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Governance Meets Innovation: AI Integration in German Schools

A Multi-Level, Typological Plausibility Probe of Policy and Practice in Education

Dissertation submitted by

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Abstract

The rapid development of generative AI tools such as ChatGPT, Gemini, or Copilot is fundamentally reshaping debates around the future of education. While these technologies are increasingly accessible, their meaningful and responsible integration into school settings remains uneven, especially across Germany's federal education system. This thesis investigates how different governance structures – at both the state and school levels – influence the implementation and use of AI tools in secondary schools.

Originally designed to evaluate whether the EU AI Act acts as a regulatory barrier or catalyst, the research shifted to a prior analytical step: mapping the institutional conditions under which AI is currently entering schools. In response to a lack of structured data, the study adopts the logic of a plausibility probe, not aiming for statistical generalization but the development of first hypotheses and pattern-based insights. Using a theory-driven mixed-methods design grounded in Multi-Level Governance (MLG) and Diffusion of Innovations (DOI), the study combines policy and website analysis with a standardized school survey across Berlin, Hamburg, and North Rhine-Westphalia. Typologies were developed to classify state governance models, school-level structures, and AI usage patterns.

The findings suggest that governance influences AI implementation primarily through visibility, framing, and institutional ownership, rather than through mandates or infrastructure alone. The study highlights policy-practice gaps, uneven preparedness for regulation, and the need for more aligned, multi-level governance strategies. It offers an initial conceptual and empirical contribution to understanding how innovation is governed in education – and under what conditions it can take root.

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1. Introduction

The rapid development of generative AI systems such as ChatGPT, Google Gemini, or Microsoft Copilot has not only transformed the public debate about education but also presents schools, teachers, and education authorities with new and largely unresolved challenges. While some stakeholders emphasize the transformative potential of AI in teaching – for example, for the individualization of learning processes or the relief of teachers – in practice, uncertainty, skepticism, and structural ambiguity often prevail regarding whether and how AI can be meaningfully, legally, and pedagogically integrated into schools (Helm & Große, 2024; Müller, 2024).

Especially in the school sector, which is characterized by federal structures, legal regulations, and limited resources, one thing becomes clear: the question is not only whether schools use AI, but *under what institutional conditions they do so, and with what consequences*. The introduction of the EU AI Act in 2024 further intensifies this discussion, as it imposes high requirements for transparency, safety, and accountability for AI systems in education (European Commission, 2024a; 2024b). But how can schools meet these requirements if previous experience with the GDPR has already shown that well-intentioned regulation, in the absence of clear implementation structures, can quickly become a barrier to innovation (Bitkom, 2023; Forum Bildung Digitalisierung, 2021)?

This research project was initially designed to examine whether the EU AI Act acts more as a catalyst or a barrier for AI use in schools. However, during the process of conceptualization, a more fundamental problem emerged: there is a lack of systematically collected, comparable, and explainable data on the current state of AI use, governance, and integration, especially in the German education system. Against this backdrop, the focus of the study shifted away from a direct evaluation of the AI Act, toward an upstream analysis of the structural preconditions under which such regulation would even take effect.

This thesis, therefore, examines how governance – that is, political steering and institutional structuring (Keohane & Nye, 2004) – is related to the use and integration of AI in schools. The focus is not only on legal frameworks or technical infrastructure, but on the interplay between state policy, school organization, and individual practices. The aim is not to identify clear causal relationships, but rather to uncover what patterns can be observed in the

interaction of these levels, and under what conditions AI becomes visible – or remains absent – in the school context. The specific analytical approach of this study lies in the combination of Multi-Level Governance theory (MLG; Hooge & Marks, 2001) and Diffusion of Innovations theory (DOI; Rogers, 2023): While MLG analyzes the vertical and horizontal interlinking of political actors across governance levels, DOI provides insights into the conditions under which innovations are actually adopted and spread by actors in the education system.

Empirically, the study approaches the research question through a qualitatively oriented mixed-methods design, combining document analysis, website analysis, and a standardized online survey of schools in three federal states (Berlin, Hamburg, NRW). A theory-based typology was developed to systematically compare governance and usage patterns, in order to investigate the extent to which policy frameworks are actually translated into school-level practice – or whether so-called policy-practice gaps emerge. The aim is not to make generalizable claims about the schools, but to develop initial hypotheses about plausible patterns, tensions, and governance needs that may be relevant for future research, educational policy, and school development – and that may also indirectly shed light on the conditions necessary for the EU AI Act to achieve its intended impact in the education sector.

The structure of the thesis is as follows: Chapter 2 provides an overview of the current state of literature and research on AI in school contexts, as well as relevant governance and innovation theories. It identifies the research gaps this study seeks to address. Chapter 3 develops the theoretical framework; Chapter 4 outlines the methodological approach. Chapter 5 presents the results of the empirical analysis, and Chapter 6 discusses them in light of the research question. Chapter 7 concludes with a summary and outlines implications for research, practice, and future governance strategies.

2. Literature Review

2.1 AI in Education: Concepts, Potentials, and Practical Gaps

Artificial intelligence has become an increasingly prominent topic in public and political discourse, not only in technology or healthcare but also in education. While AI systems tailored specifically for education have long been studied in the field of Artificial Intelligence in Education (AIEd) (Luckin et al., 2016; Zhai et al., 2024), the emergence of general-purpose generative tools such as ChatGPT has placed AI at the center of debates around schools and teaching since late 2022 (Cefa et al., 2025; UK Department for Education, 2023).

Although often not clearly distinguished in practice or policy, two conceptually distinct categories of AI systems emerge from the literature. On the one hand, AIEd systems, which are developed with explicit pedagogical goals and based on instructional theories (e.g., adaptive learning platforms, intelligent tutoring systems; see: Chaudhry & Kazim, 2022; Hwang, 2020; Lui et al., 2017; Verhelst et al., 2024). On the other hand, general-purpose AI (GPAI) tools like ChatGPT or Copilot, which were not developed for education but are increasingly repurposed for classroom use (see: Combéfis, 2022; Hashem et al., 2023; Karaca, 2024; Lee et al., 2024; Tan & Subramonyam, 2024). These tools are typically characterized by broad accessibility, versatility, and low entry barriers, allowing even individual teachers or students to use them without institutional support or prior training (Triguero et al., 2024).

Importantly, GPAI tools often rely on generative AI architectures (such as large language models), but the terms “generative AI” and “general-purpose AI” are not synonymous (Triguero et al., 2024). Generative AI as a technical capability is not limited to general-purpose tools – it is increasingly being integrated into AIEd systems as well, for example, in the form of adaptive feedback or automated content generation within instructional platforms (Verhelst et al., 2024).

Although research addresses widespread concerns about the risks of AI use in education, such as issues of data protection, algorithmic bias, lack of transparency, ethical misuse, and the potential deskilling of teachers (Miao et al., 2021; Vincent-Lancrin & van der Vlies, 2020),

there is wide theoretical agreement on the potential benefits of AI in education (Hwang et al., 2020). These include personalization of learning, targeted support for lower-performing students, workload relief for teachers, and increased efficiency in assessment and administration (Dematini et al., 2024; Hwang et al., 2020; Zhai et al., 2021). These possibilities are particularly relevant in light of structural strain in many education systems, marked by chronic teacher shortages, administrative overload, and declining instructional quality (Huber & Lusnig, 2022; Klein, 2023).

Nevertheless, it appears that the actual diffusion of AI technologies in mainstream schools has remained limited to date – or at least, there is little empirical evidence to suggest otherwise. Much of the academic literature on AI implementation focuses on higher education settings, where institutional autonomy, digital infrastructure, and pedagogical flexibility tend to be greater (see: Al-Mughairi & Bhaskar, 2024; Helmiatin et al., 2024; von Garrel & Mayer, 2023) In contrast, the school sector – particularly general secondary schools – has so far received less systematic attention. The few available studies and monitoring reports suggest that, while awareness of AI has increased considerably since the release of tools like ChatGPT, actual use in classroom practice remains sporadic and informal (Bitkom e. V., 2023; Deutsche Telekom Stiftung, 2024)

Given that AIEd has existed as a research field for several decades – long before the recent surge of attention triggered by GPAI – this suggests a persistent gap between theoretical optimism and practical implementation. Multiple factors likely contribute to this: long-standing digital infrastructure gaps, restrictive data protection requirements, fragmented policy environments, and a general lack of institutional support.

While some isolated pilot projects and exploratory studies demonstrate promising use cases, most of them occur in controlled, well-supported environments, offering limited insight into everyday school practice (see: Demartini et al., 2024; Helm & Große, 2024; Verhelst et al., 2024). In many contexts – especially in Germany – the adoption of AI tools remains highly dependent on individual initiative, lacking clear institutional frameworks. Even among teachers experimenting with tools like ChatGPT, studies highlight a widespread sense of uncertainty, lack of training, and institutional ambivalence (Bitkom Research, 2024; Helm & Große, 2024). These early forms of engagement are typically driven by personal curiosity, rather than by coordinated strategies or pedagogical integration. While surveys increasingly

report that AI is "being used" in schools, they rarely clarify how it is used, for what purposes, or with what effect. Is the tool part of a long-term teaching concept or just a one-time trial? Is it used for lesson planning, administrative tasks, or student interaction? And is it actually helping to solve any of the pressing problems schools face?

Without such contextualization, it remains difficult to assess the depth, sustainability, or educational value of current AI practices. This lack of clarity is symptomatic of a broader issue: AI is entering schools more quickly than many educational systems – and particularly their governance frameworks – can respond. Despite the growing interest in the topic, there is still no coherent, explainable picture of how AI is being used in everyday school settings, and under what conditions. What is missing is not only a deeper empirical understanding, but also a strategic perspective on the structural factors that shape this use.

This gap between technological optimism and practical implementation raises a crucial question: What institutional and governance conditions enable or hinder the meaningful integration of AI in schools? Adoption does not occur in a vacuum. It is shaped by the rules, responsibilities, and resources that define what is possible and permissible within an educational system. In other words, the diffusion of AI in education is inseparably linked to the way it is governed. The following section, therefore, turns to the existing literature on AI governance, with particular attention to the education sector and the case of Germany.

2.2 Governance of AI in Education

Against the backdrop of growing AI experimentation in schools, but limited institutional clarity, questions of governance have become increasingly urgent in the education sector. While discourse and expectations around AI have accelerated, implementation remains uneven and highly context-dependent. Understanding how AI is steered, regulated, and supported at different levels of the education system is therefore essential.

The governance of AI – ranging from ethical guidelines and political strategies to legal regulation and institutional implementation – is subject to particular challenges, especially in education. Technological developments often move faster than public institutions can adapt, creating a lag between innovation and regulatory response (Batool et al., 2025). This

mismatch has been especially visible with the rapid spread of generative tools like ChatGPT, which reached classrooms long before clear legal or pedagogical guidance was in place.

Academic literature offers a variety of governance models, ranging from rigid regulatory approaches to flexible, adaptive frameworks (Veale & Edwards, 2018). Such diverse governance arrangements are driven by governments, companies, and international organizations to manage risks while promoting innovation (Batool et al., 2025). At the global level, governance structures are shaped by geopolitical tensions and divergent national interests, often hindering joint efforts and regulatory clarity, and leaving a rather fragmented policy landscape (Roberts et al., 2024). Notably, governance is understood not only as rule-making, but also as a guide for ethically and socially responsible AI development (Batool et al., 2025). Thus, robust and coherent regulation is seen as crucial for creating trust in AI systems and ensuring their responsible use (Díaz-Rodríguez et al., 2023). The aim should be to balance innovation and risk: to make AI systems trustworthy and socially acceptable without stifling development.

However, governance in education must also address sector-specific concerns. Scholars emphasize the need for AI systems to be child-friendly, privacy-preserving, safe, and transparent, with fair decision-making processes and strong protections for learners (Endris et al., 2024; Miao et al., 2021; Vincent-Lancrin & van der Vlies, 2020). Policies should be developed in a context-sensitive and participatory way, with involvement from relevant stakeholders including educators, parents, school leaders, and learners themselves (Endris et al., 2024). Recent studies show that many teachers remain uncertain about how to deal with AI in practice, underlining the need for clear guidelines, institutional support, and targeted professional development to foster trust and enable effective use in classrooms (Bitkom Research, 2024).

International organizations have taken early steps toward such guidance. UNESCO (Miao et al., 2021) advocates for a "human-centered" approach to AI in education, prioritizing inclusion, equity, and transparency. The OECD (Vincent-Lancrin & van der Vlies, 2020) emphasizes the importance of equipping educators to critically assess and make use of AI technologies. Both organizations promote a proactive, enabling vision of governance – one that seeks not only to minimize harm, but also to facilitate innovation and capacity-building.

At the national level, however, policy responses remain fragmented. Although an increasing number of countries have adopted national AI strategies, these are often sector-agnostic and only marginally address education (Moravec, 2024). Where education-specific approaches exist, they tend to be formulated as non-binding guidelines or pilot initiatives, heavily reliant on local capacities, political will, and institutional readiness (Moravec, 2024). In federally organized systems in particular, such as Germany, the governance landscape is highly heterogeneous, and for many school actors, difficult to navigate (Schreiter et al., 2025)

The adoption of the EU AI Act by the European Parliament in 2024 marked a potential turning point in this fragmented regulatory environment. As the world's first comprehensive, legally binding AI framework, the Act seeks to build trust, reduce risks, and promote innovation (European Commission, 2024a). Central to the regulation is a risk-based classification of AI systems – from "minimal risk" to "unacceptable risk" (European Commission, 2024a). Educational technologies that interact with children or assess their performance frequently fall under the "high risk" category and are thus subject to enhanced requirements for transparency, data protection, and human oversight (EU AI Act, Art. 6, 2024).

For the education sector, this brings both opportunity and challenge. On the one hand, the Act provides for the first time a unified European legal standard for AI systems in schools, including clearly defined responsibilities for vendors and users (Pham & Davies, 2024). On the other hand, it raises urgent questions about implementation readiness: Are schools and educational authorities sufficiently equipped to comply with these requirements?

Experiences with the General Data Protection Regulation (GDPR) are particularly instructive in this regard. Although widely acknowledged as an important protection framework, GDPR was often perceived in schools not just as a safeguard, but also as a practical obstacle to innovation, especially where responsibilities remained unclear or where no structured support was offered (Bitkom e.V., 2023). The risk is that similarly well-intentioned regulation like the AI Act may result in new compliance burdens for schools, rather than enabling innovation.

At the same time, the EU AI Act offers opportunities to build trust, particularly among more skeptical stakeholders, by establishing minimum standards for security, explainability, and accountability. For many in the education sector, such trust is a precondition for AI adoption

in the first place (Müller, 2024). Whether the Act functions as a catalyst or a barrier, however, will depend less on its legal text than on the governance structures through which it is implemented.

Crucially, legal frameworks alone are not sufficient to ensure the responsible and productive use of AI in schools. Effective implementation depends on the coordination of multiple actors, the availability of infrastructural and pedagogical support, and the development of actionable governance strategies that are contextually attuned and practically useful (Hooghe & Marks, 2001). This includes equipping schools with technical tools, offering training for educators, and creating institutional frameworks that allow for the pedagogically meaningful and legally compliant use of AI.

Germany offers a particularly relevant case study in this regard. Education is the constitutional responsibility of the federal states (Länder), and thus, governance strategies vary widely across regions. Some states already have dedicated AI strategies, procurement mechanisms, or platform models in place, while others do not (Limpert, 2024; Schreiter et al., 2025). These differences create asymmetrical starting conditions for schools and raise the empirical question of whether – and how –state steering actually supports or hinders AI-related innovation.

This study takes these open questions as a starting point to investigate how existing governance structures shape the early implementation of AI in schools. The next section, therefore, outlines the central research gaps and presents the rationale for a multi-dimensional analytical approach.

2.3 Research Gaps

The previous sections have shown that, while the opportunities and risks of AI in education are widely discussed, there remains a fundamental lack of empirical insight into how AI is actually being used in schools – and under what conditions. Much of the existing literature focuses on theoretical use cases, higher education settings, or small-scale pilot projects, leaving general secondary schools underrepresented. Even when surveys report AI activity in schools, they often fail to differentiate between isolated individual use and more formal, institutionally supported integration.

At the same time, governance frameworks, especially in Germany's federal system, remain fragmented and uneven. While the EU AI Act introduces new, binding regulatory expectations for high-risk educational AI systems, it is still unclear how these requirements will be translated into everyday school practice. The experience with the GDPR suggests that ambitious regulation can create additional uncertainty if not accompanied by clear responsibilities and support structures.

What is missing, therefore, is a structured, comparative picture of how schools currently engage with AI across different governance contexts. This includes understanding not only who is using AI and for what purposes, but also how political strategies, institutional conditions, and individual practices intersect. Thus, this study seeks to uncover plausible patterns and governance constellations that shape the visibility, accessibility, and integration of AI in schools. Against this background, the study is guided by two central research questions:

(1) What does the current landscape of AI governance and integration in schools look like?

(2) To what extent do different governance approaches correspond with differing patterns of AI use and integration in school practice?

To address these questions, the study draws on two complementary theoretical approaches: Multi-Level Governance (MLG) and Diffusion of Innovations (DOI). MLG offers a lens to examine the complex interplay between actors and institutions across multiple levels of the education system, ranging from EU policy to school leadership. DOI, in turn, provides insights into how innovations like AI spread within organizations and what factors shape their adoption. The next chapter introduces both frameworks in more detail and explains how their combination enables a multi-dimensional understanding of the political, institutional, and practical conditions shaping AI use in schools.

3. Theoretical Framework

In order to systematically analyze the implementation of artificial intelligence (AI) in schools and the impact of various governance approaches, a theoretical framework that can map both structural control mechanisms and the specific adoption behaviors of local actors is needed. The use of AI in schools is embedded in a complex, multi-level system in which political strategies, institutional frameworks, and individual scope for action intersect. This study, therefore, combines two complementary theoretical perspectives:

(1) The perspective of multi-level governance (MLG) for analyzing vertical and horizontal control processes between political levels (EU, federal government, states, schools),

(2) and Everett Rogers' (2003) diffusion of innovations (DOI) theory for explaining individual and school adoption patterns and usage practices.

This combination enables a systematic examination of both structural and action-related dynamics in the use of AI in schools, revealing how political guidelines and school realities are interlinked – or not. Below, both perspectives will first be explained individually, then integrated, and finally converted into an analytical typology.

3.1 Multi-Level Governance (MLG)

The concept of multi-level governance was originally developed in the context of European integration (Hooghe & Marks, 1996; 2001) to describe the increasing interdependence of decision-making processes across different political levels. MLG describes political governance not as a hierarchical top-down system, but as interactive coordination and decision-making processes at multiple levels – from supranational to local.

MLG is particularly relevant in the context of this work, as AI governance in education spans multiple levels, especially in Europe – and specifically in Germany: The EU is establishing a binding regulatory framework with the AI Act; The federal government is developing funding strategies and framework programs; The states are implementing these in different ways; And the schools are ultimately responsible for implementation. On the one hand, this structure opens up opportunities for action at all levels; on the other hand, it also leads to

coordination problems, fragmentation, and implementation barriers, as frequently discussed in the governance literature (Benz, 2007).

In light of this, the following key questions for analysis arise:

Table 1 – MLG translated into analytical categories

Key MLG Questions	**Translation into analytical Categories**	**Implied Dynamics**
At which governance level is AI policy formulated?	Governance Level	Fragmentation vs. centralization
Which governance level is referred to or relied upon in the policy?	Governance Level Reference	Interdependencies & vertical coordination efforts
Who is responsible for AI in schools? Are responsibilities clearly assigned?	Roles & Responsibilities	Coordination problems; lack of accountability
What tools are used to steer AI adoption in schools?	Governance Instruments	Horizontal variation through different state strategies and capacities
How binding are measures?	Degree of Formalization	Mandatory vs. voluntary
How much freedom of action do schools have?	Implementation autonomy	Freedom to innovate vs. top-down constraints

MLG thus helps to analyze structural conditions, as well as identify gaps between political intentions and actual implementation.

