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School principals as ethical safeguards of datafication: digital trustworthiness and AI governance in Italian schools

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Abstract: Digital transformation in schools increasingly relies on datafied processes, yet the role of principals as ethical safeguards of these processes remains underexplored. This study examines e-leadership, defined as the capacity to guide, sustain and legitimise the digital transformation of educational institutions, focusing on two dimensions of an original framework: Digital Trustworthiness and Ethics, and AI for Governance and Data-Driven Leadership. A cross-sectional descriptive survey was administered online to 122 Italian school principals, recruited through purposive and snowball sampling, using a 65-item questionnaire whose construct validation is preliminary. Procedural practices were consolidated: 73.0% reported complete and communicated data-protection policies and 81.1% systematic verification of digital providers. AI tools were in use at least experimentally in 40.2% of schools, yet only 7.4% monitored ethical impact and 46.7% reported low preparedness for informed adoption decisions. Faced with an opaque dropout-prediction system, 64.8% would request methodological information and 5.7% would adopt it. The findings point to a gap between formal digital accountability and the organisational capacity to govern AI, and are read as reported orientations rather than observed behaviour. They support professional development in AI literacy, critical data use and transparent organisational practices, while preserving human professional judgement.

Keywords: AI governance; school leadership; integrated e-leadership; digital trust; datafication

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1. Introduction

Schools are increasingly traversed by processes of datafication, in which aspects of learning, behaviour and participation are rendered as data, aggregated into dashboards and mobilised to inform decisions at the level of the classroom, the organisation and the system (Williamson et al., 2023). The introduction of artificial intelligence adds a further layer of complexity. Systems characterised by autonomy, learning and inscrutability complicate their management and make the attribution of responsibility less straightforward than it was for earlier generations of educational technology (Berente et al., 2021), and the ethics of AI in education has come to include fairness, accountability, transparency, bias, autonomy and inclusion (Holmes et al., 2022).

Much of the existing debate addresses these questions by starting from the technologies themselves, their algorithms and the metrics they produce. Research on school leadership and AI has so far concentrated largely on adoption, and in particular on how principals' digital leadership relates to teachers' competency in

integrating AI tools (Zeng et al., 2025), or on the challenges and opportunities that AI poses for school leaders (Fullan et al., 2024). Less attention has been paid to the governance dimension of the principal's role. Principals decide which systems are adopted, which data are collected and shared, how providers are assessed and in what terms these choices are communicated to staff, students and families. Their capacity to steer digital transformation in an ethical and trustworthy manner can therefore be considered a preliminary condition for participation in technology-mediated processes to be legitimate, transparent and equitable. The literature on digital leadership, moreover, remains fragmented and largely anchored to linear and predictable technologies, as reflected in the e-leadership models on which it draws (Van Wart et al., 2019).

This article aims to reflect on the role of school principals as ethical safeguards of datafication, drawing on a study that conceptualised and measured e-leadership among Italian school principals. An original framework[1], based on an integrated e-leadership construct drawing on established conceptual models, was articulated into eight competence dimensions and operationalised in a 65-item questionnaire.

The present contribution focuses on two of these dimensions: Digital Trustworthiness and Ethics, and AI for Governance and Data-Driven Leadership. The Italian context is of particular interest, given stringent obligations on data protection, recent ministerial guidance assigning explicit responsibilities for AI oversight to principals (Ministero dell'Istruzione e del Merito [MIM], 2025), and persistent territorial disparities that raise questions of distributive justice.

The article offers empirical evidence on a professional profile still little explored in research on datafication and AI in education, and suggests a conceptual lens for situating digital and data-driven practices within a broader system of organisational responsibility.

