems capable of transforming raw data into actionable insights.

Potential applications include:

- Early warning systems;
- Student retention monitoring;
- Academic risk prediction;
- Resource allocation optimization;
- Programme effectiveness assessment;
- Personalized learner support pathways.

As Long and Siemens (2011) argue, learning analytics can significantly enhance institutional decision-making when supported by high-quality integrated data.

The purpose of analytics within the proposed framework is not surveillance but informed intervention that promotes learner success and institutional effectiveness.

#### *5.2.5. Component 5: Continuous Improvement and Digital Transformation*

The final component recognizes that educational data governance is an ongoing organizational process rather than a one-time technological implementation.

Institutions should establish continuous improvement mechanisms involving:

- Regular governance audits;
- User feedback systems;
- Data quality reviews;
- Professional development initiatives;
- Technological upgrading cycles;
- Institutional benchmarking exercises.

This component aligns with broader digital transformation literature emphasizing organizational adaptability and learning capacity as critical determinants of long-term success (Bond et al., 2018).

### 5.3. Singapore as an Illustrative Regional Benchmark

The experience of Singapore offers valuable insights into the practical implementation of integrated educational data ecosystems.

Under the Smart Nation initiative, Singapore has pursued coordinated investments in digital identity systems, educational technologies, data governance frameworks, and institutional interoperability (Smart Nation Singapore, 2023). Educational institutions benefit from nationally aligned standards that facilitate information exchange while maintaining strong safeguards for privacy and security.

Particularly relevant to the present study is Singapore's emphasis on integrating technology, governance, and human capacity development. The country's experience demonstrates that successful digital transformation requires more than technological infrastructure alone. Effective implementation also depends upon clear governance arrangements, stakeholder trust, organizational readiness, and continuous professional development.

Although Vietnam operates within a different educational and policy environment, several lessons are transferable:

- Adoption of common interoperability standards;
- Strengthening institutional data governance capacity;
- Expansion of learner-centred data ecosystems;
- Increased utilization of learning analytics;
- Development of national frameworks supporting educational data integration.

Rather than replicating Singapore's model directly, Vietnamese institutions may adapt these principles according to local contexts, resource availability, and governance structures.

### 5.4. Strategic Recommendations

Based on the findings and proposed framework, five strategic recommendations are advanced.

#### *5.4.1. Recommendation 1: Establish National Interoperability Standards*

Educational authorities should develop common technical standards governing data exchange, metadata structures, and learner identifiers to facilitate institutional interoperability.

#### *5.4.2. Recommendation 2: Strengthen Institutional Data Governance Capacity*

Universities and vocational institutions should establish dedicated governance committees responsible for data quality, stewardship, compliance, and accountability.

#### *5.4.3. Recommendation 3: Expand Learner Profile Architecture*

Institutions should progressively enrich learner records to include information supporting holistic learner development and personalized intervention.

#### *5.4.4. Recommendation 4: Promote Learning Analytics Adoption*

Educational institutions should leverage integrated data systems to support evidence-based decision-making and proactive learner support initiatives.

#### *5.4.5. Recommendation 5: Invest in Organizational Change Management*

Digital transformation initiatives should incorporate professional development programmes that strengthen staff confidence, digital competencies, and acceptance of integrated governance systems.

Together, these recommendations provide a roadmap for transitioning from fragmented information environments toward interconnected, learner-centred educational ecosystems.

## 6. Conclusion and Policy Implications

This study examined the challenges associated with fragmented learner information systems and explored the potential of interconnected Digital Learner Records (DLRs) as a foundation for effective educational data governance. Drawing upon quantitative survey findings and qualitative interview evidence, the study identified significant operational inefficiencies, interoperability limitations, data quality concerns, and organizational barriers affecting learner management within higher education and vocational institutions.

The findings indicate that fragmented information systems constrain institutional decision-making, reduce administrative efficiency, and limit the capacity of educational institutions to provide personalized learner support. These challenges are not solely technological in nature but reflect broader governance, organizational, and cultural issues that influence how educational data are managed and utilized.

The study contributes to the literature by integrating Connectivism Theory, Educational Data Governance Theory, and Learning Analytics perspectives into a unified conceptual framework for learner record governance. The proposed Interconnected Digital Learner Record Governance Framework positions learner information as a strategic institutional asset capable of supporting evidence-based decision-making, enhanced learner outcomes, and sustainable digital transformation.

From a policy perspective, the findings underscore the importance of interoperability standards, governance mechanisms, data quality assurance processes, and learner-centred information architectures. Educational modernization efforts should therefore prioritize not only technological infrastructure but also the institutional capacities required to govern and utilize educational data effectively.

Although the study focuses primarily on Vietnam, the findings have broader relevance for educational systems undergoing digital transformation across Southeast Asia and other developing contexts. The comparison with Singapore illustrates how coordinated governance frameworks can enhance the value of educational data while supporting innovation and accountability.

Several limitations should be acknowledged. The study employed purposive sampling and an exploratory mixed-methods design, limiting the generalizability of the findings. Future research may expand the sample size, examine multiple institutional contexts, and evaluate the implementation of integrated learner record systems using longitudinal research designs.

Ultimately, the study argues that the future of educational governance depends not merely on digitizing records but on creating interconnected knowledge ecosystems capable of transforming institutional data into meaningful educational intelligence. Interconnected Digital Learner Records represent an important step toward achieving more responsive, learner-centred, and evidence-based educational systems in the digital age.

## Acknowledgements

The authors also gratefully acknowledge the academic guidance, editorial support, and constructive feedback received from the reviewers and JHSSR editorial office during the preparation and revision of this manuscript.

## Funding

The authors declare that they received no financial support for the research, authorship, and/or publication of this article.

## Declaration of Conflicting Interests

The authors declare that they had no competing interests.

## Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used Generative AI and AI-assisted technologies solely for editorial purposes, including language refinement, grammar correction, stylistic improvement, and the enhancement of clarity and coherence. These tools were not used to generate the research ideas, theoretical framework, analysis, interpretation, arguments, or conclusions presented in the manuscript. All intellectual content, conceptual development, methodological decisions, and scholarly interpretations remain the sole responsibility of the author.

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