3.2 Diffusion of Innovations (DOI)

Everett Rogers' (2003) Diffusion of Innovations theory offers a model for explaining how and why new technologies – such as AI tools – spread at different speeds and to varying degrees within social systems. The diffusion process is understood as a social communication and decision-making process that takes place along specific characteristics of the innovation and the characteristics of the adoption contexts. Key characteristics that determine the likelihood

of adoption are the perceived advantage over previous solutions (relative advantage), compatibility with existing practices, the perception of effort or complexity, the possibility of testing on a small scale (trialability), and the visibility of positive user experiences (observability) (see Table 2). In addition, the theory distinguishes between different adopter groups – from innovators to early and late majorities to laggards – and emphasizes the role of social systems and institutional frameworks.

DOI is particularly relevant in the school context, as the introduction of new technologies is heavily dependent on individual attitudes, skills, and support structures. It provides a lens to explain why some teachers or schools actively use AI – sometimes even without official guidelines – while others are hesitant or resistant. In the case of ChatGPT in particular, it can be assumed that individual teachers are already experimenting, while others remain skeptical or find institutional frameworks to be a hindrance.

The characteristics of DOI theory can be understood not only conceptually, but also empirically – for example, through references in school self-descriptions, political strategy documents, or individual assessments by educational professionals. The following table provides an overview of how the central DOI characteristics can be theoretically located and identified based on typical contextual elements in the school and education policy environment:

Table 2 – DOI attributes in the AI in education context

DOI Attribute	**Significance in the school context**	**Forms of observation**
Relative Advantage	Perceived benefits of using AI tool compared to previous practices	Positive reviews, benefits, references to relief or efficiency gains
Compatibility	AI tool fits with existing school culture and teaching methods	Reference to guiding principles, integration into existing concepts or teaching methods
Complexity	Perceived effort or technical hurdles to using AI tool	Indications of technical obstacles, lack of training, or ambiguities in application
Trialability	Opportunity for risk-free	Mention of pilot projects,

	testing of AI tool	test phases, or voluntary use on a small scale
Observability	Visibility of positive user experiences	Project reports, articles on school websites, exchanges among teaching staff

The DOI theory is therefore particularly well suited to analyzing at the micro level why certain actors already use AI – whether within official structures or informally – while others hesitate or refrain from using it altogether (Fisher, 2005). On the one hand, informal practices, such as the use of ChatGPT in the classroom without official approval, can be explained by the subjectively perceived advantages of the technology, for example, in terms of saving time in lesson preparation or providing support in text production and idea generation. On the other hand, it is clear that such perceptions do not arise in isolation, but are significantly influenced by institutional framework conditions (Keohane & Nye, 2004). For example, if government agencies provide a licensed platform, this new platform might have a relative advantage over ChatGPT because the evaluation criteria shift, and this new platform is now easier to use, appears to be compliant with data protection regulations, or is better integrated into existing systems. The perceived adoption characteristics of a technology – key factors in DOI theory – are therefore not static, but can be influenced by governance. This is precisely where multi-level governance (MLG) becomes relevant: it provides the conceptual framework for analyzing how political control measures and structures frame and influence the conditions for adoption. The interaction between the two theories is further derived below.

3.3 Integrating MLG and DOI: Theoretical Interplay and Analytical Implications

The combination of MLG and DOI opens up a multidimensional analytical perspective that takes into account both political steering and the realities of adoption in schools:

While MLG shows which structural framework conditions are created at various governance levels – for example, through platform licenses, training opportunities, or data protection regulations –DOI facilitates an analysis of how these framework conditions are perceived and processed at the micro level. Based on the governance mechanisms within MLG, it is therefore possible to deduce which DOI characteristics (e.g., complexity, trialability, institutional support) are positively or negatively influenced. Once these characteristics have

been contextualized, DOI can be used to explain how specific actors act within these conditions – whether they adopt, reject, or individually develop innovations.

This results in a three-step analytical process:

Governance shapes conditions → Conditions shape DOI attributes → DOI attributes explain adoption behavior

This logic forms the conceptual core of a theoretical typology and the subsequent empirical analysis. However, given that governance and decision-making occur on various levels in this study, it is crucial to note that this logic chain only works if governance measures are actually communicated, understood, and perceived as relevant by all stakeholders involved. Especially in multi-level systems, such as the German federal education system, where responsibilities and communication flows are often unclear, the visibility and communicative mediation of measures are critical success factors (Hooghe & Marks, 2001). Accordingly, even well-intentioned or formally well-designed control instruments can lead to policy-practice gaps – whether due to a lack of visibility, unclear responsibilities, or contradictory communication channels. In such cases, DOI-relevant characteristics such as trialability or observability remain theoretical but ineffective in practice.

This perspective is particularly significant in light of the imminent enactment of the EU AI Act. While previous efforts to regulate AI in education have mostly been non-binding, voluntary, or fragmented and decentralized, the AI Act introduces a legally binding regulatory framework (Pham & Davies, 2024). The objective is to promote innovation, strengthen trust, and limit risks, but its actual effectiveness depends largely on how compatible the new requirements are with the reality of schools (European Commission, 2024a). Experience with the GDPR shows that a lack of coordination between political intentions and practical implementation options can quickly lead to bureaucratic burdens, with the risk of restricting rather than expanding opportunities for educational innovation (Forum Bildung Digitalisierung, 2021).

Against this backdrop, the present study aims to conduct a comparative analysis of existing governance strategies, perceptions in schools, and actual usage patterns. The goal is to paint a plausible, theory-based picture of the current AI implementation and AI governance

landscape to inform how prepared the system is for implementing the AI Act – and whether existing governance approaches already provide guidance or even exacerbate existing complexity. The combination of MLG and DOI allows us to consider not only formal strategies but also their visibility, connectivity, and perceived impact at the level of school decision-makers, thereby revealing plausible key prerequisites for a realistic and effective implementation of future regulations.

3.4 A Theory-Driven Typology as the Analytical Model of this Study

In order to systematically examine the theoretically derived relationships between governance, perception, and action, an ideal-typical typology was developed based on the MLG-DOI link outlined above. These types serve as an analytical framework for the empirical study and enable a comparative classification of government control approaches, school strategies, and individual usage patterns.

The typology assumes that different forms of control influence specific DOI characteristics (such as complexity, trialability, or institutional support) in different ways, thereby making specific usage constellations more or less likely. At the same time, it acknowledges that even with weak formal control, bottom-up adoption processes can emerge through individual initiative or internal school leadership.

The following table suggests three types of governance in the sense of AI in education:

Table 3 – Governance Approaches and their DOI Impact

Type	**Characteristics**	**Impact on DOI Attributes**
Formal-enabling	Governance through structured, binding measures (e.g., platform licenses, clear rules and regulations, mandatory training)	Reduced complexity, increased trialability, institutional support visible and available
Info-enabling	Governance primarily through communicative measures (e.g., guidance, recommendations, discussion in strategy documents)	Increased awareness and visibility, but little change in actual usage requirements

Bottom-up enabling	Lack of or weak external control, but independent school or individual initiatives	Usage occurs despite a lack of framework conditions – driven by self-motivation, collegial networks, or local leadership

These types do not represent a complete description of all possible realities, but serve as a heuristic model to explore plausible governance-adoption constellations. They are used in the empirical part of the research to categorize the collected data (documents, websites, surveys) and form the basis for the subsequent comparative analysis.

In addition, the underlying theories structure the three central levels of analysis of the study, as shown in the following overview:

Table 4 – Analysis Dimensions and Theoretical Connections

Analysis Dimension	**Theory Connection**	**Key concepts**
State governance	MLG	Actor roles, governance instruments, vertical coordination
School Governance	MLG + DOI	School autonomy, management structure, support, communication structures
Usage Patterns	DOI	Perception of AI, usage practices, individual motivation, perceived benefits

Thus, the typology not only provides a theory-based classification scheme but also serves as a methodological reference point for empirical analysis. It allows observable constellations to be systematically compared along the categories of structure, visibility, impact, and use, and consequently also reveals possible policy-practice gaps.

4. Methodology

4.1 Research Design

Building on the theoretical framework developed in the previous chapter, this study pursues a theory-based, exploratory research design that aims to identify plausible patterns of political governance and school use of AI in the German education system. The goal is not to test causal hypotheses or make generalizable statements, but rather to develop a plausible picture of governance adoption dynamics based on theoretical assumptions. The methodological approach is based on a plausibility probe (George & Bennett, 2005), which is particularly suitable for applying theoretical concepts exploratively in fields with limited empirical data and dynamic developments.

The intertwining of multi-level governance (MLG) and diffusion of innovations (DOI) theory forms the conceptual foundation of the study: While MLG enables the analysis of institutional control mechanisms and coordination processes at different political levels (EU, federal, state, schools), DOI allows conclusions to be drawn about how these institutional framework conditions are perceived at the micro level – i.e., in schools and by individual actors – and how they affect adoption decisions.

Given the limited empirical data available and the dynamic developments surrounding AI in education, a methodological approach based on three complementary data sources was chosen. These cover different levels and perspectives and, when combined, enable a theory-driven, differentiated view of the field of investigation:

(1) A document analysis to record educational policy control approaches and institutional framework conditions at the state level,

(2) A website analysis as a non-reactive survey instrument to examine school positioning, visibility, and institutional orientation in dealing with AI,

(3) A standardized online survey to record individual perceptions, usage patterns, and structural conditions from the perspective of school stakeholders.

The combination of these sources should result in a theory-based triangulation that allows plausible constellations, discrepancies, or correspondences between control intentions and practical implementation to be identified – especially with regard to the question of how prepared the education system is for the introduction of the EU AI Act.

4.2 Case selection and Sampling strategy

4.2.1 Case selection: German Federal states

The selection of cases is based on the goal of providing a comparative insight into different governance approaches to the integration of AI in education. The federal structure of the German education system offers an ideal setting for comparison, as the federal states have considerable scope for action. In fact, recent studies (e.g., Deutsches Schulportal der Robert Bosch Stiftung, 2025; Schreiter et al., 2025, p. 9) reveal that the states are pursuing different approaches, especially with regard to key governance instruments such as state-wide coordinated licenses for AI tools or targeted pilot projects. An overview map of existing state licenses and model projects served as the starting point for the systematic selection of comparison cases (See Appendix A: Overview of federal states by AI license).

On this basis, the two city-states of Berlin and Hamburg were selected as the primary comparison cases, as they differ significantly in their governance approaches (Berlin offers centrally licensed AI tools, whereas Hamburg has not implemented centrally coordinated measures to date), but are socioeconomically comparable.

Due to a low response rate in the survey, an open call for participation was published at a later stage. A large proportion of the responses received came from the federal state of North Rhine-Westphalia (NRW). NRW was therefore included as a supplement, although no theory-based pre-selection was made. As the most populous federal state with ongoing AI pilot projects, NRW nevertheless provides valuable contrasting insights.

Note: The additional inclusion of NRW is pragmatic and exploratory, not hypothesis-driven. The possible structural heterogeneity is reflected in the discussion of the results.

4.2.2 Sampling Strategy: Schools and Documents

School Sample

The selection of schools followed clearly defined inclusion and exclusion criteria in order to examine comparable school types within different governance contexts:

- Inclusion: Public high schools and integrated comprehensive schools (with Abitur qualification).

- Exclusion: Primary schools, special schools, private schools, special schools (e.g., bilingual, Montessori), newly founded schools (<10 years).

The socioeconomic environment was taken into account for contextualization: In Berlin and Hamburg, the three highest and lowest rated districts (based on unemployment rate and income level) were identified. A sample of 100 schools was compiled from each of these regions. Of these, approximately 50 per city-state were contacted by telephone, and the remainder by email. The goal was to achieve a survey response rate of 6–10 schools per federal state. Knowing that teachers in their busy routines are unlikely to take much time for a survey, the sample of contacted schools was accordingly high in order to increase the chance to a higher final sample. For the website analysis of Berlin and Hamburg, 30 schools from the socioeconomically highest and lowest regions were included, resulting in a total sample of 60 schools for the website analysis (see Appendix C.1 School Website Corpus).

As North Rhine-Westphalia (NRW) was included in the study retrospectively due to a strong response to the open call for survey participation, schools from this state were not part of the initial sampling design and were therefore not included in the website analysis. NRW was instead analyzed solely through the documents and the survey data, providing internal perspectives on school-level governance and usage practices.

Document Sample

The documents were systematically collected from the official websites of the education ministries of the three federal states. Publicly accessible, thematically relevant texts relating to school digitization or AI (e.g., strategy, press, or training documents) were included. Accompanying measures (e.g., equipment, further training) were also taken into account.

A detailed overview of the search terms, indicators, and metadata used can be found in Appendix B.

A predefined target scope of documents was not set, as visibility and availability varied greatly from state to state. The document publication period spanned from 2016 to 2025, with 2016 chosen as the starting point because the GDPR established a central framework for data-based technologies in education upon its implementation.

4.3 Data Collection

Three different but complementary data sources were collected to examine governance strategies and usage patterns: official documents, school websites, and a standardized online survey. Each of these sources targets a specific level of analysis (macro, meso, and micro) and, when combined, enables theory-driven triangulation along the typology introduced in Chapter 2. The survey logic followed an iterative analytical approach: initial theoretical assumptions were operationalized, while at the same time leaving room for inductive additions during the evaluation.

4.3.1 Document Analysis

The document analysis aimed to systematically record educational policy approaches and tools to enable – or prevent – the integration of AI in schools, with a focus on formal instruments, strategic guidelines, and communicative measures. The data collection was based on the official government websites of the three federal states under consideration (Berlin, Hamburg, North Rhine-Westphalia). The documents were selected based on a two-stage process:

(1) Context Germany (top-down): First, central national portals (websites of the federal government, the BMBF, and the KMK) were explored to gain an overall impression of the federal policy framework and whether there was a first indication of specific state governance tools. However, federal policy documents were not systematically analyzed; instead, they were used exclusively for contextual classification.

(2) Systematic selection at the state level (Berlin, Hamburg, NRW): A systematic review of the official state websites was carried out for the three federal states. Defined search terms, such as "AI," "artificial intelligence," "digital education," "teacher training," and "platform," were used as a basis. The search was conducted both in general navigation areas and specifically using the respective search functions of the websites.

The research was conducted using a defined catalog of search terms (e.g., “AI,” “artificial intelligence,” “digital education,” “platform,” “ChatGPT,” “teacher training”). Both the general navigation structure and the search function of the websites were used. For each document that met the predefined selection criteria, metadata (title, year, publisher, document type, source, and brief description) was systematically recorded and documented in a survey table. (See Appendix B.1: Document Corpus with Metadata Scheme). In addition, communicative visibility was recorded as an analysis aspect, e.g., findability via navigation, presence of an AI menu item, references to training opportunities, or mentions in newsletters. (See Appendix B.2: Visibility Indicator Scheme Document Analysis)

4.3.2 Website Analysis

The analysis of school websites served as a non-reactive survey instrument for recording publicly visible references to digitization, AI use, and strategic positioning in the school context. It focuses in particular on the meso level – i.e., school organizational framework conditions and external communication. The websites were systematically searched for the presence of defined characteristics. The basis for this was a survey grid developed in advance, which was based on typical indicators of school digitization and AI activity. Among other things, the following was recorded:

- Whether there was a separate section on "AI," "digitalization," or "media education,"
- Whether relevant terms were mentioned in the mission statement, profile, or on teaching pages,
- Whether responsibilities for digitalization or AI (e.g., "digital officers") were named,
- Whether collaborations or external providers were mentioned,
- Whether there were current articles on AI in the news section.

The information collected was documented in a tabular structure, each with an indication of the feature (present/not present) and supplementary notes for contextualization. (See Appendix C.2: Visibility Indicator Scheme Website Analysis) New aspects that emerged during the analysis were added iteratively.

4.3.3 Online Survey

The standardized online survey was directed at school staff in various functional areas, including teachers, school administrators, coordinators, and administrative staff. The objective was to gather insights into user experiences, institutional conditions, and subjective attitudes toward AI in the school context.

The survey was conducted using Google Forms and contained both closed and semi-open questions. It was divided into the following thematic sections:

- School context (e.g., type of school, location, number of students),
- Level of digitization (as a control variable; e.g., equipment, platforms),
- Use of AI (whether and how AI is used; forms, tools, access),
- Degree of formalization (existence of strategies, initiators, barriers),
- Attitudes and skills (e.g., attitudes toward AI, training opportunities).

(See Appendix D: Survey Questionnaire)

The survey was voluntary, anonymous, and GDPR-compliant. It was distributed in two ways: first, through direct contact with approximately 200 schools in Berlin and Hamburg (from the sample), and second, following a low response rate, an open call for participation was made via social networks.

A total of 12 fully usable responses were received: 3 from Berlin, 2 from Hamburg, and 7 from North Rhine-Westphalia. An additional response from Bavaria was excluded. Vocational schools in North Rhine-Westphalia also participated; their contextual characteristics were documented in the questionnaire.

4.4 Data Analysis Strategy

To analyze how governance structures at different levels influence the adoption and integration of AI in schools, I employed a theory-driven typological analysis, grounded in the combined framework of Multi-Level Governance (MLG) and Diffusion of Innovations (DOI). The aim was not to test causal hypotheses, but to explore plausible relational patterns between political context, institutional structures, and usage behavior, consistent with the logic of a plausibility probe.

4.4.1 Typology Construction and Variable Roles

Three central typologies were constructed to capture the main dimensions of analysis:

- **State Governance Typology (macro level):** based on document analysis; conceptualized as an independent variable representing external policy context.

- **School Governance Typology (meso level):** based on survey and website data; treated as dependent on state policy, and independent for explaining integration and use.

- **AI Use Typology (micro level):** based on survey data; conceptualized as a dependent variable reflecting actual usage patterns by staff.

In addition, two supporting classification schemes were developed:

- **AI Integration Typology:** to assess the degree of institutional embedding of AI at the school level (dependent variable).

- **Digitalization and Perception Scores:** to control for school-level readiness and individual-level attitudes (control variables).

Each typology was developed using rule-based scoring systems derived from the theoretical framework (see Appendix E). Variables such as training availability, tool access, internal coordination, perceived barriers, and number of tools used informed the classification logic.

4.4.2 Coding and Classification Procedure

Survey responses were first cleaned and coded using a structured variable scheme. For example:

- The number and type of AI tools used informed the Use Typology (e.g., "embedded", "exploratory", "non-use").
- Responses on governance structures, training opportunities, and strategic orientation were used to determine the School Governance Typology.
- Individual attitudes toward AI, reported barriers, and openness were used to derive Perception Scores.

The State Governance Typology was determined separately based on structured document analysis and coded indicators (e.g., licensing, training, visibility, degree of centralization).
Each respondent was then assigned a complete profile including all typologies and control scores. This created a structured dataset for comparative analysis.

4.4.3 Analytical Logic and Pattern Matching

The analysis proceeded in three steps:

1. **Typology Assignment:** All cases were classified along the five dimensions (state type, governance, integration, use, digitalization/perception).

2. **Cross-Comparison:** Patterns were explored to examine how state-level governance types relate to school governance structures, and how these, in turn, relate to actual use and integration of AI.

3. **Plausibility Mapping**: Triangulation across documents, websites, and survey responses allowed for identifying alignment (e.g., strategic governance + embedded use), misalignment (e.g., strong governance but weak use), and “bottom-up” patterns (e.g., weak governance, but proactive individual adoption).

Correlations and patterns were interpreted within the logic of DOI and MLG, particularly focusing on how structural conditions (governance) shape DOI-relevant attributes such as perceived complexity, institutional support, or observability. Misalignments were interpreted as potential policy-practice gaps or indicators of barriers to adoption.

While statistical generalization was not the aim, basic descriptive comparisons and frequency patterns were used to support typological plausibility.

4.5 Ethical Considerations

This study was conducted in accordance with established ethical standards for empirical social research and aligned with the principles of the General Data Protection Regulation (GDPR), as well as the broader norms of voluntary participation, transparency, data minimization, and non-maleficence. Formal ethical approval was obtained from [name of your institution's ethics committee] prior to data collection (see Appendix F: Ethics Approval Form).

4.5.1 Online Survey: Voluntary, Anonymous, and Informed Participation

The online survey was directed exclusively at adults working in educational institutions, including teachers, school administrators, digital coordinators, and other educational staff. Students were not eligible to participate. Participation was entirely voluntary and anonymous. No names, email addresses, IP addresses, or other personally identifiable data were collected. Respondents were explicitly informed—both in the invitation and at the beginning of the questionnaire—about the purpose of the study, the scope of data collection, and their rights under GDPR (Art. 13), including the right to withdraw at any time without consequence. The survey could be exited at any point, and no incentives or pressure to participate were offered. The data collected was used solely for academic research purposes and has not been shared with any third parties.