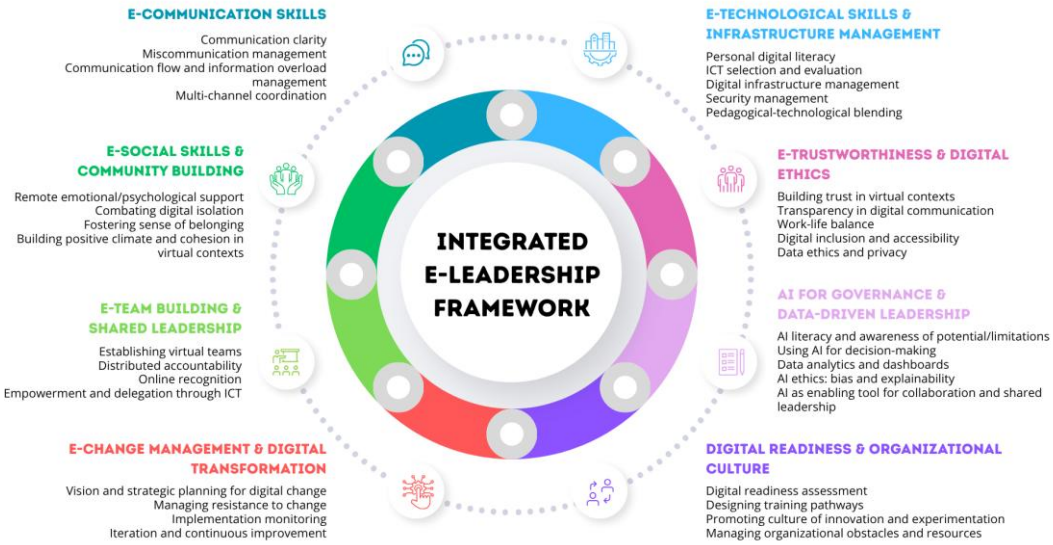
2. Materials and Methods

2.1 Conceptual framework

E-leadership is defined here as the capacity to guide, sustain and legitimise the digital transformation of educational institutions. Existing models were developed largely in organisational and public-administration settings around ICT-mediated communication (Van Wart et al., 2019) and were not designed for features specific to AI, such as model opacity, the partial delegation of decisions to automated systems and the assessment of providers whose technology the school cannot inspect. The integrated framework used here (Figure 1) draws on established conceptual models and articulates e-leadership into eight dimensions.

[1] The integrated e-leadership framework was validated through a multi-stage process. Content validity was addressed through item review by an expert panel of ten members (researchers, Ministry officials, technical inspectors and school principals), who assessed relevance, clarity, appropriateness to the Italian school context and overlap. Face validity and comprehensibility were examined through cognitive interviews with three serving principals, using a think-aloud protocol, and a pilot with ten principals. Dimensionality was explored through Categorical Principal Component Analysis (CATPCA). A full account of the validation procedures and results goes beyond the scope of this article and is not detailed here.

Figure 1. Integrated conceptual framework of e-leadership, articulated into eight competence dimensions. Source: original elaboration by the author.



In this paper, two dimensions are examined. *Digital Trustworthiness and Ethics* conceptualises the fiduciary premise of e-leadership: transparent and documented digital decisions, compliance with data protection, verification of providers and communication of adoption criteria. *AI for Governance and Data-Driven Leadership* extends existing models to AI and concerns the capacity to decide on adoption, recognise algorithmic risks, translate guidance into rules, roles and monitoring, and use data in decision-making (Greco & Morini, 2021; Schildkamp, 2019; Long & Magerko, 2020). Both dimensions sit where datafication is decided: the conditions under which data are used and communicated, and what changes when decisions are informed by AI.

2.2 Study design and instrument

The questionnaire was developed within a doctoral project on e-leadership and organisational change in schools. The study adopts a cross-sectional descriptive survey design. The integrated e-leadership framework (Figure 1) was operationalised through a 65-item questionnaire, reduced from an initial pool of approximately 90 items and organised across eight theoretically defined dimensions. Items focused primarily on observable practices and perceived competence, with response formats varying according to item content (frequency, agreement or degree). The questionnaire also collected socio-demographic and school-context information and included four optional open-ended questions.

Instrument development involved an expert panel of ten members, including researchers, Ministry officials, technical inspectors and school principals experienced in digital innovation. Experts assessed item relevance, clarity, appropriateness to the

Italian school context and overlap with other items. Face validity and item comprehensibility were subsequently examined through cognitive interviews with three serving principals using a think-aloud protocol (Willis, 2005), followed by a pilot with ten principals.