4.5.2 Website and Document Analysis: Public, Non-Reactive Data

The website and document analyses were conducted using only publicly accessible, institutionally published content. This included official school websites and state education ministry documents. No private or personal data (e.g., teacher names or photos) were analyzed or recorded in any way. Although school websites may contain references that allow inferences about individual institutions, no school was named or made individually identifiable in the reporting. The analysis was limited to identifying visible governance

patterns and communicative signals, and no evaluative comparisons or normative judgments were made. The aim was solely to analyze institutional discourse and structural variation, not individual performance.

4.5.3 Minimizing Harm and Ensuring Institutional Respect

Special care was taken to ensure that the research design and reporting would not result in reputational harm to individuals or institutions. All findings are presented in aggregated, typological, or anonymized form, and no schools or respondents are quoted or compared in a way that would allow identification. The study followed the principle of contextual sensitivity: institutional practices were interpreted within their governance and infrastructural environments, without moralizing or deficit framing.

4.6 Limitations

Despite its theory-driven design and multi-source approach, this study is subject to a number of methodological limitations that should be taken into account when interpreting the findings. These limitations primarily concern the scope, sampling logic, data interpretation, and certain design constraints.

Limited Sample Size and Representativeness

The number of fully completed survey responses was small (N=12) and unevenly distributed across states (3 from Berlin, 2 from Hamburg, and 7 from North Rhine-Westphalia). This limited sample does not allow for statistical generalization. Instead, the study follows the logic of a plausibility probe – its aim is to identify plausible patterns and initial hypotheses, not to establish population-wide findings.

Moreover, the inclusion of North Rhine-Westphalia was not theory-driven, but rather an adaptive response to participation dynamics. While this allowed for the inclusion of additional perspectives, it created an asymmetry in case comparability. Post-hoc contextualization via school-level indicators and typological assignment helped mitigate this limitation, but cannot fully compensate for the lack of consistent sampling logic.

Self-Selection and Limited Institutional Representation

Survey participation was entirely voluntary, which introduces the possibility of self-selection bias: individuals already interested or involved in AI use may have been more inclined to respond. Furthermore, with only one person per school surveyed in most cases, the results may reflect individual perspectives rather than institution-wide practices. While the analysis treats the school as the unit of comparison, this representation is inherently partial. In the few cases with multiple respondents from the same school, the answers were triangulated internally to improve reliability.

Additionally, responses about AI use were based on self-reporting and did not measure depth, frequency, or pedagogical quality. For example, stating that one has used "ChatGPT" may refer to anything from a single experiment to systematic curricular integration. As such, usage should be interpreted as an indicator of exposure, not evidence of deep implementation.

Website Analysis as a Limited Proxy

The website analysis provided non-reactive access to publicly visible school-level signals, but cannot be assumed to reflect actual everyday practices. Websites differ widely in how regularly and strategically they are updated, and low visibility may reflect communication constraints rather than the absence of activity. The findings should therefore be understood as discursive visibility, not operational fact.

Conceptual and Technical Constraints

Due to limited familiarity with advanced coding environments (e.g., R or Python), the typology assignment and pattern comparison were conducted manually using Excel, supported by generative AI feedback (e.g., coherence checks and formula validation). While every effort was made to ensure internal consistency, the manual process increases the likelihood of minor classification inconsistencies, particularly given the deliberate choice to avoid binary categories and instead reflect governance and integration as multi-dimensional constructs.

Furthermore, the distinction between AI in Education (AIEd) and General-Purpose AI (GPAI) – outlined in the literature review – was not consistently applied throughout the survey design. As a result, the analysis cannot fully differentiate how respondents perceived or used these categories in practice.

Temporal Boundaries

The study was conducted in a context of rapid technological change and evolving educational policy, particularly with the anticipated implementation of the EU AI Act. The findings reflect a snapshot of governance structures and usage practices at the time of data collection and may shift as policies mature, new tools emerge, or institutional capacities evolve.

5. Findings

This chapter focuses on the systematic presentation of empirical findings on government governance and the implementation of artificial intelligence (AI) in schools in three German states: Berlin, Hamburg, and North Rhine-Westphalia (NRW). The analysis combines a document-based governance analysis (top-down), an examination of school websites (bottom-up), and the results of an online survey of school stakeholders.

The objective is to identify typical governance profiles, classify the levels of AI integration and user behavior in schools, and explore how these are shaped by different state-level governance approaches. The analytical framework is grounded in concepts from multi-level governance theory (MLG) and diffusion of innovations research (DOI).

5.1 Document-based analysis: Governance types in a federal comparison

In the first phase of the study, 26 education policy-related documents – ranging from formal strategies and guidelines to press releases, newsletters, and state education ministry portals (see Appendix B.1 for the full document corpus) – were analyzed comparatively across Berlin, Hamburg, and NRW. The aim was to identify different governance types in relation to AI integration in the school system through a structured document analysis. The analysis used ten categories derived from MLG and DOI concepts, covering areas such as strategic communication, control instruments, implementation clarity, vertical coordination, and adopter behavior.

5.1.1 Initial Findings of State Governance

The initial selection of states was based on their varying approaches to licensing AI tools for use in schools, under the assumption that states offering state-wide licenses demonstrated a stronger commitment to AI integration. However, since governance involves more than just the provision of tools, a broader and more nuanced analysis was needed to capture the complexity of state-level AI governance.

To this end, a scoring system was developed that quantifies support across several governance dimensions, grounded in the DOI framework. This analysis revealed that all selected states could be classified as proactive and comprehensive supporters of AI (see Table 5). While this quantitative perspective suggests a high overall level of support, it does not fully capture the distinct strategies, priorities, and mechanisms each state employs. The following section, therefore, presents a more detailed, descriptive portrayal of the different governance types observed.

Table 5 – Overall State Governance Scoring Summary

Dimension	Berlin	Hamburg	NRW
Adopter Type	Early Majority	Early Majority	Early Majority
Governance Instrument Diversity	High (3 pts)	High (3 pts)	High (3 pts)
Instrument DOI Influence	High (3 pts)	High (3 pts)	High (3 pts)
Governance Instrument Score	Comprehensive Supporter (6pts)	Comprehensive Supporter (6pts)	Comprehensive Supporter (6pts)
Strategic Framing	Proactive	Proactive	Proactive
School Autonomy	Hybrid	Hybrid	Hybrid
Communication Structure	Medium (2 pts)	High (3 pts)	High (3 pts)
Usefulness for Implementation	High (3 pts)	High (3 pts)	Medium (2 pts)
Communication Score	Medium (5 pts)	High (6 pts)	Medium (2 pts)

5.1.2 Typologized Profiles of State-Level AI Governance

Berlin: Portal-Centered Enablement with Centrally Defined Tool Provision

Berlin pursues a cautious but access-oriented approach to AI in schools. The Senate Department for Education, Youth, and Family Affairs (SenBJF) primarily acts as a provider of digital infrastructure, particularly through the Berlin School Portal and the Berlin Learning Space. At the same time, strategic or pedagogical-normative documents on AI are scarce or remain very general. Artificial intelligence is addressed more implicitly as a component of existing tools, but is not positioned as an independent strategic field of action.

Key features:

- **Strategic framing:** Tactically visible, but without a clear goal framework.
- **Governance instruments:** Focus on platform access and AI guidance, no binding mechanisms.
- **Communication:** Not very diverse; few public updates or press releases. The available materials are clearly structured but primarily technical in tone. Emphasis on utility over normative framing.
- **Adopter type:** Self-proclaimed to be an early adopter, emphasizing that it was one of the first federal states with official ChatGPT guidelines.
- **Vertical coordination**: Functional, but institutionally narrow.
- **Implication:** Berlin's governance can be summarized as "enabling, portal-based governance," which facilitates technical access but lacks a pedagogical-didactic framework.

The document-based analysis shows that Berlin relies on a centralized, infrastructure-oriented control logic, which, however, is only weakly embedded in strategy. What is striking is a strong focus on platforms and centrally provided licenses, for tools such as ChatClass, Microsoft Copilot, or Bettermarks, combined with a limited scope of strategic guidelines.

This infrastructure strategy enables schools with limited resources, in particular, to access AI applications, as they do not have to rely on their own resources or expertise.
Despite this formal availability, there is a central deficit in didactic and communicative support. Although information materials exist, such as a handout on ChatGPT, these remain sporadic and vague in terms of content. In addition, relevant information is scattered across various subpages and documents, making access difficult for teachers who are pressed for time. Technical accessibility is thus not accompanied by an equivalent strategic or didactic orientation.

Berlin's governance logic can therefore be described as access-oriented but only limitedly reflexive. AI is made available without it being clear for what purpose, how, or under what educational conditions these tools should be used sensibly. Teachers are thus faced with the choice of either using the centrally provided tools without further guidance or searching for alternatives themselves. This indicates inconsistent usage practices and increased efforts for individual navigation.

Overall, the Berlin model manifests itself as a portal-centered enabling regime with weak strategic framing. Control is primarily exercised through technical access, but not through curriculum-embedded guidelines or educational objectives.

Hamburg: Resource- and Information-Based Enablement Without Central Tool Selection – School-Led AI Practice

Hamburg pursues a hybrid control model that combines central support with school autonomy. The state provides both financial resources and comprehensive information services – including specific AI budgets and didactic guidance – but leaves the specific selection and application of AI tools to the schools. Technical standardization is achieved through the mandatory use of the state portal eduPort; pedagogical application remains voluntary. The State Institute for Teacher Training and School Development (LI Hamburg) offers a wide range of materials that are systematically made available via various platforms, but without being embedded in a coherent overall strategy.

Key Characteristics:

- **Strategic Framing:** Positive-pragmatic, but lacking a coherent overarching strategy.
- **Governance Instruments:** Project funding (e.g., *Digital macht Schule*), AI-specific budgets, voluntary teacher training, no centralized licensing.
- **Communication:** Modular and audience-specific, but fragmented in structure.
- **Adoption Type:** Early adopter, having introduced AI budgets for schools as early as 2023.
- **Vertical Coordination:** Referencing federal programs such as the DigitalPakt Schule, but without strong EU alignment.
- **Implication**: Hamburg can be characterized as a resource- and information-oriented enabling model system, with high functionality and pedagogical openness, but little strategic depth.

The document-based analysis shows that Hamburg places great emphasis on information transparency and guidance. Numerous materials are made available via central platforms such as the Hamburg Education Server and the LI Hamburg topic portals, including guidelines, practical examples (e.g., the use of ChatGPT in foreign language teaching), didactic recommendations, and further links. This content is tailored to specific audiences, clearly structured, and easily accessible. The aim is to strengthen pedagogical judgment, not to prescribe specific applications.

In addition, Hamburg has allocated dedicated AI budgets at an early stage (from 2023) and enables context-related project funding through programs such as Digital macht Schule (Digital Makes School) or supplementary digital budgets. Whether and how these funds are used in the AI context depends heavily on the commitment and management skills of individual schools. There is no central provision or selection of tools.

One striking element is the public visibility of AI topics. AI topics are regularly addressed in press releases, project descriptions, and pilot initiatives, such as the use of avatars for sick children. This media presence signals openness to technological innovation, but it does not replace a strategically bound framework.

Overall, Hamburg pursues a supportive but flexible governance logic based on broad information provision and financial support. Implementation takes place autonomously at the school level, without central AI tool specifications, but with diverse orientation.

North Rhine-Westphalia (NRW): Structured Enablement with Impulse-Driven Strategy – AI as a Pilot Field of Reflective Governance

North Rhine-Westphalia (NRW) pursues a strategically embedded, implementation-oriented governance model that combines structural clarity with pedagogical openness. The state offers a coordinated framework of digital infrastructure, target group-specific information platforms, training initiatives, and pilot projects to provide schools with guidance, resources, and testing grounds. Central to this is the understanding of piloting as a reflective control instrument: innovation should be enabled, experience gathered, and the compatibility of various measures tested, without binding requirements.

Key features:

- **Strategic Framing:** Opportunity-oriented and pragmatic, with clear strategic embedding.
- **Governance Instruments:** Mix of support tools, pilot programs, and monitoring mechanisms.
- **Communication:** Structured, diverse, and accessible; high public visibility through press releases and educational media.
- **Adoption Type:** Early majority; strategically positioned in digitalization, adaptive in AI.

- **Vertical Coordination:** Strong institutional integration at state, federal, and EU levels.

- **Implication:** NRW stands for structured facilitation with impulse-based governance, in which AI serves as a strategic pilot field to promote innovation, test transferability, and enable practical connectivity in schools, without restricting the autonomy of schools.

The document-based analysis shows a broadly developed governance system consisting of several complementary components. Platforms such as lernen-digital.nrw, the NRW education portal, and the NRW education media library bundle numerous contents, including training opportunities, didactic guidelines, and teaching examples for the use of AI. These materials are clearly structured, easily accessible, and directly related to school application scenarios, making AI accessible in a practical and professional manner.

A key control element is the NRW AI pilot project in the subjects of German and mathematics. It not only serves to support individual schools but also fulfills a strategic observation and testing function. Participating schools are testing the use of AI-supported learning platforms, the effects of which are being systematically documented. The project creates a room for reflection in which innovation, transferability, and complementarity can be observed, not as binding requirements, but as strategic guidance. The momentum comes from the top down, but also has an effect on schools that are not directly involved, which are encouraged to follow suit by the visibility of the project.

NRW is also characterized by a high level of communicative visibility. AI and digitization initiatives are regularly featured in press releases, public education portals, and project communications. This not only creates transparency but also generates political attention and strengthens a publicly visible digital agenda – a factor that further promotes connectivity in schools.

A wide range of support measures and financing options are available to accompany this, some specific to AI, some as part of overarching digitization programs. Funds from the DigitalPakt Schule (Digital Pact for Schools) also contribute to improving the infrastructure

requirements for AI applications in schools. At the same time, there is sufficient scope for local needs and internal school management.

Overall, North Rhine-Westphalia has created a governance architecture that offers clear entry points without prescribing fixed paths. The model combines strategic impetus from above with creative freedom from below, supported by visible innovation drivers, structured guidance, and an explicit strategy of open testing.

Nevertheless, while the document-based analysis has identified key differences in state policy approaches, the question remains as to what extent these strategies are actually visible at the level of individual schools. In order to examine this connectivity, the following section provides a systematic analysis of school websites. The aim is to identify governance signals, institutional communication, and signs of concrete AI-related activities at the school level—not as evidence of actual use, but as publicly accessible indicators of prioritization, visibility, and (non-)integration of artificial intelligence in everyday school life.

5.2 School website analysis: Governance and usage types at the school level

The systematic analysis of the websites of 30 schools in Berlin and Hamburg provides in-depth insights into the implementation of government policy initiatives at the school level and the visibility of artificial intelligence (AI) in the school context. The aim was to capture both the integration of AI in schools' external communication and indications of internal governance structures in the area of digital education.

North Rhine-Westphalia (NRW) is not included in the website sample. This is due to the fact that NRW was not part of the initial case selection for the website analysis and was only integrated into the study at a later stage, prompted by the relatively low number of survey responses from Berlin and Hamburg and the disproportionately high level of participation from NRW. Given this shift in focus, the decision was made not to retroactively conduct a website analysis for NRW. This choice reflects a methodological tradeoff: while school websites offer broad but often superficial and inconsistently maintained data, the survey provides more context-sensitive and practice-oriented insights. Even with a small sample

size, the survey responses offer valuable internal perspectives that complement the external indicators captured in Berlin and Hamburg.

Berlin: First anchor points with predominant invisibility

An analysis of the websites of 30 Berlin schools shows that artificial intelligence (AI) has a low overall visibility, but there are initial signs of targeted integration. Although the majority of schools (22 out of 30; 73.3%) make no mention of AI, three cases (10%) show signs of formal integration. One of these schools stands out in particular: it has a separate menu item dedicated to AI, offers regularly updated information on specific applications, and names the people responsible – an example of strategic external presentation that can be considered a reference case for AI transparency at the school level. In addition, five schools (16.7%) address AI informally, for example, in the context of project days, external lectures, or school news articles. This form of addressing the topic indicates a growing awareness of the issue, but remains non-binding in organizational terms.

The scenery remains cautious in the area of digital management structures: only three schools (10%) show signs of coordinated management, such as designated digitalization officers or clearly recognizable training strategies. Ten schools (33.3%) can be classified as "passive permitters" – i.e., schools that make digital content visible but without any recognizable strategic anchoring. In 17 cases (56.7%), there is no evidence of structured digital support.

Hamburg: Structural support and increasing AI visibility

In comparison, Hamburg shows a more pronounced degree of formalized integration and coordinated digital control. While 24 out of 30 schools (80%) show no visible signs of AI, five schools (16.7%) have formally integrated AI into their external image. Another school (3.3%) addresses the topic at least informally. Formal integration includes visible references to specific AI tools such as fobizz or fiete.ai, AI workshops or school development projects in the field of digitalization, and the naming of responsible teachers. Individual schools also present AI as an integral part of their digital school strategy. This form of visibility indicates institutional efforts to integrate new technologies into school culture in a transparent and structured manner.

An analysis of digital management structures also points to a much more pronounced understanding of governance in Hamburg: 16 schools (53.3%) have clearly defined responsibilities, training approaches, or strategy papers in the area of digitization. Two schools (6.7%) can be classified as "passive permissive," while twelve schools (40%) have no visible governance structure.

Comparison: Visibility in schools as a reflection of state policy control logic

A comparison of the two federal states reveals clear differences both in the visibility of AI and in the design of digital management structures at the school level – differences that can be interpreted as an expression of differing state policy control logic.

In Berlin, three schools (10%) have formally integrated AI, with one school standing out for its particularly structured and visible presentation. Another five schools (16.7%) address AI at least informally, for example, through project reports or events. In contrast, the vast majority (73.3%) have no AI reference whatsoever.

In Hamburg, formal integration is already more advanced, with five schools (16.7%) addressing AI. In addition, one school addresses AI informally (3.3%). This puts Hamburg ahead in terms of both quantity and quality when it comes to the visibility of AI topics on school websites.

The difference is particularly evident in the area of digital management structures: in Hamburg, 16 schools (53.3%) show signs of coordinated digital management, compared to only three schools (10%) in Berlin. While more than half of the schools in Hamburg appear to be structurally prepared, Berlin lags behind in this area, with over 56% of schools lacking any recognizable digital governance structures.

The results suggest that the differences are not solely due to individual decisions made by the schools, but have deeper, systemic causes. Hamburg's more centralized and coordinated digital strategy seems to have a visible impact at the school level, while Berlin's decentralized management approach results in greater heterogeneity and lower visibility.

Thus, the website analysis not only provides clues about internal school priorities but can also be read as an indicator of state political management styles and their effectiveness in everyday school life.

Nevertheless, it is important to emphasise that these observations are not statements about actual usage practices, but rather externally communicated indicators. Visibility on websites can be influenced by political control as well as internal prioritisation, capacities, or resource allocation within the school.

At the same time, these patterns provide initial indications that differences at the state level – for example, in terms of management style, infrastructure, or support formats – can certainly continue to be reflected in the external image of school organizations. The website analysis serves here as preliminary, exploratory evidence in the sense of a plausibility probe, which must be triangulated with other data sources – in particular the school survey – in a next step.

Table 6 – Website Types Comparison

Typology	Type	Berlin	Hamburg
AI Integration	**Formally / Partially integrated**	3	5
	Informally addressed	5	1
	No AI presence evidence	22	24
School Leadership Support	**Strategic or coordinated supporter**	3	16
	Passive Permitter	10	2
	No enabling evidence	17	12

5.3 Deepening the Analysis through Survey Data: Internal Perspectives on School-Level AI Governance

The analysis of school websites in Berlin and Hamburg has provided initial indications of differences in visibility and institutional frameworks for dealing with artificial intelligence (AI). However, this external perspective is limited in its significance: it shows how schools present themselves to the outside world, but not how decision-making processes work

internally, how AI is actually used in everyday teaching, or what attitudes school stakeholders have toward the topic. To close this analytical gap, the next step will be to conduct a descriptive evaluation of the survey data collected from school staff. The survey provides in-depth insight into the governance structures, usage practices, and subjective perceptions of AI in schools, and supplements the findings to date with a necessary inside view from school practice.

Particularly noteworthy is the inclusion of feedback from North Rhine-Westphalia (NRW). Although schools in NRW were not systematically surveyed via their websites, a disproportionately large number of survey responses were received from this federal state as a result of an open call for participation. This pattern can be interpreted as an expression of increased resonance or awareness in the school sector, which may be attributable to the state's publicly visible pilot project. NRW in particular illustrates that even in the absence of clearly defined AI strategies at the state level, targeted initiatives, institutional visibility, and school-based initiatives can lead to active engagement with the topic.
The following section, therefore, first presents the descriptive findings of the survey. This is followed by an analytical link to the previously identified governance types from the website analysis.

5.3.1 Survey findings: usage patterns, barriers, and attitudes

The results from the website analysis presented above provide insights into the external presentation and institutional framing of AI in schools, but without enabling any conclusions to be drawn about actual usage practices or the attitudes of the individuals involved. The online survey of school stakeholders (N = 18) offers a complementary perspective here: it provides an "inside" look at individual usage experiences, subjective perceptions, institutional support structures, and structural barriers. Despite the limited sample size, initial consistent patterns can be identified that deepen and differentiate the previous findings.

General usage patterns: Between individual initiative and institutional restraint

The majority of respondents (14 out of 18) report that artificial intelligence is used at least selectively at their school. However, this usually takes place in informal, decentralized, and poorly coordinated forms:

- In five cases, it is used individually by individual teachers.
- In six cases, its use is subject-specific or limited to certain grade levels.

- Only three respondents report school-wide integrated use.
- In three schools, there is currently no use at all.

These patterns indicate an early phase of adoption development, in which AI integration is predominantly bottom-up – that is, through the personal commitment of individuals, but not through systematic strategies.

Tools used: Platforms between everyday usability and popularity

Among the applications used, well-known tools with low accessibility thresholds dominate:

- fobizz and ChatGPT are mentioned most frequently (11 mentions each), followed by Gemini (7), Copilot (6), and SchulKI (4).
- Tools such as sofatutor or bettermarks are less common, which suggests specific areas of application or lower awareness.
- Tools with institutional licensing play only a minor role, which indicates weak strategic integration.

Use is therefore primarily characterized by low barriers to entry and personal tool competence, not by school-wide standardization or specifications.

Digital infrastructure and support conditions

The basic digital equipment in schools is rated positively by the majority of respondents in the survey:

- The technical infrastructure (internet, devices, equipment) is often described as "good" or "excellent."
- However, the assessment of IT support is noticeably more reserved: ten participants rate it as only "okay," and only three as "excellent."

These assessments indicate that, although the basic technical requirements for AI use are in place, there is a lack of accompanying support during ongoing operations.

Barriers: Governance gaps and institutional uncertainties

The open-ended responses identify various obstacles to broader AI integration. The main barriers are:

- The lack of a school strategy or orientation framework
- Legal uncertainties and data protection concerns
- Lack of time and lack of training opportunities
- In some cases, technical limitations, especially in the area of IT support

These barriers point to a policy-practice gap: although there is much political talk about AI, in reality, schools often lack operational frameworks for action and clear responsibilities.

Attitudes and subjective innovation potential

One particularly revealing finding concerns the attitudes of the respondents:

- Many participants express a high level of interest in AI tools and would like to learn more about their educational benefits.
- Even among those who do not currently use AI, there is a fundamental openness.
- At the same time, many report uncertainties in dealing with AI applications and a feeling of low self-efficacy.

This discrepancy between attitude and action points to a classic "attitude–behavior gap." In terms of diffusion of innovation theory (DOI), this can be interpreted as an indication of a lack of reinvention space (opportunities to adapt to one's own context) and low "observability" (observability of successful examples).

Interim conclusion: Potential exists – but remains untapped

The survey provides a complex picture of AI governance in schools "from the inside": The majority of teachers are interested, but institutional support, strategic orientation, and access to training often remain vague or are completely lacking. The existing potential for innovation is therefore not being exploited, even though the basic technical requirements are often in place.

Overall, the survey findings complement the website analysis with a key insight: visibility alone is not enough – clear structures, responsibilities, and opportunities for further development are needed to turn openness into actual usage.

5.4 Comparison and connection of school governance and usage types

Connecting the results from the website analysis with the survey data enables a more in-depth typology that systematically illuminates the interplay between institutional control approaches, technical requirements, individual attitudes, and actual usage practices. This allows us to first identify recurring patterns between the previously developed governance

types and reported usage experiences. Building on this connection, a more differentiated case typology is then presented, which reveals more complex configurations.

5.4.1 Relationship between school governance type and usage patterns

A consistent relationship between governance type and usage practices can be seen across state borders. Schools with a clearly recognizable management structure – for example, with designated digitalization officers, existing strategy papers, or regular training opportunities – tend to have higher AI usage rates. These schools can be typologically assigned to the "Strategic Enabler" or "Coordinated Facilitator" groups.

In contrast, schools classified as "Unstructured" or "Passive Permitter" show significantly lower usage intensity. Here, AI either remains an individual topic for individual teachers or, despite the existing infrastructure, is hardly operationalized.

This correlation is particularly pronounced in North Rhine-Westphalia, where several schools show high levels of use combined with structured governance. This suggests the effectiveness of well-designed control architectures, even in contexts without explicit AI strategies at the state level. Apparently, targeted initiatives, regional pilot projects, or school-based initiatives can be key factors in activating innovation.

5.4.2 Role of digital starting conditions

A differentiated analysis of the control variables shows that digital infrastructure is necessary, but by no means sufficient, for the successful use of AI in a school context. There are several cases in which the technical equipment was rated as good or very good, but the actual use of AI remains low.

The explanation lies in the lack of content and didactic specification: schools have broadband, end devices, and platform access, but they lack specific training formats for AI applications, licensed tools, and pedagogically anchored usage concepts.

These findings highlight an important distinction: digitalization is not the same as AI governance. While general digitalization strategies lay the foundation, AI requires its own governance logic that takes into account specific challenges, risks, and potential.

5.4.3 Correlations between school governance configurations and types of use

The combination of website analysis and survey data allows for a differentiated assessment of the observable relationship between governance structure and reported AI use. The survey data in particular shows that schools with clearly defined responsibilities, training opportunities, and coordinating structures are more likely to report specific application scenarios –whether in subject teaching, lesson preparation, or school projects.

The following matrix summarizes the observed correlations between governance type and usage patterns based on the combined data:

Table 7 – Most common typologies per governance type

Governance-Typ	Most common types (according to survey)
Strategic Enabler	Regular User; Partially Integrated
Coordinated Facilitator	Experimental User; Partially Integrated
Passive Permitter	Experimental User; Informally Addressed
Unstructured / Isolated	Non-user; Not addressed

This distribution indicates a clear correlation: the likelihood of regular and school-wide integrated use increases with the degree of institutional control, especially where specific responsibilities, resources, and strategic orientations are in place. However, it should be emphasized that no causal conclusions can be drawn from these patterns. These are observable correlations whose complex causes can only be deciphered through further qualitative analysis (e.g., case studies).

A detailed overview of the original governance typology and the classification of individual schools can be found in Appendix G.

5.4.4 Case typology based on combined patterns: school governance, attitude, and use in interaction

While the previous sections describe linear relationships between governance and use, a combined analysis of governance configuration, digital infrastructure, individual attitudes, and actual use also reveals divergent patterns that point to more complex dynamics in everyday school life.

From this integrative perspective, four ideal-typical case patterns can be derived that reveal different characteristics and tensions in school AI governance:

Table 8 – Resulting Types

Case Type	Characteristics	Relevance
Positive Deviation	Weak governance, but high usage through individual initiatives (e.g., Hamburg)	Indicates innovation potential from "early adopters"
Infrastructure–Usage Mismatch	Good digital infrastructure, but no AI usage	Requires targeted AI-specific support
Attitude–Action Gap	Positive attitude, but hardly any usage	Need for implementation support and training
Governance Present, No Execution	Supportive governance but no use	Hypothetical contrast case for validation

These types underscore that effective AI usage does not automatically follow from good governance, and vice versa. Innovation can emerge "from the bottom up," particularly when individuals are motivated and empowered, even in the absence of strategic frameworks. The Attitude–Behavior Gap is particularly noteworthy. Many teachers express interest in AI but do not yet translate this into classroom use, often due to legal uncertainty, lack of training, or low self-efficacy. This aligns with patterns described in innovation theory, where the absence of "reinvention spaces" and observability can stall adoption. Finally, Governance Without Execution serves as a useful counterfactual model—not strongly present in the data, but conceptually important for testing the limits of the typology. It raises the question of whether governance measures are truly effective or merely symbolic.

This case typology expands the governance framework by incorporating multi-dimensional real-world patterns, capturing how institutional, technical, and personal conditions interact. It thus offers valuable insight for tailoring future governance and implementation strategies in school contexts.

5.6 Observable correlations between state strategy, school governance, and AI use

5.6.1 Overview: Variation along state governance logic

A comparison of the three federal states studied - Berlin, Hamburg, and North Rhine-Westphalia (NRW) - reveals systematic differences in the interplay between state policy strategy, school governance structure, and observable AI use at the school level. These

differences are reflected in all three data sources: the state strategy documents, the website analyses, and the survey results.

The following overview summarizes key characteristics at each level:

Table 9 – Cross-case comparison

Level of Analysis	Berlin	Hamburg	NRW
State Strategy	Portal-based information policy, occasional mention of tools, no central AI strategy	Technically standardized infrastructure (eduPort), pedagogically open offerings, modular information structure	Early digital strategy, pilot projects, multi-level portal governance
School Governance (Websites)	Mostly "Unstructured" or "Passive Permitter"	Uniformly "Passive Permitter", some digital responsibilities	n/a
AI Integration (Websites + Survey)	Occasionally visible, informal	Symbolic, sporadic	Greater variability: partly regular, occasionally embedded
Survey Signals	Sporadic use, high uncertainty	Basic interest, low implementation	Broader use, partly integrated into pilot initiatives

The data suggests that, depending on the governance constellation, different institutional starting conditions for the use of AI in schools are emerging.

5.6.2 Indications of configurations between state governance and school implementation

The combined analysis of website and survey data allows a descriptive allocation of specific patterns in the relationship between state control logic and school practice. The following configurations emerge:

- Berlin: In an environment of weak strategic framing and technology-oriented infrastructure policy, predominantly fragmented or undeveloped governance structures are evident at the school level. Reports of uncertainty, sporadic use, and a lack of clear responsibilities dominate the survey data.

- Hamburg: Despite clear infrastructural requirements and high visibility of digital topics on websites, AI-specific implementation remains weak. There is a lack of strategic anchoring at the school governance level, even if digital responsibilities have been named in some cases. In the survey, many teachers expressed interest, but also a lack of didactic and technical orientation.

- NRW: Where pilot projects, multi-level platform architectures, and training courses are documented, more differentiated forms of governance can be seen. Both passive

and strategically coordinated schools can be found in the website analyses. The survey data report more frequently on regular use, organizational integration, and, in some cases, systematic concepts.

These configurations indicate possible links between macro-governance and micro-structure, particularly with regard to institutional orientation and depth of implementation.

5.6.3 Initial indications of the contextual impact of state governance models

A country comparison of the observed distributions reveals the following patterns:

- Strategic school governance types (e.g., “strategic enablers”) occur exclusively in NRW - i.e., where state initiatives such as pilot projects, targeted funding, or structured portals are documented.

- Despite clear technical standardization and high information density, Hamburg shows only limited AI-specific implementation in schools.

- Berlin appears fragmented in terms of both institutional control and usage practice, despite the availability of portals and central tool access.

These differences suggest that state policy governance models create different starting conditions for school AI practice, for example, through visibility, orientation aids, or impulse projects. The survey data reinforces this impression through divergent perceptions of support and uncertainty.

5.6.4 Summary: Plausibilizing relationship patterns

The following descriptive patterns can be identified as part of this “plausibility probe”:
School use of AI varies - both in terms of its extent and institutional depth:

- These differences run along country-specific control configurations - for example, in the interplay of strategic framing, infrastructure, qualification measures, and degree of coordination.

- There are initial indications of a possible link between governance types and utilization practice, especially where structural support instruments are linked to pedagogical orientation.

- These correlations are to be understood as explorative hypotheses, not as generalizable statements. They form an analytical basis for in-depth case studies or comparative follow-up research.

This typification thus offers a theory-guided starting point for visualizing potential mechanisms of action between state control and school implementation. It is not intended to prove causal relationships, but to show where they appear conceivable and worthy of investigation, and thus forms the empirical foundation for the subsequent discussion in Chapter 5.

6. Discussion

6.1 Overview: Governance Shapes Use – But Indirectly

This study aimed to investigate how government and school governance approaches influence the implementation and actual use of AI tools in German secondary schools, with a particular focus on possible policy-practice gaps and the role of institutional frameworks. The theoretical basis was a combination of multi-level governance (MLG) and the diffusion of innovations (DOI) theory. This combination made it possible to analyze both structural governance processes and perception-based adoption decisions.

The results show that governance generally plays a relevant role, though usually not directly, mediated via visibility, institutional support, and perceived orientation. Neither the existence of central platforms nor financial resources alone automatically led to active AI use. Instead, patterns emerged in which communicative clarity, strategic school leadership, and internal school coordination were more decisive than formal control instruments.

The comparative analysis of the three federal states of Berlin, Hamburg, and North Rhine-Westphalia reveals apparent differences in the strategic framing and implementation of AI governance at the state level:

- Berlin pursued a strongly infrastructure-focused approach with central portals and tools, but without a pronounced educational orientation framework.

- Hamburg offered financial resources and extensive information, but deliberately left the specific choice of tools to the schools.
- NRW combined targeted pilot projects, publicly visible initiatives, and structured platforms without formally obliging schools.

These differences created different structural starting conditions, but did not automatically lead to different implementations in schools. Instead, it was shown that even in supportive governance contexts, concrete use often depended on intra-institutional factors such as coordination, individual initiative, or collegial networks. This confirms central assumptions from the MLG literature: governance is not linear-top-down, but depends on vertical and horizontal coordination. Even where clear regulations were in place, their operational connectivity to everyday school life often remained unclear.

Moreover, a key finding of the analysis is the importance of internal school governance structures for the implementation of AI. Schools with designated digital officers, strategic concepts, or regular training structures had significantly higher levels of integration and use than those without recognizable governance. This shows that schools do not act as passive implementers of government guidelines, but as active mediators that can interpret, filter, or even ignore political impulses. In individual cases, this has even led to bottom-up innovations, where active use has taken place despite weak external guidelines, driven by individual conviction or local leadership.

This dynamic corresponds to DOI's understanding: innovation adoption is based on perceived support, complexity, and usefulness, not necessarily on formal guidelines. Governance can structure these perceptions, but must be visible, connectable, and didactically framed in order to have an impact.

5.2 Policy-practice gaps and informal utilization paths

The triangulated analysis shows clear tensions between strategic control and school reality in all federal states. In many cases, there were either formal offerings without practical connectivity (e.g., centrally licensed tools that are not used) or informal use without a strategic framework (e.g., teachers using ChatGPT on their own initiative).

Two patterns emerge here:

- Policy-practice gaps: policy measures either do not reach schools visibly, are not perceived as relevant, or fail due to a lack of concretization.
- Informal usage paths: Many actors rely on low-threshold, freely available tools (e.g., ChatGPT, fobizz), regardless of whether they are officially recommended or legally verified.

From a DOI perspective, these patterns can be explained by subjectively perceived characteristics: Low-threshold, visibility, and perceived benefits encourage adoption, even in

the absence of regulatory or structural frameworks. However, this development harbors the risk that informal use will undermine regulatory requirements, especially with regard to upcoming obligations under the EU AI Act.

5.3 Systemic connectivity with the EU AI Act

The EU AI Act, which was adopted in 2024, is regarded as the world's pioneering regulation for artificial intelligence (Pham & Davies, 2024). It brings with it new requirements for education systems in particular - for example, in terms of transparency, risk assessment, and human oversight. However, the results of this study suggest that schools are not yet sufficiently prepared structurally for these requirements:

- Formal responsibilities are often not clarified.
- Support services are unevenly distributed or not very visible.
- Many usage scenarios are informal, individual, and not embedded in institutional processes.

In addition, it became clear during the research process that the distinction between AIEd and GPAI (e.g., ChatGPT vs. school platforms) is hardly operationalized in school practice. This conceptual blurring makes both governance and regulatory connectivity more difficult.
This threatens to create a scenario that is already familiar from the introduction of the GDPR: well-intentioned, legally binding regulation meets unclear responsibilities, excessive demands, and implementation uncertainty, with the risk that innovation will not be promoted, but rather slowed down (Bitkom e.V. 2023).

5.4 Conclusion and Outlook

The results show that governance – understood as a structuring, framing, and supporting authority – is crucial for the integration of AI in schools. However, it is not the existence of measures that is decisive, but their concrete visibility, connectivity, and didactic framing in everyday school life. This has several implications for the sustainable design of AI governance in the education sector:

- Improve coordination between the EU, federal government, federal states, and schools in order to avoid contradictory signals.
- Strengthen institutional support and visibly anchor internal school responsibilities, further training, and resources.
- Eliminate strategic blurring and differentiate AIEd and GPAI, concretize contexts of use.
- Enable innovation – but with orientation – and allow freedom without normative emptiness or legal uncertainty.

Only if political control and school reality are coherently interlinked can AI unfold its potential in the education sector – and, at the same time, be integrated in a responsible, equitable, and future-oriented manner.

7. Conclusion

7.1 Objectives and Theoretical Approach

This study aimed to investigate the role of governance structures in the implementation and use of AI in German secondary schools. The central question was to what extent political steering approaches at the state level and internal school organizational structures influence the actual use of AI tools in everyday school life, and whether governance practices and usage align or diverge. To conduct the analysis, a combined theoretical framework was used, drawing from Multi-Level Governance (MLG) and the Diffusion of Innovations (DOI) theory. MLG enabled the analysis of vertical steering mechanisms and institutional frameworks, while DOI explained at the micro level under which conditions new technologies actually spread within schools.

7.2 Key Findings

The empirical analysis, based on a mixed-methods design, consisting of document analysis, website analysis, and a standardized online survey, shows that governance plays a central role in the use of AI in schools. However, this influence is neither direct nor linear; it is largely mediated by visibility, institutional compatibility, and perceived support.

Key findings include:

- State strategies differ significantly in terms of instruments, visibility, and objectives. While Berlin offers centralized access, Hamburg emphasizes informational and resource sovereignty. North Rhine-Westphalia (NRW) follows an impulse-based, strategically visible pilot system.

- Internal school governance is crucial. Schools with clear responsibilities, professional development offerings, or strategic papers integrate AI more frequently than those without recognizable steering—regardless of the federal state.

- Informal use is widespread, especially with freely accessible tools like ChatGPT. This points to a tension between individual initiative and institutional frameworks.

- Policy-practice gaps are evident. Even when strategies or licenses exist, there is often a lack of clear communication, pedagogical integration, or structural support.

- System maturity regarding the EU AI Act is limited. Requirements for transparency, risk assessment, and institutional accountability are hardly met in current practice.

7.3 Contribution and Relevance of the Study

This study contributes to empirical research on AI governance in education in Germany, particularly through the first-time integration of MLG and DOI perspectives in a school context. This approach allows for a multidimensional analysis of the interactions between policy, institution, and practice in a largely unexplored field. Furthermore, the study shows that questions of governance theory cannot be viewed in isolation from adoption behavior. The mere existence of strategies, licenses, or guidelines does not guarantee implementation; rather, communicative, organizational, and pedagogical mediation at the school level is necessary.

7.4 Methodological Positioning and Limitations

As an exploratory study in the sense of a plausibility probe design, the work does not aim for representativeness, but for the development of theoretically grounded, empirically plausible hypotheses. The small number of cases, asymmetric distribution among federal states, and potential self-selection of participants limit generalizability. The manual type classification without automated coding also represents a methodological limitation, but was deliberately chosen to adequately address the complexity of governance phenomena.

7.5 Outlook and Further Research Needs

In light of the upcoming implementation of the EU AI Act, further research is urgently needed. Key follow-up questions include: The institutional implementation of regulatory requirements at the school and state level (e.g., risk assessment, transparency obligations); The didactic quality of AI use in teaching and its impact on learning processes; The role of school leadership and teaching staff in developing sustainable cultures of innovation; Comparative studies with other federal states or international education systems, to better understand transfer potential and structural barriers.