Given the predominantly ordinal nature of the items, dimensionality was explored using Categorical Principal Component Analysis (CATPCA; Linting et al., 2007). The analysis identified four components, yielding a more compact empirical structure than the eight theoretically specified dimensions. Given this divergence, the eight dimensions are retained in the present study as theoretically grounded analytical dimensions rather than as empirically confirmed latent constructs. Construct validation should therefore be regarded as preliminary.

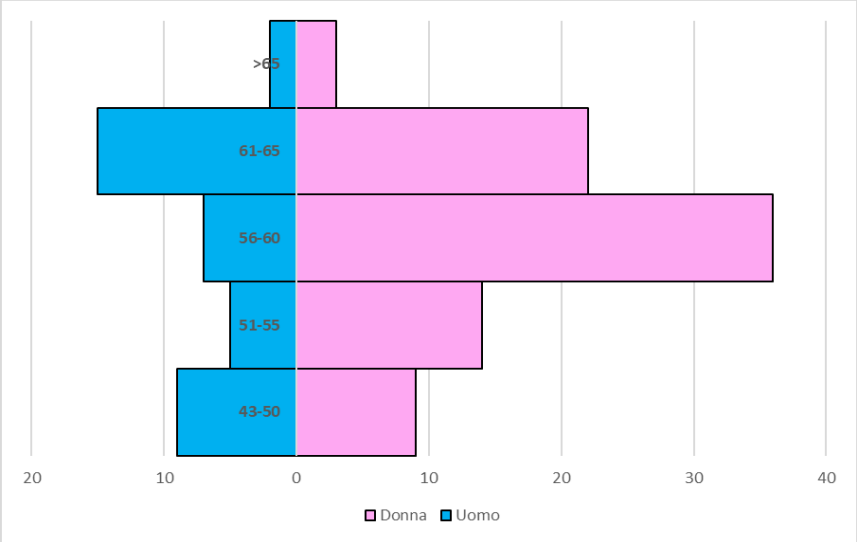
The present article focuses on two dimensions: Digital Trustworthiness and Ethics, comprising seven questions addressing transparency and accountability, documentation of digital decisions, data protection, provider verification, communication of adoption criteria, security incidents and perceived areas of trustworthiness; and AI for Governance and Data-Driven Leadership, comprising eleven questions addressing AI adoption, areas of use, awareness of bias, ministerial guidelines (MIM, 2025), actions undertaken, concerns, training, perceived readiness, personal and professional AI use, and a hypothetical scenario.

2.3 Participants and data collection

The questionnaire was administered online (CAWI) using LimeSurvey over a two-month period. An email invitation with a personal link was sent to an initial pool of 535 Italian school principals, identified through purposive sampling (Teddlie & Yu, 2007) to ensure variation by NUTS 1 macro-area, school level and type, school size and territorial context. The invitation was subsequently extended through professional associations and informal networks using snowball sampling. The sample describes this group of principals without supporting population estimates (Table 1). A total of 122 valid questionnaires were collected. Relative to the initial pool of principals directly contacted, this corresponds to 22.8%; however, this figure cannot be considered an overall response rate, since additional participants were reached through snowball sampling and the total number exposed to the invitation is unknown.

Among the 122 principals, 68.9% were women; age ranged from 43 to 68 years ($M = 57.6$, $SD = 5.5$) (Figure 2), and experience in the role ranged from 1 to 35 years.

Figure 2. Pyramid showing the sample by age and gender



Comprehensive schools accounted for 54.9% of the sample and upper secondary schools for 41.8%. Respondents were distributed across the North West (21.3%), North East (22.1%), Centre (28.7%), South (23.0%) and Islands (4.9%) (Table 1).

Table 1. *Sample and national distribution of principals by school type and geographical area.*

Source: MIM

		Respondents		Italia	
		n	%	n	%
School type					
	Primary School	2	1.6	150	2.0
	Comprehensive school	67	54.9	4684	62.7
	Lower secondary school	2	1.6	56	0.7
	Upper secondary school	51	41.8	2583	34.6
Geographical area					
	North West	26	21.3	1784	23.9
	North East	27	22.1	1226	16.4
	Centre	35	28.7	1492	20.0
	South	28	23.0	2024	27.1
	Islands	6	4.9	947	12.7
Tot		122	100.0	7473	100.0

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For descriptive purposes, the sample distribution was compared with national data. The distribution by school type did not differ significantly from the national distribution ($\chi^2 = 4.39$, $df = 3$, $p = .22$), whereas the distribution by geographical macro-area did ($\chi^2 = 15.09$, $df = 4$, $p = .004$). These comparisons are used to characterise the sample and should not be interpreted as evidence of representativeness. Given the purposive and snowball sampling design, the sample is non-probabilistic and the findings are interpreted as descriptive of the participating principals rather than as generalisable estimates for the population of Italian school principals.

2.4 Data analysis

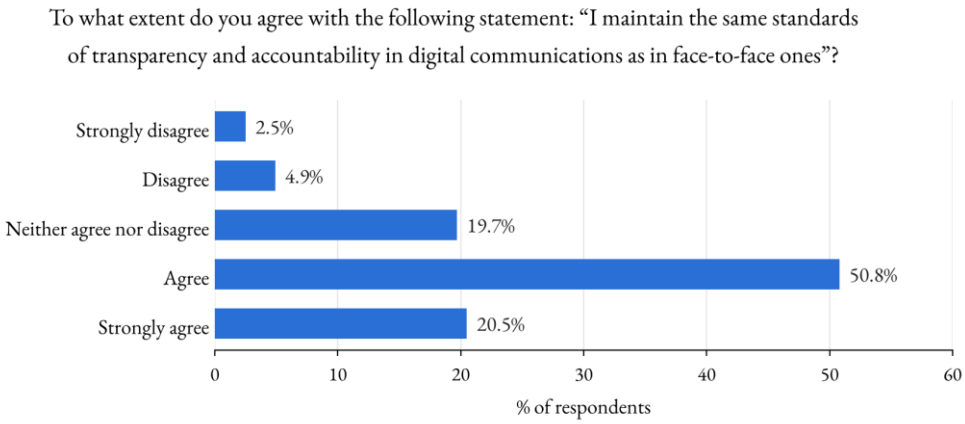
The present study adopts a descriptive analytical approach, consistent with its research questions and non-probabilistic sampling design. The analysis focuses on items belonging to Digital Trustworthiness and Ethics and to AI for Governance and Data-Driven Leadership. Closed-ended items were analysed using frequencies and percentages. Unless otherwise specified, item-level analyses are based on the 122 respondents who provided valid responses to the closed-ended items examined in this study, and percentages refer to the full sample, rounded to one decimal place. For multiple-response questions, percentages refer to the proportion of respondents selecting each option and therefore do not sum to 100%.

3. Results

3.1. Digital Trustworthiness and Ethics

Principals' perceptions of transparency in digital contexts were largely positive (Figure 3). Of the respondents, 50.8% agreed and 20.5% strongly agreed that they apply the same standards of transparency and accountability in digital and face-to-face communication (71.3% in total), while 19.7% took a neutral position and 7.4% disagreed. Decisions taken through digital channels were formally documented always or often by 55.7% and sometimes by 31.1%, which indicates that a majority adopts systematic or frequent decision traceability.

Figure 3. Agreement with maintaining the same standards of transparency and accountability in digital and face-to-face communication.



Data protection was among the most consolidated practices. Policies on privacy and data protection (GDPR) were reported as complete and communicated by 54.9% and as complete, communicated and actively monitored by 18.0%, for a total of 73.0%; a further 21.3% reported partial policies limited to some tools. Systematic verification of digital providers was reported by 81.1% (35.2% before adopting any new service, 38.5% through annual review and 7.4% through continuous monitoring with audits). Criteria for technology adoption were communicated through internal documents by 33.6%, public channels by 29.5% and participatory processes by 22.1%, so that 85.2% use structured, public or participatory forms. As for security incidents, 50.8% had never managed one; among the others, minor incidents prevailed (32.0%) over moderate (13.1%) and serious ones (2.5%), the latter requiring external or legal support.