In the long term, an integrated governance approach is needed – one that coordinates political steering, pedagogical practice, and technical development in a context-sensitive and adaptive way. Only in this way can the potential of AI in education be fully realized – not as a short-term trend, but as a responsibly designed, learning-enhancing, equitable, long-term innovation.

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[1] *Statement on the Use of Generative AI Tools: Generative Artificial Intelligence (AI) tools were utilized during the development of this thesis for the following purposes: Translating survey questions included in the appendix from German to English; Assisting in the refinement and presentation of scoring schemes to ensure greater consistency and comprehensibility; Enhancing the clarity, coherence, and overall quality of the writing style throughout the thesis. All core research, critical analysis, and the final arguments presented in this work are entirely the authors own.*

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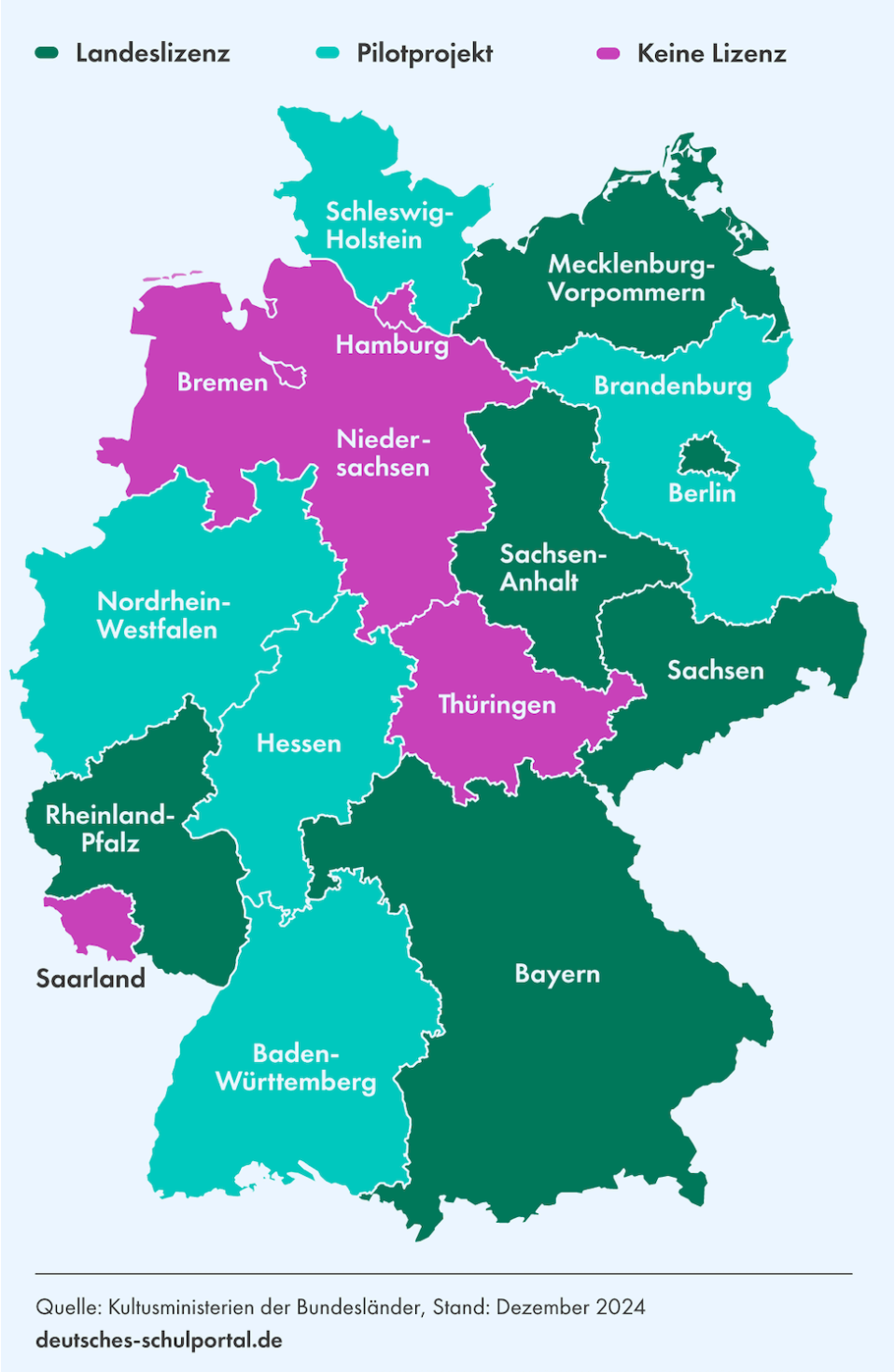
Appendices

Appendix A: Case Selection Materials

A.1 Overview of Federal States by AI License

Landeslizenz = State License ; Pilotprojekt = Pilot project ; Keine Lizenz = No License



Appendix B: Document Analysis Instruments

B.1 Documents Corpus with Metadata Scheme

Document Title	Publication Date	Publication Institution	State	Document Type	Link	Access Info	Governance Level

Senatsverwaltung für Bildung, Jugend und Familie – Bildung	Live / continuously updated; last accessed June 2025	Senatsverwaltung für Bildung, Jugend und Familie Berlin	Berlin	Webpage	https://www.berlin.de/sen/bildung/	Website navigation analysis of all subpages under 'Bildung'	State (Berlin)
Bildungsserver Berlin-Brandenburg	Live / continuously updated; last accessed June 2026	SenBJF (Berlin) & MBJS (Brandenburg) – via LISUM Berlin-Brandenburg	Berlin, Brandenburg	Portal	https://bildungsserver.berlin-brandenburg.de/	KMK > Themen > Bildung in der digitalen Welt > Distanzlernen > Berlin	Inter-state (Berlin & Brandenburg)
Lernraum Berlin	Live / continuously updated; last accessed June 2027	Senatsverwaltung für Bildung, Jugend und Familie Berlin	Berlin	Portal (LMS)	https://www.lernraum-berlin.de/start/	Bildung > Schule > Schule in der digitalen Welt > Digitale Plattformen > Lernraum Berlin	State (Berlin)
Berliner Schulportal	Live / continuously updated; last accessed June 2028	Senatsverwaltung für Bildung, Jugend und Familie Berlin	Berlin	Portal	https://schulportal.berlin.de/start	Bildung > Schule > Schule in der digitalen Welt > Digitale Plattformen > Berliner Schulportal	State (Berlin)
Digitalisierungsstrategie – Schule in der digitalen Welt (Berlin, 2021)	2021-08-09 00:00:00	Senatsverwaltung für Bildung, Jugend und Familie Berlin	Berlin	Strategy	PDF Download (330 kB) – Stand: Aug 2021	Bildung > Schule > Schule in der digitalen Welt > Digitalisierungsstrategie	State (Berlin)
Digitalisierungsstrategie 2.0 – Schule in der digitalen Welt (2025)	2025-02-01 00:00:00	Senatsverwaltung für Bildung, Jugend und Familie Berlin	Berlin	Strategy (updated)	PDF Download (726 kB) – Stand: Feb 2025	Bildung > Schule > Schule in der digitalen Welt > Digitalisier	State (Berlin)

						ungsstrategie	
Handreichung zum Umgang mit KI (ChatGPT) – Press Release	2023-04-24 00:00:00	Senatsverwaltung für Bildung, Jugend und Familie Berlin	Berlin	Press Release	https://www.berlin.de/sen/bjf/.../pressemitteilung.1316517.php	Berlin website search "Künstliche Intelligenz"	State (Berlin)
Empfehlungen für den Umgang mit KI-Anwendungen am Beispiel von ChatGPT (Guidance for Schools) – Handreichung	2024-04-01 00:00:00	Senatsverwaltung für Bildung, Jugend und Familie, Berlin	Berlin	Guidance document (schools guideline)	PDF – [Download]	From Home ➔ Bildung ➔ Unterricht ➔ Fächerübergreifende Themen ➔ Digitale Welten ➔ Empfehlungen…ChatGPT (PDF link on page)	High (explicitly about AI tool use in schooling)
Behörde für Schule, Familie und Berufsbildung (BSFB Hamburg)	Live / continuously updated; last accessed June 2025	Behörde für Schule, Familie und Berufsbildung, Hamburg (Education Authority)	Hamburg	Webpage (official portal page)	https://www.hamburg.de/politik-und-verwaltung/behoerden/bsfb/	Hamburg.de official site > Politik & Verwaltung > Behörden > BSFB	State
Hamburger Bildungsserver	Live / continuously updated; last accessed June 2026	Landesinstitut für Lehrerbildung und Schulentwicklung (LI Hamburg)	Hamburg	Portal	https://bildungsserver.hamburg.de/	Public educational portal (Lehrende & Lernende)	State
eduPort – Zugangsportal	30/08/2017 (service agreement date)	Behörde für Schule und Berufsbildung, Hamburg (Education Authority)	Hamburg	Portal (state digital school platform)	https://eduport.hamburg.de/	Public platform (login required for school accounts; via KMK distanzlernen listing for Hamburg)	State
Künstliche Intelligenz (KI) in der Schule (LI Hamburg)	April 2024 (page upda	Landesinstitut für Qualifizierung und Qualitäts	Hamburg	Webpage (thematic	https://li.hamburg.de/ki	LI Hamburg site > Themen > Medienbildung > KI	State

	ted with AI guidelines)	entwicklung in Schulen (LI Hamburg)		info page)		(linked via BSFB site)	
Digital macht Schule (project site)	26/08/2019 (project launch press release)	Behörde für Schule und Berufsbildung & Joachim Herz Stiftung	Hamburg	Portal (project website)	https://digitalmachtschule.de/	Project site (BSB Hamburg & Joachim Herz Foundation; via BSFB Themen A–Z > Digitalisierung)	State (public–private initiative)
Digitale Medien – Ein Leitfaden für den Fachunterricht	2020	Landesinstitut für Lehrerbildung und Schulentwicklung Hamburg (LI Hamburg)	Hamburg	Leitfaden (guidance e-book)	https://ebook-medien.li-hamburg.de/#/	Bildungsserver > Themenschwerpunkte > Digitale Werkzeuge (free e-book, no login)	State
Leitlinien für den Einsatz von KI-Systemen in Schule und Unterricht	2024-04-04 00:00:00	Behörde für Schule, Familie und Berufsbildung & LI Hamburg (developed with ARIC)	Hamburg	Leitfaden (digital Handreichung)	https://ki-portal.li-hamburg.de/#/	Online e-publication (LI Hamburg KI-Portal; accessible via li.hamburg.de/ki)	State
ChatGPT, Dall-E und Co. im Unterricht – Schulbehörde veröffentlicht Leitlinien…	2024-04-04 00:00:00	Behörde für Schule, Familie und Berufsbildung, Hamburg (Pressestelle)	Hamburg	Press Release	https://www.hamburg.de/.../2024-04-04-bsb-chatgpt-dall-e-und-co-im-unterricht-871336	BSFB > Veröffentlichungen > Pressemitteilungen (Digitalisierung)	State
Mit Avataren können schwerkranke Kinder am Unterricht teilnehmen	2024-02-23 00:00:00	Behörde für Schule, Familie und Berufsbildung – Amt für Bildung (Newsletter)	Hamburg	Newsletter (Schulbehörde)	https://www.hamburg.de/.../newsletter-der-schulbehoerde-2024/23-februar	BSFB Newsletter archive 2024 (Feb issue, online version)	State
Newsletter der Schulbehörde: Kaum noch Kreide	Dec 2024 (Year-end 2024	Behörde für Schule, Familie und	Hamburg	Newsletter	https://www.hamburg.de/newsletter/1000186/HTML	BSFB Newsletter (web version, “Hamburg	State

in den Klassenräumen	newsletter)	Berufsbildung – Amt für Bildung (Newsletter)				setzt mit DigitalPakt Maßstäbe…")	
Kaum noch Kreide in Hamburgs Klassenräumen	2024-12-30 00:00:00	Behörde für Schule, Familie und Berufsbildung, Hamburg (Pressestelle)	Hamburg	Press Release	https://www.hamburg.de/.../2024-12-30-kaum-noch-kreide-in-hamburgs-klassenraeumen-1000244	BSFB > Pressemitteilungen > Digitalisierung	State
Bund und Länder schließen Vereinbarung zum Digitalpakt Schule 2.0…	2024-12-13 00:00:00	Behörde für Schule, Familie und Berufsbildung, Hamburg (Pressestelle)	Hamburg	Press Release	https://www.hamburg.de/.../2024-12-13-bsb-bund-und-laender-schliessen-vereinbarung-zum-digitalpakt-schule-2-0-1000394	BSFB > Pressemitteilungen > Digitalisierung	State
Alphabetisierung: KI kann helfen	2024-09-05 00:00:00	Behörde für Schule, Familie und Berufsbildung, Hamburg (Pressestelle)	Hamburg	Press Release	https://www.hamburg.de/.../2024-09-05-bsb-alphabetisierung-ki-kann-helfen-962898	BSFB > Pressemitteilungen > Digitalisierung	State
7,2 Millionen digitale Mathematikaufgaben im aktuellen Schuljahr…	2024-04-24 00:00:00	Behörde für Schule, Familie und Berufsbildung, Hamburg (Pressestelle)	Hamburg	Press Release	https://www.hamburg.de/.../2024-04-24-bsb-ueber-7-millionen-digitale-mathematik-aufgaben-871318	BSFB > Pressemitteilungen > Digitalisierung	State
Weitere 18 Avatare im Klassenzimmer…Projekt „Karlsson“	2023-02-15 00:00:00	Behörde für Schule, Familie und Berufsbildung, Hamburg (Pressestelle)	Hamburg	Press Release	https://www.hamburg.de/.../weitere-18-avatare-im-klassenzimmer-...-schulprojekt-karlsson--577248	BSFB > Pressemitteilungen > Digitalisierung	State
50.000 Euro für die Künstliche Intelligenz	2023-10-23 00:00:00	Behörde für Schule, Familie und Berufsbildung, Hamburg	Hamburg	Press Release	https://www.hamburg.de/.../2023-10-23-bsb-50000-euro-fuer-die-kuenstliche-intelligenz-522790	BSFB > Pressemitteilungen > Digitalisierung	State

		(Presseste lle)					
Hamburger Bildungsser ver – Themensch werpunkt Künstliche Intelligenz	Live / conti nuou sly upda ted; last acce ssed June 2025	Landesin stitut für Lehrerbil dung und Schulent wicklung (LI Hamburg)	Ham burg	Portal	https://bildungsserver.hamburg.de/themenschwerpunkte /kuenstliche-intelligenz	Via Bildungsser ver > Themensch werpunkte > Künstliche Intelligenz	State
Hamburger Bildungsser ver – Digitale Werkzeuge	Live / conti nuou sly upda ted; last acce ssed June 2026	Landesin stitut für Lehrerbil dung und Schulent wicklung (LI Hamburg)	Ham burg	Webp age	https://bildungsserver.hamburg.de/themenschwerpunkte /digitale-werkzeuge	Via Bildungsser ver > Themensch werpunkte > Digitale Werkzeuge	State
MSB NRW Main Website (“Bildungsp ortal NRW”)	Live / conti nuou sly upda ted; last acce ssed June 2027	Ministeri um für Schule und Bildung NRW	NR W	Portal / Websi te	https://www.schulministerium.nrw/	schulminist erium.nrw > Startseite > Themen > Digitalisier ung > KI in Schule und Bildung	State
Lernen-digi tal.nrw (“Lehren und Lernen in der digitalen Welt” portal)	Live / conti nuou sly upda ted; last acce ssed June 2028	MSB NRW / Medienbe ratung NRW on portal	NR W	Portal	https://www.schulministerium.nrw/digitalisierung	schulminist erium.nrw > Themen > Digitalisier ung > Lehren und Lernen in der digitalen Welt → lernen-digit al.nrw	State
Bildungsme diathek NRW (Digital Media Library)	Live / conti nuou sly upda ted; last acce ssed June 2029	Medienbe ratung NRW in cooperati on with MSB NRW	NR W	Portal	https://bildungsmediathek-nrw.de/	lernen-digit al.nrw > Mediennutz ung > Bildungsme diathek NRW → bildungsme diathek-nrw .de	State / Muni cipal

Digitalstrategie Schule NRW	2021-09-24 00:00:00	MSB NRW	NRW	Strategy (PDF & Webpage)	https://www.lernen-digital.nrw/bezugsdokumente/digitalstrategie-schule-nrw	lernen-digital.nrw > Bezugsdokumente > Digitalstrategie Schule NRW	State
Faktenblatt Digitalstrategie Schule NRW 2020–2025	2021-09-23 00:00:00	MSB NRW – Pressestelle (Schulministerium NRW)	NRW	Press Release / Factsheet	https://www.schulministerium.nrw/system/files/media/document/file/210923_faktenblatt_digitalstrategie.pdf	schulministerium.nrw > Presse > Pressemeldungen > 23.09.2021 > Faktenblatt Digitalstrategie Schule NRW	State (NRW)
Pressemitteilung: Ministerin Gebauer – 2 Mrd. € Digitalstrategie & 184 Mio. € Ausstattungsprogramm	2021-09-23 00:00:00	MSB NRW – Ministerium für Schule und Bildung (press release)	NRW	Press Release	https://www.schulministerium.nrw/23092021-digitalstrategie-schule-nrw	schulministerium.nrw > Presse > Pressemeldungen > 23.09.2021 > Ministerin Gebauer: Digitalstrategie Schule NRW	State (NRW)
Pressemitteilung: Ministerin Gebauer – Land & EU unterstützen Schulträger mit 184 Mio. €	2021-10-18 00:00:00	NRW State Government (MSB NRW & MWIDE joint press via Land.NRW)	NRW	Press Release	https://www.land.nrw/pressemitteilung/ministerin-gebauer-land-und-eu-unterstuetzen-schultraeger-mit-184-millionen-euro	land.nrw > Presse > Pressemitteilungen > 18.10.2021 > Unterstützung Schulträger mit 184 Mio. €	State (NRW)
Medienkompetenzrahmen NRW – Framework for Media Competence in Schools	2018-06-26 00:00:00	MSB NRW in cooperation with Medienberatung NRW (state media advisory service)	NRW	Portal / Guideline	https://www.lernen-digital.nrw/bezugsdokumente/medienkompetenzrahmen-nrw	lernen-digital.nrw > Bezugsdokumente > Medienkompetenzrahmen NRW	State (NRW)
Lehrkräfte in der digitalisierten Welt – Orientierungsrahmen für Lehrerausbildung und -fortbildung	2020-01-22 00:00:00	Medienberatung NRW (on behalf of MSB NRW)	NRW	Guideline (Strategy)	https://www.schulministerium.nrw/digitalisierung/lehrkraefte-digitalisierte-welt	schulministerium.nrw > Themen > Lehrerbildung > Digitalisierung > Orientierungsrahmen digitale Welt	State (NRW)