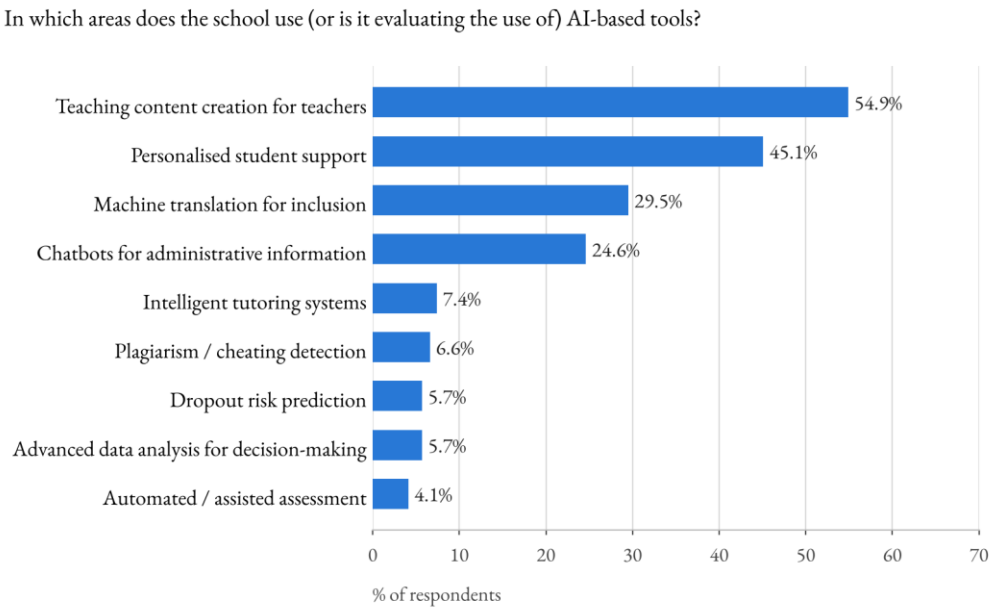
Asked which aspects contribute to digital trust in their school, principals most often selected effective data protection (50.0%) and clear, shared decision criteria (36.9%). Accessible documentation, functioning accountability and genuine stakeholder participation were each selected by 23.8%, and balanced communication of benefits and risks by 19.7%. Perceived trust therefore rests mainly on regulatory and procedural practices, while participatory and relational aspects offer scope for further development.

3.2. AI for Governance and Data-Driven Leadership

AI tools were in use, at least on a pilot basis, in 40.2% of schools, and a further 46.7% were exploring possibilities and 11.5% were not evaluating adoption. Use concentrated on content creation for teachers (54.9%), personalised student support (45.1%), machine translation (29.5%) and administrative chatbots (24.6%), whereas data-intensive applications, such as dropout risk prediction, advanced data analysis for decision-making and automated assessment, were selected by 4.1–5.7% (Figure

4). For their own work, 34.4% of principals use or plan to use AI to analyse data on learning, participation and process indicators.

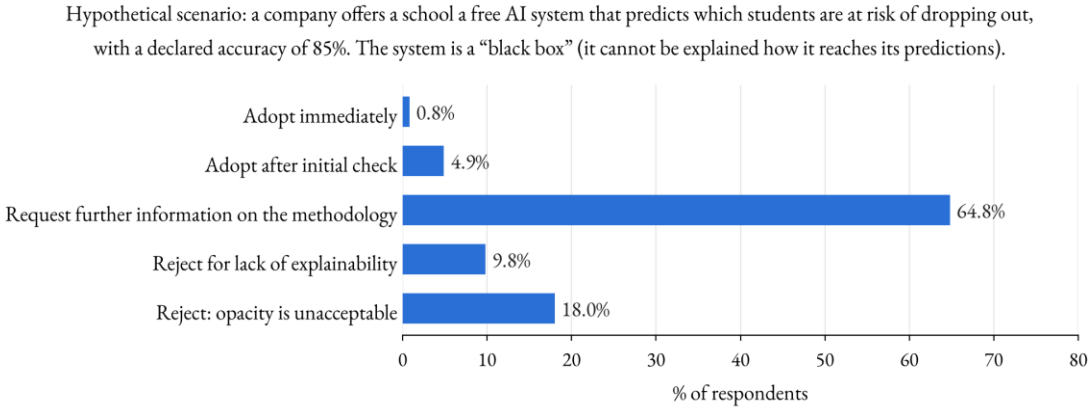
Figure 4. Areas in which the school uses or is evaluating AI-based tools.



Ministerial guidelines on AI had been presented to staff groups in 36.9% of schools and integrated into strategic documents in 18.0%, while 20.5% reported that only the principal or a few referents knew them. Actions undertaken were mainly training (38.5%) and integration into digital policies or the school plan (33.6%); 7.4% monitored ethical impact. Awareness of algorithmic bias was fairly or highly developed for 33.6% of respondents and moderate for a further 33.6%, and 34.4% had followed structured training of at least three hours. Nevertheless, 46.7% reported low preparedness for informed adoption decisions. The main concerns were loss of human skills (55.7%), privacy (48.4%) and over-reliance on technology (45.9%), followed by bias (29.5%) and unclear ethical implications (26.2%).

In the hypothetical scenario of an opaque dropout-prediction system with a declared accuracy of 85% (Figure 5), 64.8% would request methodological information before deciding, 27.9% would reject it (9.8% for lack of explainability, 18.0% because opacity is unacceptable) and 5.7% would adopt it (4.9% after an initial check, 0.8% immediately).

Figure 5. Decision in the opaque dropout-prediction scenario.



Awareness, training and preparedness are unevenly distributed across respondents, which makes AI literacy and critical data use a natural area for professional development. Since the scenario is hypothetical, the orientation towards scrutiny of opaque systems is read as a declared intention rather than as observed behaviour.

4. Discussion

This study examined how school principals' reported e-leadership practices may contribute to the ethical governance of datafication and artificial intelligence in educational institutions. The findings point to well-established procedural arrangements for digital accountability, alongside AI-specific governance practices that are still taking shape . Three interpretive axes structure the discussion: the relationship between regulatory compliance and relational trust, the gap between AI adoption and governance readiness, and the difference between ethical caution and the capacity to evaluate algorithmic systems critically.

The first axis concerns formal accountability and the relational foundations of digital trust. A substantial proportion of principals reported complete and communicated data-protection policies (73.0%), some form of provider verification (81.1%) and frequent or systematic documentation of digitally mediated decisions (55.7%). Procedures of this kind clearly hold an important place in principals' reported practices. Compliance with regulations and documentation of decisions are nonetheless necessary rather than sufficient conditions for institutional trustworthiness. Mayer et al. (1995) locate trustworthiness in the characteristics that make an actor worthy of trust, namely ability, benevolence and integrity, while Bryk and Schneider (2002) show that in schools trust grows out of everyday relationships, consistent behaviour and mutual recognition among members of the educational community. Regulatory compliance is therefore one component of digital

responsibility, and it works best when accompanied by transparent organisational practices and relationships grounded in trust.

The factors that principals associate with digital trust point in the same direction. Effective data protection (50.0%) and clear decision-making criteria (36.9%) were selected more often than stakeholder participation, accessible documentation or functioning accountability mechanisms (23.8% each). Principals appear to anchor digital trust mainly in procedural safeguards, leaving relational and participatory dimensions as a resource still to be developed. From an e-leadership perspective, the task is not limited to ensuring compliance: digital decisions also need to be understandable, contestable and open to professional and community scrutiny. Distributed leadership (Spillane, 2006) offers a useful interpretive lens here, since decisions on digital technologies involve multiple organisational actors even where formal accountability rests with the principal.

The second line of reflection concerns the diffusion of AI and the organisational capacity to govern its use. Although 40.2% of principals reported that their schools had introduced AI tools at least experimentally, the most frequently identified areas of current or prospective application were content creation, personalised support and translation. Data-intensive applications that bear directly on educational decisions were reported far less often. The difference matters because applications carry different levels of organisational responsibility, particularly when algorithmic outputs may influence judgements about students or educational trajectories.