Handlungsleitfaden zum Umgang mit textgenerierenden KI-Systemen (NRW)	2023-02-23 00:00:00	MSB NRW – Ministerium für Schule und Bildung NRW	NRW	Leitfaden (Guidance)	https://www.lernen-digital.nrw/arbeitshilfen/handlungsleitfaden-zum-umgang-mit-textgenerierenden-ki-systemen-und-weitere-begleitende-materialien	lernen-digital.nrw > Arbeitshilfen > KI & 4K-Kompetenzen > Handlungsleitfaden zum Umgang mit KI	State (NRW)
Pressemitteilung: Ministerin Feller – “Wir machen unsere Schulen fit für den Umgang mit KI-Anwendungen”	2023-02-23 00:00:00	MSB NRW – Ministerium für Schule und Bildung (press release)	NRW	Press Release	https://www.land.nrw/pressemitteilung/ministerin-feller-wir-machen-unsere-schulen-fit-fuer-den-umgang-mit-ki-anwendungen	land.nrw > Presse > Pressemitteilungen > 23.02.2023 > Schulen fit für KI-Anwendungen	State (NRW)
Pressemitteilung: Ministerin Feller – “Hervorragende Angebote, um Schule und Unterricht weiterzuentwickeln”	2023-06-12 00:00:00	NRW State Government (MSB NRW) – Land.NRW press release	NRW	Press Release	https://www.land.nrw/pressemitteilung/ministerin-feller-hervorragende-angebote-um-schule-und-unterricht-weiterzuentwickeln	land.nrw > Presse > Pressemitteilungen > 12.06.2023 > Portal Lernen in der digitalen Welt	State (NRW)
Pressemitteilung: Ministerin Feller – Mit KI in Mathematik und Deutsch neue Lernmöglichkeiten erproben	2024-09-26 00:00:00	NRW State Government (MSB NRW) – Land.NRW press release	NRW	Press Release	https://www.land.nrw/pressemitteilung/mit-ki-in-mathematik-und-deutsch-neue-lernmoeglichkeiten-erproben	land.nrw > Presse > Pressemitteilungen > 26.09.2024 > KIMADU: KI in Deutsch und Mathematik	State (NRW)
Pressemitteilung: KMK-Handlungsempfehlung “Für einen kritisch-konstruktiven Umgang mit KI in der Schule”	2024-10-10 00:00:00	NRW State Government / KMK – Land.NRW press release	NRW	Press Release	https://www.land.nrw/pressemitteilung/fuer-einen-kritisch-konstruktiven-umgang-mit-ki-der-schule-neue	land.nrw > Presse > Pressemitteilungen > 10.10.2024 > Kritisch-konstruktiver Umgang mit KI	State (NRW)
Pressemitteilung: Ministerin Feller – “Unser KI-Pilotproj	2025-01-10 00:00:00	NRW State Government (MSB NRW) – MSB	NRW	Press Release	https://www.schulministerium.nrw/10012025-ki-pilotprojekt-startet	schulministerium.nrw > Presse > Pressemeldungen > 10.01.2025	State (NRW)

ekt steht in den Startlöchern ”		press release				> KI-Pilotprojekt gestartet	
Zusatzqualifikation “Künstliche Intelligenz in der Beruflichen Bildung” (Runderlass MSB NRW)	2025-06-24 00:00:00	MSB NRW – Ministry for School/Education (official circular)	NRW	Webpage (Policy)	https://bass.schul-welt.de/86119.htm	bass.schul-welt.de > Runderlasse > Berufskollegs > Zusatzqualifikationen > Künstliche Intelligenz	State (NRW)
Impulspapier I: “Distanzlernen – Didaktische Hinweise” (NRW)	04/2020 (approx.)	MSB NRW – Medienberatung NRW (authored by experts for MSB)	NRW	Webpage/PDF Guideline	https://www.lernen-digital.nrw/arbeitshilfen/impulspapier-distanzlernen	lernen-digital.nrw > Arbeitshilfen > Impulspapiere > Impulspapier I: Distanzlernen	State (NRW)
Impulspapier II: “Zentrale Entwicklungsbereiche des Lernens in der digitalen Welt” (NRW)	08/2020 (approx.)	MSB NRW – Medienberatung NRW (authored by experts for MSB)	NRW	Webpage/PDF Guideline	https://www.lernen-digital.nrw/arbeitshilfen/impulspapier-entwicklungsbereiche	lernen-digital.nrw > Arbeitshilfen > Impulspapiere > Impulspapier II: Entwicklungsbereiche digitaler Bildung	State (NRW)

B.2 Visibility Indicator Scheme Document Analysis

Objectives
Identifying governance structures and tools (RQ1)
Understanding school-level enabling conditions and communication (RQ2)
Inferring adoption likelihood and perception through DOI (RQ3)
Detecting policy-practice gaps and misalignments (RQ4)

	Variable	Meaning	Coding Options	Guiding Questions	Keywords / Signals to Skim	Implication	Interpretation of code	State-Level Governance Typology Contribution	Implication on other dimensions	DOI Attribute affected
Metadata	Document Title	Identification	Free text	What is the official name or title?		Number of documents per state indicate AI focus and strength of communication				

	Publication Date	Recency of strategy	DD/MM/YYY	When was the document published or updated?		Earliest document published indicates how long state has been on it. Was AI mentioned before ChatGPT release?	The earlier the document, the longer state has had topic on agenda; hints towards whether agenda was set through generative AI (if post 2022) or already before; if it was before 2022, state an early adopter; if 2022-2023; early majority; 2024-2025: late majority; nothing: laggards			
	Publication Institution	Publisher	Free text	Who published the document?		Indicates whether other actors on state level are involved beyond ministry of education; indicates who drives which types of documents				

	Document Type	Format of communication	Strategie Leitfaden Press Release Newsletter Portal Webpage	What kind of document is it?		Depending on type, implies different levels of accessibility; shows governance communication; Implies different levels of formality	Strategy: Formal strategy Guideline: informal guidance Press Release: Communication to the outside Newsletter: Information + Communication; potentially not as straightforward and much to read Portal: Structured provision of information that's accessible and easy to find; usually intuitive Webpage: Accessible information, but depending on website structure, information not as centrally collected as in portal			
	State	Case context	Berlin / Hamburg / NRW	Which federal state is it from?		Frames the state				

AI Visibility & Framing	AI Focus Level	How central is AI? Helps gauge strategic priority	High = in title/nav or major section Medium = repeated mention Low = single brief mention None = no mention	Is AI a major focus or marginal ? Is it in the title or structure ? Is it mentioned frequently throughout the tex?	Artificial Intelligence, AI, ChatGPT, Fobizz – in titles or headlines or summaries	Reveals political prioritization of AI; input for typology (RQ1)	High focus level implies that the topic is (1) on the agenda, (2) actively communicated prerequisite to determine whether or not there even is governance. If majority of documents has a low AI focus level, then there is little top-down AI governance			
	AI Type Mentioned	Differentiates GPAI from AIEd – useful for DOI attribuets of technology itself	GPAI / AIEd / Both / Vague / None	Is the AI general-purpose or education-specific? Is it named?	ChatGPT, LLM, adaptive learning, Intelligente Tutorensysteme, Fobizz	Background information on technology in focus; indicates to what extent it is just ChatGPT popularity or whether there is more thought in specific AIEd tools; knowing which type of technology helps identifying scoring on DOI attributes (RQ3)	Only AIEd implies response to recent popularity of ChatGPT; AIEd suggests more strategic and guided integration			

	Named AI tools (if any)	Specificity in tool mention improves understanding of school relevance	Free text	Which AI tools or developers are named?	ChatGPT, Gemini, Fobizz, bettermarks, sofatutor, schulKI, Co-Pilot (based on research regarding which tools are common in Germany	Helps cross-reference with survey responses and website analysis to reflect policy-practice gap				
	AI Framing	Perception of AI's risks/benefits (DOI signal)	Positive = Innovation, potential, solution Negative = Risk, concern, overload Balanced = Both are weighed Vague = No clear stance	Is AI discussed as opportunity, challenge, or both?	"Chancen", "Risiken", "Herausforderung", "Entlastung", "Unsicherheit", "Potenzial", "Bedenken"	Important for linking to DOI's relative advantage and perceived compatibility (RQ3)	If framing is positive, then relative advantage is emphasized, which should make the tool more likely to be accepted			
	Framing Quote	Evidentiary support	Free text	Copy the phrase that best shows tone	—	Used in results/discussion to ground interpretation (RQ4)				

Instruments & Governance	Instruments Mentioned	Steering mechanisms	Multi-select: Licensing = State-provided tool access, central platform containing tools Infrastructure = Wifi, tablets Training = Workshops, training offerings for AI or digital literacy Guidelines = Strategy documents, Leitfäden, FAQ Sheets Pilot Projects = state-supported experiments Support Personnel = helpdesk, AI/digital officers Communication Strategy = info portal, newsletters, online FAQs	What concrete tools does the state provide or support?	“Fortbildung”, “Landeslizenz”, “Pilot”, “Plattform”, “Qualifizierung”, “Handreichung”, “IT-Betreuung”, “Digitale Schule”	Defines how state supports implementation; Detects fragmentation vs. clarity in steering (MLG: RQ1 + RQ4)	Licensing: makes AI more accessible because schools don't have to invest financial resources they might not have Infrastructure: makes AI indirectly more accessible because it forms an environment in which AI can be integrated Training: makes AI easier to use because the actual ability to use it strategically increases; gives the opportunity to experiment with it in training settings Guidelines: makes AI easier to use because there is information on how it should be and can be used ethically Pilot Projects: gives the opportunity to			

							experiment without signing up; gives the opportunity to observe from others Support Personnel: facilitates use because questions can be solved more directly Communication Strategy: increases awareness and reduces complexibility because there is a central point for information, learning about new tools and how to use them, learning about success stories, knowing where to find answers about questions, being kept in the loop with a quickly changing technology			

	Roles & Responsibilities Clarity	Clarity of actor roles	Yes = actors named clearly Partial = vague or general No = not mentioned	Who is responsible? Are names or levels mentioned?	“Schulleitung”, “Ministerium”, “Koordinator”, “IT-Beauftragte”, “Medienkonzept”, “Aufgabenbereich”	Detects fragmentation vs. clarity in steering (MLG: RQ1 + RQ4)				
	Governance Level Reference	Shows coordination	Multi-select: EU / Federal / Länder / Municipal / None	Does the document refer to other levels (EU, federal)?	“EU AI Act”, “KMK”, “Bund”, “andere Länder”, “EU-Vorgaben”, “DigitalPakt”	MLG insight on vertical steering logic and coordination (RQ1)				
	Degree of Implementation Autonomy	Freedom to innovate vs. top-down constraints	Binding = Required or mandated Encouraged = Framed as desirable but not forced Optional = No obligation or recommendation Not Stated = Ambiguous	Is this mandatory, encouraged, or voluntary?	“muss”, “soll”, “kann”, “Empfehlung”, “verpflichtend”, “freiwillig”	Reveals school agency vs. central control (RQ2 + RQ4)	Binding: top-down constraints; Encouraged or optional: freedom to innovate			
Communication	Communication Channel	Format & access type	Webpage / PDF / Portal / Newsletter / Press Release	Where is this info found?	“PDF”, “Webseite”, “Portal”, “Newsletter”, “Download”, “Online verfügbar”	Shows how accessible and structured communication is (RQ2)				
	Communication Clarity	How understandable is the information for school actors?	2 = Clear, direct, and practical 1 = Understandable but vague 0 = Confusing or fragmented	Is it clear who should do what and how?	“konkret”, “Schritte”, “Zugang”, “Einführung”, “Handreichung” vs “unklar”, “vage”, “Verweis auf...”	Determines how well info supports implementation or adoption (RQ2 + RQ4)				

DOI Attributes	DOI Elements Present	Summary field	Multi-select based on aooearance of DOI keywords: Relative Advantage, Compatibility, Complexity, Trialability, Observability	Which attributes showed up?		Overview				
	Relative Advantage	Shows benefits of AI	free text like “reduziert Arbeitsaufwand”	Does it say AI saves time, improves teaching, or helps learners? How does the document at hand provide AI a relative advantage? How does the document emphasize AI's relative advantage? e.g. through x, AI is more intuitive than an oldschool method, which gives AI a relative advantage e.g. through platform x, AI is quicker accessible than a	“Entlastung”, “Effizienz”, “Lernfortschritt”, “individuell”, “automatisiert”, “hilft bei...”	Key predictor of AI uptake (RQ3)				

				dictionary, which gives AI the relative advantage						
	Compatibility	Fit with school context; not necessarily about the characteristics AI has, but how the institutional context makes AI's characteristics fit in	free text like "unterstützt Lehrplanziele"	Is AI said to align with curricula, goals, or values? How does this document emphasize that AI is compatible with current methods? How does this tool make AI compatible? How does this tool help integrate AI smoothly? e.g., adding an AI extension to current LMS, integrating AI into current portal, integrating AI into Lehrplan	"Medienbildung", "Rahmenlehrplan", "digitales Lernen", "Anschlussfähigkeit", "integrierbar", "verbindbar mit..."	Shows alignment with school logics (RQ3 + RQ4)				

	Complexity	Simplicity or help	free text like “Nutzung ohne technische Kenntnisse möglich”	Is it described as easy? Are supports offered? What does the document say about AI being complicated? How does this tool make AI more accessible? How does this tool make AI more understandable? e.g., providing trainings means that teachers can learn AI so that it is less complex; providing information means that AI is more understandable and doesn't seem so complex; providing a license means that no financial barriers prevent AI use, meaning the tool is easier to access;	“einfach”, “niedrigschwellig”, “keine Anmeldung”, “Vorgaben vorhanden”, “Hilfestellung”, “Fortbildung”	Indicates how the state reduces adoption friction (RQ3)				

				by having a helpdesk, teachers can ask questions to better understand and have less barriers						
	Trialability	Possibility of testing	free text like “freiwillige Teilnahme am Piloten”	Can schools or teachers try it in a small way? What does the document say about experimenting with AI? Does the instrument allow to test the tool before signing up? Does the instrument require signing up? e.g., within workshops, teachers can try AI tools; with for-free licenses that don't require signing up, teachers can test the tool before deciding if they want an account	“Pilotprojekt”, “freiwillig”, “Testphase”, “Einzelfallentscheidung”, “Erprobung”	Shows state enabling experimentation (RQ2 + RQ3)				

	Observability	Examples of use	free text like“eingesetzt an X Schulen”	Are there visible pilots, success stories, awards?	“Beispielschule”, “ausgezeichnet”, “Best Practice”, “Interview”, “Modellschule”, “Praxiseinsatz”	Makes adoption socially acceptable + spreadable (RQ3)				
	DOI Score	Summarized enabler strength	0 = No DOI attributes present 1 = One weak or vague attribute 2 = At least one strong attribute (clear, supportive language) 3 = Two or more strong DOI signals	How many strong DOI signals are present?		Enables cross-case comparison				
Notes	Additional Notes	Space for reflections, contradictions, uncertainty								

Appendix C: Website Analysis Instruments

C.1 School Website Corpus

[redacted]

[redacted]

C.2 Visibility Indicator Scheme Website Analysis

Topic	Variable	Meaning	Guiding Question	Keywords / Signals to Skim	Coding Options	Implications	Interpretation of code	Single dimension contribution	Implication on other dimensions
Metadata	School Name	Identifies the school	What is the full name of the school?		Text	Provides unique identifier for matching coded data with other sources.			
	City / District	Geographic location	Where is the school located?		Text	Supports contextual understanding; may correlate with regional digital disparities.			
	Federal State	German Bundesland	In which federal state is the school?		Text	Crucial for comparing across state-level governance structures.			
	School Type	School format	What is the school type?		Text	Helps explore variation in AI/digital use across school types.			
	Website Link	Website access	What is the full URL?		URL	Reference point for validation and auditing of coded data.			
	Website Quality	Overall quality of website	Is the site modern and up-to-date?		High = Updated, modern, well-structured site Medium = Mostly functional, some outdated content Low = Outdated, broken links, minimal maintenance	Signals school's digital maturity, communication capacity, and transparency; may indicate implementation level.	If website quality high, then information on it is more reliable; if a website quality is high and it has been recently updated but no AI indication, then it is more likely to be accurate	school governance: AI integration visibility:	

							that they school has in fact not formally integrated AI		
Digitalization	Digital Focus Level	Extent of digitalization presence on website	How prominent is digitalization? are selbstauss agen saying digitalization is a common basis, an integrated process? Does digitalization have its own place at navigation bar? Are digital badges present?	Digital strategy, digital media, digital badge, presence in navigation bar	High = Digitalization is central and clearly structured (e.g., digital strategy), has its own section, is mentioned as part of every day routines Medium = Digital media mentioned consistently across pages Low = Brief or vague mention of digital tools or concepts	Captures strategic priority of digitalization; relevant to governance and implementation depth	If digital focus on website is high, then digitalization is likely strategically integrated, which serves as an important prerequisite for AI; if digitalization in school not high, then AI is unlikely to be formally integrated in school routines	school governance: digitalization focus being high implies that AI can easier be implemented, so school enables a prerequisite for AI	If digital focus level high, it could be supported by state governance tool of infrastructure support; If digital focus level high, it builds a prerequisite for a more explicit AI integration. If digital focus level low, then integration of AI unlikely to be formal and explicit and more likely to be either informally used by staff or entirely absent.

	Digitalization Content Location	Placement of digitalization content	Where is digitalization content located?	Menu, mission, services, news	Multiple Possible: Menu = Found in main navigation tabs (e.g., 'Media & Learning') Mission = Appears in school mission or educational vision Services = Mentioned under platforms or digital offerings News = Covered in blog posts or update sections	Indicates how embedded digital topics are within school identity; contributes to governance visibility; contributes to digital focus level.	the more locations digitalization is placed, the higher the digital focus level	school governance: digitalization being represented in various locations implies that digitalization is a more integrated part in school routines, which enables AI integration	If digital content location diverse, digitalization more likely to be embedded, which implies that AI is more likely to also be formaly integrated since the digitalization prerequisite is. If digitalization is not variously represented on website, it implies digitalization is not a priority, which might mean low digitalization levels, which serves as a barrier to implementing AI in the first place – serves as a control variable to check that if digitalization low, formal AI implementation unlikely and it's not about state AI guidance but digitalization before

	Digitalization Roles	Responsibility assignment	Who is responsible for digital initiatives?	Digital officer, team	Clearly Assigned = A specific person is named responsible None = No digital role indicated	Informs formal governance typology through clarity of role assignments; contributes to digital focus level	clearly assigned digitalization officer indicates higher level of digitalization; digitalization officer means there is a direct person to contact in cases of trouble	school governance: clearly assigned officer indicates higher level of digitalization; clearly assigned officer is a support tool, which enables AI use	If digital officer is assigned, formal AI integration more likely because there is a person responsible for supporting use
	Specific Platforms Mentioned	Tool specificity	Are digital tools or platforms specified?	Moodle, Padlet	Named=Explicit tools or platforms listed (e.g., Moodle) Not Named =Generic reference to digital platforms None =No mention of platforms or tools	Reflects digital maturity and potential tool adoption pathways (usage patterns).	if specific platforms are mentioned, it implies higher level of digitalization and implies that AI more compatible with current practices	school governance: platforms mentioned implies that they are formally integrated	If platforms are mentioned, but AI is not used, then lack of digitalization cannot be the reason; more likely for AI visibility to be formaly integrated
	Digital Badges	Presence of digital certifications	Are there visible digitalization-related badges?	Fobizz, NRW	Present = A badge or award is visible Absent= No badge shown on the website	Shows external validation; contributes to legitimation and strategic positioning (governance).; contributes to digital focus level	If digital badge present, then digitalization formally integrated, which enables AI integration	school governance: indicator for indirectly enabling AI integration	If digital badge not present it should be more likely that AI is not used
	Specific Digital Badge	Specifity of digital badge	Which badge is shown	insert options that are present (like digitale schule oder sowas)	free text	to determine badge type	provides context		

	Digital Badge Type	Source of digital certification	What type of award is shown?	Fobizz, state institutions	Platform Award=Awarded by a private provider Institutional Award = Awarded by a public body (e.g., Ministry) None = No badge or source is unclear	Differentiates between institutional recognition and private endorsements; governance legitimacy signal; contributes whether vertical or horizontal coordination	if digital badge from a government project, it implies coordination between school and government; if badge from a private actor, implies horizontal cooperation	interaction between state governance and school governance	supports dimension interaction: if digital badge provided by state, it implies that school is aware of state level governance and there is no state policy - school practice gap (could still be that teachers report no use though)
AI	AI Focus Level	Visibility of AI	How prominently is AI featured?	AI, artificial intelligence	High=AI is prominently featured, e.g., as a major section Medium = Mentioned as part of broader digitalization Low = Brief or vague mention of AI None = No reference to AI found	Key indicator of AI strategic relevance; supports classification into usage and governance types.	If AI focus level on website is high, it implies that AI is formally integrated on the school governance level	School governance: a high AI focus level implies school leadership support AI integration visibility: indicator that AI is formally integrated and that there is school governance support	indicates that AI is formally integrated on the management level, which implies school support, so teachers should not have barriers to use AI

	AI Content Location	Placement of AI references	Where is AI mentioned?	Navigation, services, news	MULTIPLE POSSIBLE Menu = Found in site's navigation structure Mission = Included in the school's vision or mission Services = Listed under available services/tools News = Mentioned in school news or updates	Reveals prominence and framing of AI; relevant for typology construction; feeds into AI Focus level; reflects to what extent AI is a topic and to what extent school governance makes it visible	If AI content is visible in many places throughout the website, it implies a high AI focus level and (depending on phrasing) it is more likely that AI is formally integrated	school governance: AI being located in many different places implies school leadership support AI integration visibility: if AI a topic in navigation bar, mission, or service, then AI likely formally integrated	If content location diverse, implies that AI more likely to be used by teachers; if state governance is supportive with AI content location being diverse, it's an indicator of no policy – school level practice gap
	AI Roles	Responsibility assignment for AI	Who manages AI in the school?	AI coordinator	Clearly Assigned = A person is specifically responsible for AI None = No visible assignment of AI responsibility	Maps formal responsibility and role clarity; critical for governance structures; relevant for to what extent it is implemented and how it is governed; connects to DOI factors	If there is a dedicated AI person, then AI likely to be formally implemented and there is school management support for it	school governance: presence of dedicated AI person as asupporting factor in using AI and making it less complex AI integration visibility: presence of dedicated AI person implies formal integration on school management level	if dedicated AI role, teachers should be using AI; if state governance actively supportive, implies no policy-school practice gap

	AI Badges	Presence of AI certifications	Is there an AI-related badge?	Fobizz, AI school	Present = An AI-related badge is displayed Absent = No AI-related badge visible	Represents AI recognition and can signal maturity of engagement; reflects governance	If there is a badge, it implies formal integration of AI & school level support	school governance: badge implies that school invests enough resources to support AI integration AI integration visibility: badge implies that AI is formally integrated on the school level	If badge present, teachers should be using AI; if badge present and state governance supportive, no policy-school practice gap it goes without saying that no badge being present does not imply a policy-practice gap because there are too many other influencial factors. It simply matters if a badge is present because that signals yes. Unless explicitly stated on the website that AI is not used, any of these indicators not being present does not mean no implementation
	Specific AI Badge	Specificity of AI badge	Which AI badge is shown	insert options of AI badges that are present (such as fobizz)	free text	to determine AI badge type	contextualizes badge		

	AI Badge Type	Type of badge authority	Who awarded the badge?	State, platform	Platform Award = Issued by private platforms Institutional Award = Issued by public education bodies None = No badge or unclear source	Indicates source legitimacy and integration level (e.g., public-private ties); reflects whether vertical or horizontal coordination	if digital badge from a government project, it implies coordination between school and government; if badge from a private actor, implies horizontal cooperation	interaction between state governance and school governance	if it is a state badge, no policy-school practice gap
	Type of AI Mention	Specificity of AI tools	What kind of AI is mentioned?	ChatGPT, adaptive learning	Specific = Specific tools are named (e.g., ChatGPT) Vague = Mentions AI but does not specify tools None = Does not mention AI	Distinguishes between generic and domain-specific AI use; crucial for use pattern dimension; potential relevant for percieved relative advantage	to connect it to the attributes of the technology itself beyond whether or not there are factors that promote these attributes	just interesting for descriptive factors	descriptive analysis to show actual use
	Frequency of Mention	AI activity timeline	How recently and how often is AI mentioned?	2025, multiple mentions	Frequent =Multiple AI mentions Rare mentions = At least 1 mention None=No mention of AI	Signals implementation phase and relevance; supports diffusion analysis; reflects to what extent it is implemented	higher frequency implies that AI is a bigger topic, which (if framed positively), implies formal integration	school governance: frequency of mention implies that it is a big topic and (depending on phrasing) there must be school support AI integration visibility: frequent mentins on website imply formal AI integratio	frequent mentions imply that AI is also used by staff

								n on school level	
	Specific AI Tools Mentioned	Tool naming	Are AI tools named?	ChatGPT, Learning View	free text	Tool specificity helps map concrete usage scenarios; useful for implement ation depth.	if Ai tools are specified, then it implies school governanc e support and might be formally integrated	AI governan ce: (dependin g on phrasing) specific mentions imply school governan ce support AI integratio n visibility: specific tools mentione d implies that they are formally integrated	implies that teachers more likely to use it
Support & Partnersh ips	Partnership s	External collaborat ions	Are external partners named?	Partner names, providers	present / not present	Highlights horizontal collaborati on and external resource integration; informs governance structure; highlights whether there is external support (which facilitates integration)	if there are partnershi ps that means that there is support	AI governan ce: suport tool that enables AI integratio n AI integratio n visibility: if AI partners mentione d, AI likely to be formally integrated	implies that teachers more likely to use it

	Training & Resources	Training visibility	Is training or certification mentioned?	Workshops, training	MULTIPLE POSSIBLE Teacher trainings = indication for trainings, news aobut workshop Information portal = references to central information resources Guidance = AI specific document that can be downloaded	Indicates capacity-building efforts and institutional readiness; workshops show trialability, trainigs reduce complexity; informational newsletter articles or panels increase information and potentially increase perceived relative advantage	if there are trainings, it means that the school actively supports teachers in using it; information portal implies support but rather indirect support and teachers require more of their own initative	AI governance: support tool that enables AI integration	implies that teachers more likely to use it
	Source of Support	Origin of support	Where does support come from?	NGO, school-led, KMK	external partner / internal / state projects	indicates state-school level communication; horizontal communication	if government training initiatives are advertised it implies that school is aware of government support / that government support is communicated adequately	connection between state governance and school governance	indicates whether government support is made use of; whether schools are aware of governance support
	Implementation Level	Whether AI is explicitly integrated in daily practices	Is it explicitly mentioned that AI is integrated?	mention of pilot projects, mention to what extent AI is integrated into daily routines	Explicit = Clear, formal confirmation Absent = Status unknown, cannot assume non-use	verifies indicators of whether AI is formally integrated	if explicitly said AI is formally integrated, then no need to speculate	AI integration visibility: confirms it	if it explicitly says AI is integrated into practices, then teachers more likely to use it

Appendix D: Online Survey Materials

D.1 Survey Questionnaire

(Translated from German with generative AI)

Overview

- **Section 1 – Survey Context & GDPR**
- **Section 2 – School Context**
- **Section 3 – Digital Infrastructure & Vision**
- **Section 4 – Use of AI Tools (if general AI usage was answered "Yes")**
- **Section 5 – Introduction and Organization of AI at School**
- **Section 6 – No Current AI Use (if general AI usage was answered "No")**
- **Section 7 – Perception, Training, and Future Planning**
- **Post-Submission Screen – Thank You!**

Section 1 – Survey Context & GDPR Dear Participant,

Thank you for taking the time to complete this survey.

This survey is part of my Master's thesis on the use of Artificial Intelligence (AI) in secondary schools in Germany. The aim is to better understand what types of AI are being used, how they are implemented, and what factors influence their adoption.

Even if no AI tools are currently being used at your school, your feedback is still valuable. "No AI use" is also a form of implementation and contributes to a complete picture.

The survey takes about 10 to 15 minutes to complete and is conducted in accordance with the EU General Data Protection Regulation (GDPR). Participation is voluntary and you may stop at any time without giving a reason. All responses will be used solely for academic purposes. No personal data will be published.

You have the right to request the deletion of your data at any time. Participants must be at least 18 years old.

If you have any questions or would like to receive a summary of the results, feel free to contact me:

Lea-Marie Schmidt
Email: lschmidt@student.ibei.org
Institut Barcelona d'Estudis Internacionals & Central European University

Multiple Choice: Do you agree to participate in this survey under the conditions described above? *
- Yes, I agree
- No, I do not agree (please close this window)

Section 2 – School Context In this section, you will be asked to provide some general information about your school. Providing the federal state is required, as it is central to the analysis.

All other school-related details – e.g., your role at the school, school name, or location – are voluntary. They help contextualize responses (e.g., by school type or region). Providing the school name can also help consolidate multiple responses from the same school.

This data is for internal analysis only and no identifiable information will be published.

Multiple Choice: What is your role at your school? *
(Please select the option that best describes your current position.) - Principal / Head of School
- Deputy Principal
- Administrative Staff (e.g., front office)
- Teacher with leadership duties (e.g., department head, digital coordinator)
- Teacher (without leadership role)
- Other:

Short Answer: School name or school ID

Short Answer: City

Short Answer: Postal code

Dropdown: Federal State - Baden-Württemberg - Bavaria - Berlin - Brandenburg - Bremen - Hamburg - Hesse - Mecklenburg-Vorpommern - Lower Saxony - North Rhine-Westphalia - Rhineland-Palatinate - Saarland - Saxony - Saxony-Anhalt - Schleswig-Holstein - Thuringia

Multiple Choice: What type of school best describes your school?
(Please select the option that best fits. If none apply or your school combines types, select "Other.") - Gymnasium (academic secondary school)
- Comprehensive School
- Realschule (intermediate secondary school)
- Hauptschule (basic secondary school)
- Vocational School
- Other:

Multiple Choice: Approximately how many students are currently enrolled at your school?
- Fewer than 300
- 300–499
- 500–699
- 700–899
- 900–1109
- 1100–1299
- 1300 or more
- I don't know / can't estimate

Multiple Choice: Approximately how many staff members are currently employed at your school?
(This includes teachers, administrative staff, and educational support personnel.) - Fewer than 30
- 30–49
- 50–69
- 70–89
- 90–1109
- 110–129
- 130 or more
- I don’t know / can’t estimate

Section 3 – Digital Infrastructure & Vision

This section focuses on the digital infrastructure at your school and any strategies or frameworks for digitalization. These insights help assess how well your school is prepared for new technologies such as Artificial Intelligence (AI).

The term “digital” here refers to common teaching and learning tools like smartboards, laptops, or digital platforms (e.g., Moodle, IServ).

Only the last question in this section directly addresses AI tools.

Multiple Choice Matrix:

How would you rate the following aspects of digital infrastructure and support for digital teaching at your school?
(Based on your everyday experience. If something is not available, choose “Not available.”)

	Excellent	Good	Okay	Poor	Inadequate	Not available
Internet access quality (Wi-Fi)						
Digital classroom equipment						
Devices for teachers						
Devices for students						
Access to digital platforms						

Infrastructure reliability

IT support availability

Training for digital tools

Multiple Choice:

Is there a dedicated contact person or coordinator for digitalization or media development at your school?

- Yes
- No
- In planning
- Not sure

Does your school have a written digital strategy or mission statement?
(e.g., a document outlining goals, principles, and approaches for digital teaching and learning)

- Yes
- No
- Not sure

Multiple Choice (select all that apply):

How are digital tools (non-AI) currently integrated into your school's daily routine?

- Digital tools are an established part of teaching school-wide
- Digital tools are used regularly in specific subjects or grades
- Digital tools are used occasionally (e.g., only in projects)

- Digital tools are used regularly in administration and communication
- Digital tools are used occasionally in administration and communication
- Digital tools are not currently used
- Not sure

Definition – AI-based Tools

In this survey, AI-based tools refer to digital applications that use artificial intelligence to automatically generate, adapt, analyze, or respond to content.

These tools are often used for tasks such as:

- Generating or adapting texts, tasks, or feedback
- Responding to questions in chat-like formats
- Supporting planning, teaching, personalized learning, or assessment

Examples include:

- Educational AI platforms like Bettermarks, fobizz KI, or schulKI
- General-purpose AI tools like ChatGPT (OpenAI), Google Gemini, Microsoft Copilot

This survey focuses on the use of such tools by school staff – including teachers, administrators, or school leadership. AI tools used by students are also relevant if they are introduced or guided by school personnel.

Multiple Choice:

Are AI-based tools currently being used by school staff at your school?

- Yes, school-wide
- Yes, in specific subjects and/or grades
- Yes, informally by individual staff
- No

- Not sure

Section 4 – Use of AI Tools *(if general AI use was answered "Yes")*

This section looks at how AI tools are being used at your school. The focus is on use by staff, but tools used by students are included if guided by school staff.

The survey covers both:

- **AI in education (AIED)** – e.g., fobizz, schulKI, adaptive learning tools
- **General-purpose AI (GPAI)** – e.g., ChatGPT, Microsoft Copilot

Responses may be based on your own experience or general awareness of your school's practices.

Checkboxes:

Which AI-based tools are currently used by staff at your school? (Select all that apply)

- Bettermarks
- fobizz
- schulKI
- Sofatutor
- ChatGPT (OpenAI)
- Google Gemini
- Microsoft Copilot
- Not sure
- Other:

Multiple Choice Matrix:

How are these tools accessed or licensed? (Select the applicable type for each tool; choose "Not applicable" if not in use.)

Tool	State license	School license	Private paid	Free version	Not sure	Not applicable
Bettermarks						
fobizz						
schulKI						
Sofatutor						
ChatGPT (OpenAI)						
Google Gemini						
Microsoft Copilot						

Short Answer:
If you selected “Other,” please describe how access to that tool is provided or licensed.

Checkboxes:

For which tasks are AI tools used at your school? (Select all that apply)

Teaching Preparation

- Lesson planning (e.g., idea generation, outlines)
- Creating worksheets or tests
- Researching topics for class

In-Class Use

- Real-time student support (e.g., AI assistance during class)
- Personalized exercises (e.g., adaptive learning)
- Using AI chatbots in discussions (e.g., ChatGPT for group work)

Assessment & Feedback

- Learning analytics / tracking progress

- Automated grading (e.g., with rubrics)
- Plagiarism detection

Administrative / Organizational

- Scheduling (classes, rooms)
- Writing emails or parent letters
- Writing report cards or performance feedback
- Not sure
- Other:

Multiple Choice Matrix:

How often are AI tools used for these tasks by staff? (Estimate overall frequency; general impression is sufficient)

Task Category	Frequently	Occasionally	Rarely	Never	Not sure
Teaching preparation					
In-class application					
Assessment and feedback					
Administrative / organizational use					

Checkboxes:

Why do staff at your school use AI tools? (Select all that apply)

- To reduce workload and improve efficiency
- To manage large or growing class sizes
- To address staff shortages
- To support personalized student learning

- To promote digital literacy and future-readiness
- Due to innovation initiatives or funding programs
- Not sure
- Other:

Multiple Choice Matrix:

What impact has AI had in the following areas? (Select based on perceived outcomes)

Area	Positive change	No change	Negative change	Not sure
Lesson organization & processes				
Staff motivation				
Student engagement				
Student performance				
Administrative workload				

Section 5 – Implementation and Organization of AI at the School

This section explores how AI tools are introduced and structured within schools. It looks at whether use is formal or informal, initiated top-down or bottom-up, and whether it is school-wide or limited to certain subjects or grades. It also asks about rules or guidelines for AI use.

Multiple Choice:

How is AI currently structured at your school?

- School-wide – across all departments and grades
- Subject-specific – primarily in specific subjects (e.g., Math, English)
- Grade-specific – primarily in specific year levels

- Individual – initiated by individual teachers
- Pilot project – limited use in trial settings
- Not sure

Checkboxes:

Who initiated AI use at your school? (Select all that apply)

- School leadership
- Department heads
- Individual teachers
- State / Ministry of Education
- External providers / companies
- Students
- Not sure
- Other:

Multiple Choice:

Are there official policies or guidelines regarding AI use at your school? (Applies to staff and students)

- Yes, there is a clear school-wide policy
- Yes, there are official guidelines that provide orientation
- Yes, at department/year level only
- No official policy, but informal agreements
- No rules or agreements
- Not sure

Checkboxes:

What are the main barriers to broader or more effective AI use at your school? (Select all that apply)

- AI is already widely and effectively used
- Lack of technical infrastructure
- Lack of funding or licenses
- Low staff interest
- Data privacy or security concerns
- No pedagogical benefit
- Lack of or inadequate training opportunities
- Low leadership engagement or support
- No clear school-wide strategy or guidance
- Not sure
- Other:

Section 6 – No Current AI Use (if general AI use was answered “No”)

This section is for participants whose schools do not currently use AI. It explores why that is the case, whether future interest exists, and whether any discussions or rules about AI have started.

Checkboxes:

What are the main reasons AI tools are not used at your school? (Select all that apply)

- Lack of technical infrastructure
- Lack of funding or licenses
- Low staff interest

- Data privacy or security concerns
- No recognizable pedagogical benefit
- Lack of or insufficient training opportunities
- Low leadership engagement or support
- No clear school-wide strategy or vision
- Not sure
- Other:

Multiple Choice:

Is there general interest in using AI in the future?

- Yes
- No
- Not sure

Multiple Choice:

Are there any rules or guidelines on AI use at your school?
(Applies to both staff and students. Includes policies restricting or banning AI use.)

- Yes, a clear school-wide policy exists
- Yes, official guidelines are in place as orientation
- Yes, subject/year-level rules exist
- No official rules, but informal agreements exist
- No rules or agreements
- Not sure

Section 7 – Perception, Training, and Future Planning

This final section applies to all participants. It collects general attitudes toward AI, availability of training, and future plans for using AI. Some questions are reflective and optional.

Multiple Choice:

How would you describe the leadership's general attitude toward AI in education?

- Actively supportive
- Generally open, but cautious
- Neutral / wait-and-see
- Reserved or skeptical
- Opposed
- No unified stance
- I cannot assess
- Other:

Multiple Choice:

How is AI use perceived by the staff?

- Mostly positive, seen as helpful and future-oriented
- Mixed – some are open, others skeptical
- Mostly skeptical or negative
- Not yet discussed
- I cannot assess

Multiple Choice:

Are there training opportunities for school staff on AI tools?
(Includes internal and external courses or webinars.)

- Yes, internal in-person training (e.g., school workshops)
- Yes, external in-person training (e.g., seminars from providers)
- Yes, digital training (e.g., online courses, webinars)
- No training currently offered
- Not sure

Multiple Choice Matrix:

Would you like to use AI more often or learn how to use it effectively? (Indicate how each statement applies to you.)

Statement	Applies	Partially applies	Does not apply	Not sure
I regularly and purposefully use AI tools				
I feel confident using AI tools in my role				
I would like to use AI tools more frequently				
I want to learn how to use AI tools more effectively in education				
I want to better understand available AI tools for education				
I am currently not interested in using AI tools				

Open Textbox:

Use this space for any additional comments, clarifications, or aspects not yet covered that are important to you.

Post-Submission Screen – Thank You!

Thank you for participating in the survey!
Your responses have been successfully submitted.

To deepen the insights gained from this survey, I would like to conduct short, voluntary follow-up interviews with selected participants. These interviews will complement the quantitative data and provide valuable insights into practical school experiences.