AI adoption is also not consistently matched by formalised governance arrangements. Training activities (38.5%) and the integration of AI-related principles into school policies or planning documents (33.6%) were reported by substantial minorities, whereas only 7.4% of principals indicated that their schools monitored the ethical implications of AI, and 46.7% reported low preparedness for informed adoption decisions. Experimentation with AI thus appears to be moving faster than the institutional capacity to assess, supervise and evaluate it. This reading is consistent with Berente et al. (2021), who identify autonomy, learning and inscrutability as characteristics that complicate the management of artificial intelligence. In schools, these characteristics raise questions about technical performance, but also about the allocation of responsibility, the legitimacy of data use and the preservation of professional judgement.

The third strand concerns ethical awareness and operational competence, and the hypothetical dropout-prediction scenario is informative in this respect. Faced with a system claiming 85% accuracy but offering no explanation of its predictions, 64.8% of the overall sample would request additional methodological information, 27.9% would reject its adoption and only 5.7% would proceed. These responses reveal a predominantly cautious orientation towards algorithmic opacity. Requesting further information, however, does not in itself demonstrate the ability to evaluate the validity, fairness or educational appropriateness of an algorithmic system. Given the limited proportion of respondents reporting high awareness of algorithmic bias, and the uneven distribution of structured training and perceived preparedness, ethical sensitivity should be kept separate from demonstrated evaluative competence.

This separation is central to the notion of school leadership as an ethical safeguard. Ethical responsibility cannot rest on an individual disposition to act

cautiously, nor can formal compliance satisfy it alone. It requires organisational conditions in which technological decisions can be justified, critically examined and, where necessary, reconsidered. The principal's role can accordingly be understood as creating the conditions for responsible collective judgement, rather than acting as the sole technical evaluator of digital systems. This view connects ethical leadership (EU, 2022; Starratt, 2004) with distributed leadership (Spillane, 2006) and with emerging approaches to AI governance that emphasise accountability, transparency and human oversight.

The findings also invite reflection on datafication and educational judgement. As Williamson and Eynon (2020) argue, data-driven processes increasingly shape how educational phenomena are represented and acted upon, yet indicators derived from digital traces cannot fully capture the contextual and relational complexity of schooling. The limitation becomes pressing when predictive systems translate probabilistic classifications into potentially consequential educational decisions. The ethical responsibility of school leadership therefore extends beyond the protection of personal data to the critical examination of what is measured, how algorithmic outputs are interpreted and which decisions should remain subject to human professional deliberation.

Several limitations qualify these interpretations. The study relies on a non-probabilistic sample of Italian school principals recruited through purposive and snowball sampling, which limits the generalisability of the findings. Data are self-reported and may be affected by social desirability, differences in interpretation and uneven familiarity with AI-related terminology. The findings should therefore be read as evidence of reported orientations and organisational practices, not as a direct assessment of principals' ethical competence or of the effectiveness of school-level AI governance.

Future research could combine principals' self-reports with documentary analysis of school policies, interviews with teachers and other stakeholders, and observation of actual technology-adoption processes. Such approaches would help establish whether formal safeguards translate into transparent organisational practices, and whether declared caution towards opaque systems holds when decisions involve competing educational, administrative and technological pressures.

5. Conclusions

This study contributes to the emerging debate on school leadership and artificial intelligence by examining e-leadership through the interconnected dimensions of digital trustworthiness, data-informed decision-making and AI governance. The findings indicate that Italian school principals report relatively widespread practices of data protection and procedural accountability, while AI-specific ethical monitoring, structured preparation and critical governance practices remain areas with scope for development.

The main contribution of the study lies in identifying a distinction between the formal management of digital responsibility and the organisational capacity to govern the ethical implications of datafication. Principals' cautious responses to an opaque predictive system suggest an awareness of the importance of explainability.

These findings have implications for leadership development and educational policy. Professional learning should extend beyond the operational use of AI tools

to include algorithmic literacy, critical interpretation of data, assessment of technology providers and the ethical implications of automated decision-making. At the organisational level, transparent procedures, shared responsibilities and opportunities for professional deliberation may strengthen the conditions for responsible AI governance.

School leadership as an ethical safeguard should therefore be understood as a perspective through which to interpret and develop the responsibilities of educational institutions in increasingly datafied environments. The challenge is not merely to adopt digital technologies responsibly, but to ensure that their use remains educationally justified, institutionally accountable and subject to meaningful human professional judgement.

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