If you are interested in participating in such an interview, please click the link below to securely submit your contact information. Your survey responses will remain completely anonymous and cannot be linked to your identity.

https://leamschmidt.limesurvey.net/423965?lang=de

Appendix E: Typology Construction Framework

E.1 State Governance Dimensions & Scoring System

Typology	Dimension	Description	Based On	Aggregation Process	Scoring Structure	Sub-Element (if applicable)	Criteria	Points
State Governance	Adopter Type	When and how AI was first addressed	Publication Date, AI Type Mentioned	Look at the earliest Publication Date per state. Cross-check with AI Type Mentioned (GPAI vs AIEd).	Innovator = Pre-2021 + AIEd Early Adopter = 2021–2022 + AIEd/Mixed Early Majority = 2022–2023 + GPAI Late Majority = 2024–2025 Laggard = No clear AI docs			
State Governance	Governance Instrument Diversity	How many different instruments are used	Instruments Mentioned	Count number of different instrument types mentioned	High = 6–7 tools (3 pts) Medium = 3–5 tools (2 pts) Low = 1–2 tools (1 pt) None = 0 tools (0 pt)			
State Governance	Instrument DOI Influence	How strongly instruments enable DOI attributes	Instruments Mentioned	Assign each instrument a DOI Score (0–2) based on how many DOI attributes it supports. Sum total per state.	High = 7–10 pts (3) Medium = 4–6 pts (2) Low = 1–3 pts (1) None = 0 pts (0)	Licensing Infrastructure Training Guidelines Pilot Projects Support Personnel Communication Strategy	.+Relative Advantage, +Trialability (2) +Compatibility, -Complexity (1) +Rel. Advantage, -Complexity (2) +Compat., -Complexity (1) +Trialability, +Observability (2) -Complexity (1) +Observability, +Rel. Advantage (1)	
State Governance	Governance Instrument Score	Combined tool breadth and DOI impact	Governance Instrument Diversity + DOI Influence	Add points from both sub-scores	Comprehensive Supporter = 5–6 Moderate Enabler = 3–4 Minimal Promoter = 1–2 Non-Involved = 0			
State Governance	Strategic Framing	Tone and emphasis of AI framing	AI Focus Level, AI Framing, Framing Quote, Document Title	Use modal or average values across documents	Proactive = High focus + Positive/Balanced Neutral = Medium/Vague Risk-averse = Negative or Low/None			
State Governance	School Autonomy	Mandate vs. ena	Degree of Implementation A	Modal value of autonomy variable, adjusted by presence of enabling instruments	Top-down = Binding only Hybrid = Encouraged + supports Autonomous = Optional + multiple supports			
State Governance	Communication Structure	How well-structi	Number of Documents, Do	Score 1 pt per met criterion	High = All 3 (3 pts) Medium = 2 (2 pts) Low = 1 (1 pt) None = 0	Documents ≥5 Diverse formats Includes Portal/Webpage	≥5 docs 2+ structured types Includes portal	1 pt each
State Governance	Usefulness for Implementation	How usable the	Comm. Clarity, Roles & Res	Score 1 pt per criterion met	High = All 3 (3 pts) Medium = 2 (2 pts) Low = 1 (1 pt) None = 0	Clarity ≥1.5 Roles clear Handreichung present	≥1.5 clarity Roles: Yes/Partial Includes FAQ/steps	1 pt each
State Governance	Communication Score	How visible, acc	Comm. Structure + Usefulr	Add both sub-scores (out of 6)	High = 5–6 Medium = 3–4 Low = 1–2 Very Low = 0			

E.2 Website Governance Types & Scoring System

Typology	Label	Description	Coding Interactions
AI Integration (Visibility)	School level formal Integration into daily practives	Independently of whether or not AI is made use of by staff in daily practices, it is formally integrated by the school management	AI Badge present OR Dedicated AI Person present OR Implementation explicitly stated on website OR AI part of website menu OR Specific Tools mentioned (excl. ChatGPT)
	Informally Addressed	AI is only mentioned in news or vague sections	AI addressed in news or without naming specific AI tools AI tools not specified but just vaguely mentioned ChatGPT addressed
	Absent	Explicitly mentioned that AI is not used at the school	Explicitly mentioned on website
	No AI presence evidence	No discernible mention of AI on website	AI Focus Level None
School leadership support	Coordinated Facilitator	School offers training, guidance, or identifies roles.	Training present AI / Digital role present Specific AI tool available Guidelines that can be downloaded
	Passive Permitter	Offers passive resources (e.g., downloads, guidance, news).	AI mentioned in news Information is visible
	No enabling evidence	No support or structure visible on website.	Roles & Support indicators not present

E.3 Survey Typologies

E.3.1 Survey Scoring Systems

Typology	Dimension	Description	Based On Variables	Aggregation Process	Scoring Structure	Sub-Element (if applicable)	Criteria	Points
School Governance	Digital Enablement (Structural)	Broader enabling digital structures in the school	Infra_Overall, DigiCoord, Strategy	Addition of Digital Context components	3 max	Infra_Overall DigiCoord Strategy	Medium-High OR High Clearly assigned Present	1 pt each
School Governance	Licensing Presence & Scope	Whether school/state licenses exist and how many tools are institutionally licensed	Institutional_Licenses	Check number of school/state licensed tools	1 = 1pt >1 = 2pt			
School Governance	AI Structure Type	Degree of formalization of AI usage structure	AI_Structure	Assign based on structured use coding	School-wide = 2 pts Subject-limited = 1 pts None = 0 pts			Max 2 pts
School Governance	Training Availability	Availability of internal/external training on AI tools	AI_Training	Check if any form of training exists	Yes = 2pt Partial = 1pt			Max 1 pt
School Governance	Leadership Perception	How supportive school leadership is toward AI adoption	AI_LeaderAtt	Score based on selected attitude category	Positive – Active= 2 pts Positive – Cautious = 1pt Fragmented = 0			Max 2 pts
School Governance	Initiator	Whether school leadership influenced initiation	AI_Initiatiors	Score based on whether top-down is present	Top-down – Leadership = 1pt			
School Governance	Barrier Type (Penalty)	Whether governance-related barriers exist	AI_Barriers_General	If either "Low leadership support" or "No school-wide strategy" are selected	max minus 1.5	AI_Barriers_General AI_Barriers_General	Leadership Lack of Strategy	minus 1 pt minus 0.5pts
School Governance	Innovation Driver (Bonus)	Whether innovation mandates triggered AI use plus whether there are no barriers perceived	AI_Barriers_General, AI_Reasons	Check if reason includes policy or innovation program + If barrier is "AI is already used extensively and effectively"	max plus 1	AI_Barriers_General	No barrier	1 pt

Typology	Dimension	Description	Based On Variables	Aggregation Process	Scoring Structure	Sub-Element (if applicable)	Criteria	Points
AI Integration	AI Structure Type	How widely AI is used across the school	AI_Structure	Use declared structure type as assigned in coding	School-wide = 3 pts Subject-limited = 2 pts Individual-driven = 1 pt None = 0 pts			
AI Integration	Regulation	Degree of formal rules or guidance for AI use at school level	AI_Regulation	Use declared regulation type as assigned in coding	School-wide Rules = 3 pts School-wide Guidance = 2.5 pts Partial Guidance = 2 pts Informal = 1 pt None = 0 pts			
AI Integration	Licensing	Whether AI tools are officially licensed or used informally	Type_License	Assign 1 pt for any school/state license, 0 for private/free use only	State Licensed OR School Licensed = 1 pt Private/free = 0 pts		at least 1 institutional license present	Max 1 pt
AI Integration	Visible Support Structures	Whether support exists to sustain AI use	AI_Training, Digital_Coord, Institutional_Licenses	addition of scores for each component	3 max	Digi_Coord AI_Training AI_Training Institutional_Licenses	Clearly Assigned Yes Partial >1	1pt 1pt 0.5pts 1pt
	Barrier Free (Bonus)	Self-report that AI is already being used	AI_Barriers_General	Assign bonus point if selected	No barrier = 1pt			

Typology	Dimension	Description	Based On Variables	Aggregation Process	Scoring Structure	Sub-Element (if applicable)	Criteria	Points
AI Use	Use Frequency	How regularly AI tools are used across different task domains	AI_TaskFreq_Prep, AI_TaskFreq_Instruction, AI_TaskFreq_Assessment, AI_TaskFreq_Admin	Average use value across all 4 domains (Teaching Preparation, In-Class Use, Feedback/Assessment, Administrative Use)	Avg = 3 → 3 pts Avg = 2 → 2 pts Avg = 1 → 1 pt Avg = 0 → 0 pts	Average of (AI_TaskFreq_Prep, AI_TaskFreq_Instruction, AI_TaskFreq_Assessment, AI_TaskFreq_Admin)	High Medium Low	3 pts 2 pts 1 pt 0 pts
AI Use	Task Scope	Number of different task categories AI is used for	Task checkbox list	Count selected task types (e.g. feedback, test creation, personalization)	3+ tasks = 3 pts 2 = 2 pt 1= 1 pt 0 = 0 pts			3 pts 2 pts 1 pt
AI Use	Tool Scope	Number of different AI tools used	AI tool checkbox question	Count total tools used	3+ tools = 3 pts 2 = 2 pt 1= 1 pt 0 = 0 pts			3 pts 2 pts 1 pt
AI Use	Reason Variety	How many different use motivations are selected (functional, not attitudinal)	"Reasons for using AI" checklist	Count number of reasons selected	3+ reasons = 2 pts 1–2 = 1 pt 0 = 0 pts			Max 2 pts
AI Use	Behavioral Bonus	Explicit declaration of being a regular, goal-oriented AI user	Final perception matrix statement: 'Ich nutze KI regelmäßig und zielgerichtet'	If selected → add 1 bonus point	.+1 pt if selected			+1 pt (bonus)

Typology	Dimension	Description	Based On Variables	Aggregation Process	Scoring Structure	Sub-Element (if applicable)	Criteria	Points
Digitalization	Digital Infrastructure Quality	Overall strength of technical infrastructure and support	Infrastructure matrix (Section 3)	Convert each sub-item to numeric value (0–5) and average across items	Avg. 4.5–5 = 3 pts Avg. 3.5–4.4 = 2 pts Avg. 2.5–3.4 = 1 pt Below 2.5 = 0 pts	WLAN, teacher devices, student devices, IT support, platforms, reliability, etc.	Survey item quality scale (excellent–none)	Max 3 pts
Digitalization	Digital Coordinator Present	Whether a clear digital leadership role exists	Coordinator role question	Binary value	Yes = 1 pt No/In planning/Unsure = 0 pts			1 pt
Digitalization	Written Digital Strategy	Whether a digitalization concept or vision is in place	Strategy/vision question	Binary value	Yes = 1 pt No or unsure = 0 pts			1 pt
Digitalization	Tool Integration Scope	How broadly digital tools are embedded across the school	Digital tool integration (checkbox)	Code tool scope into levels	School-wide = 2 pts Subject/year = 1 pt Occasional or no use = 0 pts			Max 2 pts

AI Perception	Openness & Motivation	Self-reported confidence, interest, and willingness to use AI	Motivation matrix (items 2–5)	Each item: Trifft zu = 2 pts, Teilweise = 1 pt, Other = 0 pts; sum total	0–8 pts total	Confidence, Desire to Use More, Learning Interest, Tool Exploration Interest	Each matrix item scored and summed	Max 8 pts
AI Perception	Perceived Impact (Adjusted)	Perceived educational effects of AI (positive or negative)	Impact matrix (teaching, students, admin, etc.)	+1 pt for each positive impact, –1 pt for each negative impact, 0 for no change or unsure	–5 to +5 pts depending on answers	Teaching, Student Motivation, Performance, Admin Load, Staff Morale	Positive = +1, Negative = –1, No change or unsure = 0	–5 to +5 pts
AI Perception	Attitudinal Barriers	Explicit rejection of AI's value or staff disinterest	Barrier checklist (Geringes Interesse, Kein pädagogischer Mehrwert)	–2 pts per selected item	–4 to 0 pts	Belief that AI lacks value, low interest in school staff	Each of the two items reduces total score by 2 pts if selected	–2 pts each
AI Perception	Behavioral Bonus	Bonus for declared regular, purposeful AI use	Motivation matrix item 1: 'Ich nutze KI regelmäßig und zielgerichtet'	+1 pt if selected	Add 1 bonus pt to total score	Behavioral Confirmation	Trifft zu = +1 pt	+1 pt
AI Perception	Experience Bonus	Bonus for confirming AI is already used effectively at school	Barrier item: 'KI wird bereits effektiv eingesetzt'	+1 pt if selected	Add 1 bonus pt to total score	School-level implementation recognition	Selected = +1 pt	+1 pt

E.3.2 Survey Types

	Type	Total Score Range	Interpretation
AI Integration Level	**Formally Integrated**	8.5 – 10	School-wide use, formal regulation, institutional license, and strong support
AI Integration Level	**Partially Integrated**	5.0-8.9	Department- or subject-level use, some rules/guidelines, moderate support/licensing
AI Integration Level	**Informally Addressed**	1.0-4.9	informal agreements or weak support or informal agreements or individual structure
AI Integration Level	**Not Addressed**	0-0.9	No confirmed use, no structure, no rules, no licensing or support
School Governance Type	**Strategic Enabler**	9.0-10.0	Leadership is proactive; guidelines exist; staff support (roles + training) is in place; licensing coordinated
School Governance Type	**Coordinated Facilitator**	6.0-8.9	Leadership is open/supportive, but formal governance is mixed (some roles or guidelines)
School Governance Type	**Passive Permitter**	3.0-5.9	Leadership is neutral or non-blocking; no clear structures, but staff may act individually with limited support
School Governance Type	**Unstructured / Isolated**	0-2.9	No visible leadership stance; no coordinator; no training or guidelines; little to no governance evident
AI Use Type	**Embedded User**	9–11	High-frequency, high-diversity, multi-tool, institutionally supported user
AI Use Type	**Regular User**	5–8	Uses AI regularly across a few key tasks; likely uses 1–2 tools often
AI Use Type	**Experimental User**	2–4	Has tried AI tools; low frequency, task-limited, may rely on personal license
AI Use Type	**Non-user / Passive**	0–1	Rare or no AI use; low awareness, motivation, or access
Digitalization Level (Control)	**High Digitalization**	6–7	Strong infrastructure + coordination + strategic embedding
Digitalization Level (Control)	**Moderate**	4–5	Some structure and quality, but with limitations
Digitalization Level (Control)	**Low**	2–3	Fragmented or emerging digital capacity
Digitalization Level (Control)	**Minimal / None**	0–1	No real digital groundwork; major structural gaps
Personal Perception (Control)	**Highly Positive**	11–13	Very confident and motivated; perceives strong impact; may already use AI regularly
Personal Perception (Control)	**Moderate Openness**	7–10	Positive interest and perceived benefit, but not yet deeply engaged
Personal Perception (Control)	**Tentative / Curious**	3–6	Mild interest or early-stage curiosity; limited experience or confidence
Personal Perception (Control)	**Low Engagement**	0–2	Little interest or belief in AI's usefulness; likely non-user

Appendix F: Ethical Review

F.1 Ethical Review Form

INSTITUT BARCELONA ESTUDIS INTERNACIONALS

MA Thesis Proposal Ethical Review Form

Student Information

Full name: Lea-Marie Schmidt

Email Address: lschmidt@student.ibei.org

Program of Study: Erasmus Mundus Master's in Public Policy

Research Overview

Tentative Thesis Title: Artificial Intelligence in German Secondary Schools: A Plausibility Probe into Usage, Implementation, and Institutional Contexts

Research Question(s): What are the different approaches to AI implementation in schools, and what factors influence these AI implementation approaches?

Research Objectives:

- Identify and categorize the different approaches to implementing AI in schools
- Collect and analyze data on how these approaches are applied in real-world school contexts
- Explore and evaluate the factors that influence the choice of different AI implementation approaches

Methodology (including research design, data collection methods, and data analysis techniques):

- **Research design**: Mixed-methods case study exploring the use and implementation of AI tools in German secondary schools (plausibility probe)
- **Data collection methods**: Primary data will be collected through a structured online survey and follow-up interviews. Secondary data will be collected through publicly available school websites and documents.

- **Survey**: structured questionnaire distributed to school leadership and teaching staff
  - § Includes both closed and open-ended questions on AI tool use, implementation practices, digital infrastructure, attitudes, and perceived impacts; Estimated completion time: 10–15 minutes
  - § **Analysis:** Quantitative data will be analyzed descriptively (e.g., frequencies, cross-tabulations) and exploratorily for correlations between key variables (e.g., policy presence and usage patterns); Open-text responses will be analyzed thematically
- **Interviews**: short, semi-structured follow-ups with a small number of participants
  - § Goal: add qualitative depth and contextual understanding
  - § Duration: approx. 20–40 minutes
  - § **Analysis**: Interviews will be recorded and transcribed (with consent), then coded thematically
- **Document/Website analysis:** review of school websites and any available digital strategy documents
  - § Goal: complement survey/interview data with public framing and institutional context
  - § **Analysis**: light thematic review to identify patterns (e.g., digital priorities, public positioning)

Ethical Considerations:

1. **Does your research involve human participants? (Yes)**

If yes, briefly describe the nature of their involvement and the methods of data collection:

Participants will include school staff (e.g., principals, department heads, teachers, and administrative personnel) from German secondary schools. They will be invited to complete an online survey about the use of AI tools in their schools. A subset of participants may also take part in short, voluntary follow-up interviews to provide further context. Data will be collected through a structured online form (currently through Google Forms, but I'm looking into a survey tool that does not require anyone to sign in with an account; potentially Survey Monkey) and, where applicable, through recorded interviews (with prior consent).

2. **Does your research involve collecting, using, or disclosing sensitive data or information? (No)**

If yes, briefly describe the nature of the sensitive data or information:

Note: The survey collects institutional (not personal) information, such as the name and type of school (which is still left as an optional question), but no sensitive personal data (e.g., health, political views, or identifiable student information).

3. **Does your research involve vulnerable populations? (No)**

If yes, identify the vulnerable population(s) and explain why they are considered vulnerable:

Note: Participants are professionals acting in their institutional roles. The research does not involve minors.

4. **Is there a potential for physical, psychological, or emotional harm to the research participants? (No)**

If yes, describe the potential risks and how you plan to mitigate them:

5. **Are there any additional ethical considerations specific to your field (e.g., International Security or International Development)? (No)**

If yes, describe the specific ethical considerations and how you plan to address them:

Informed Consent and Data Protection:

1. Explain how you will obtain informed consent from the research participants (if applicable):

Participants will be provided with a detailed introduction at the start of the survey, outlining the purpose of the study, how their data will be used, and their rights (including the right to withdraw at any time). They must actively agree to a data policy before accessing the survey. For interviews, written consent will be obtained prior to participation, and participants will have the option to remain anonymous in any reporting.

2. Describe the measures you will take to ensure the anonymity and confidentiality of the research participants and their data:

No names or personal contact details will be linked to survey responses. If participants volunteer for follow-up interviews, contact details will be collected via a **separate form** (there is a link for the separate form in the post-submission screen) to ensure that survey data remains anonymous. All data will be stored securely on password-protected devices. Any potentially identifying information will be pseudonymized or removed before analysis and reporting.

Declaration:

I declare that the information provided in this form is accurate and complete to the best of my knowledge. I understand that providing false or misleading information may result in the rejection of my thesis proposal or other disciplinary actions. If any ethical considerations arise during the course of my research, I commit to informing my supervisor and the IBEI ethics coordinator immediately.

Student Signature: 

Date: 22.05.2025

Please submit this completed form to **Tutku Ayhan (tayhan@ibei.org)** for further review by the IBEI ethics coordinator.

F.2 Ethical Approval

This section is to be completed after review only
Thank you for your application. We have completed the review process and can offer a favorable opinion, contingent upon the supervisor's continued guidance in the research and development of interview questions, as well as the student's use of the provided informed consent form during participant recruitment. Name of reviewer: Tutku Ayhan Date: 26 May 2025

Appendix G: Survey Scores

G.1 Survey Scores Typology

		AI Integration		School Governance		AI User Type		Digitalization Level		Personal Perception	
School ID	State	Score Int	AI Integration Level	Score Gov	School Governance Type	Score Us	AI Use Type	Score Dig	Digitalization Level	Score Pe	Personal Perception
1	Berlin	2	Informally Addressed	4	Passive Permitter	3	Experimental User	4	Moderate	8	Moderate Openness
2	Hamburg	5,5	Partially Integrated	6,5	Coordinated Facilitator	6	Regular User	3	Low	7	Moderate Openness
3	Berlin	3	Informally Addressed	4,5	Passive Permitter	3	Experimental User	4	Moderate	6	Tentative/Curious
4a	Hamburg	5	Partially Integrated	7	Coordinated Facilitator	5	Regular User	6	High	11	Highly Positive
4b	Hamburg	4	Informally Addressed	6	Coordinated Facilitator	4	Experimental User	6	High	8	Moderate Openness
4c	Hamburg	4	Informally Addressed	6	Coordinated Facilitator	5	Regular User	6	High	9	Moderate Openness
4d	Hamburg	8	Formally Integrated	9	Strategic Enabler	6	Regular User	6	High	8	Moderate Openness
5	Berlin	6	Partially Integrated	7	Coordinated Facilitator	4	Experimental User	3	Low	8	Moderate Openness
6	NRW	0	Not Addressed	1	Unstructured/Isolated	0	Non-user/Passive	4	Moderate	2	Low Engagement
7	NRW	6	Partially Integrated	7,5	Coordinated Facilitator	6	Regular User	6	High	8	Moderate Openness
8	NRW	6,5	Partially Integrated	9	Strategic Enabler	6	Regular User	7	High	9	Moderate Openness
9	NRW	3	Informally Addressed	4	Passive Permitter	3	Experimental User	4	Moderate	7	Moderate Openness
10	NRW	0	Not Addressed	2	Unstructured/Isolated	0	Non-user/Passive	2	Low	5	Tentative/Curious
11	NRW	0	Not Addressed	1	Unstructured/Isolated	0	Non-user/Passive	2	Low	2	Low Engagement
12a	NRW	6	Partially Integrated	9,5	Strategic Enabler	6	Regular User	6	High	8	Moderate Openness
12b	NRW	8,5	Formally Integrated	9,5	Strategic Enabler	9	Embedded User	7	High	12	Highly Positive
12c	NRW	3	Informally Addressed	4	Passive Permitter	3	Experimental User	6	High	2	Low Engagement
12d	NRW	8,5	Formally Integrated	9,5	Strategic Enabler	9	Embedded User	7	High	8	Moderate Openness