

Datafication Of Education And Pedagogical Practices: Learning Analytics, Assessment, And Teacher Autonomy In An Integrative Literature Review

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Abstract

Background: Datafication of education has become a central phenomenon in contemporary educational contexts, as the expansion of digital platforms, virtual learning environments, and monitoring systems has increasingly transformed pedagogical interactions, student performance, and learning trajectories into analyzable data. This process has intensified debates about its effects on pedagogical practices, assessment processes, and teacher autonomy, especially in relation to control, performativity, and the growing use of learning analytics in education.

Methods: This study was conducted as an integrative literature review with a qualitative and descriptive-analytical approach. Searches were carried out in the SciELO, Scopus, CAPES Journals, PubMed, and CAFÉ databases, using descriptors in Portuguese and English combined with Boolean operators. Full-text scientific articles published within the last five years and directly related to datafication of education, learning analytics, assessment, and teacher autonomy were selected and analyzed.

Results: *The findings made it possible to identify four central analytical axes in the recent literature: the reconfiguration of pedagogical practices, the monitoring of learning through learning analytics, data-oriented assessment, and tensions surrounding teacher autonomy. The studies indicate that the growing centrality of data in educational settings may support more continuous monitoring, early identification of learning difficulties, and expanded feedback possibilities. At the same time, the literature highlights risks related to standardization, performative rationality, and the strengthening of control mechanisms over pedagogical work.*

Conclusion: *Datafication of education has the potential to qualify teaching and learning processes when incorporated in a critical, ethical, and pedagogically oriented manner. However, its adoption should not reduce education to technical monitoring and measurable performance. The literature suggests that the educational use of data needs to remain subordinate to formative purposes, contextual interpretation, and the preservation of teacher autonomy and the complexity of educational relationships.*

Keywords: *datafication of education; learning analytics; educational assessment; pedagogical practices; teacher autonomy.*

Date of Submission: 05-04-2026

Date of Acceptance: 15-04-2026

I. Introduction

The datafication of education has become a central phenomenon in the contemporary educational landscape, as the expansion of digital platforms, virtual learning environments, and monitoring systems has increasingly transformed pedagogical interactions, school performance, and learning trajectories into analyzable data. This movement represents not merely a technical innovation, but a broader transformation that affects the organization of teaching, the ways assessment is conducted, and the role of teachers in pedagogical decision-making, thereby raising scientific and social questions related to control, efficiency, and professional autonomy in educational work.

Recent literature understands the datafication of education as part of a broader process of the platformization of teaching, in which school and administrative practices become mediated by digital systems that record, classify, and organize information about students and teachers. Matta, Ribeiro, and Pamplona (2025) show that the incorporation of these platforms into Basic Education reshapes pedagogical routines and repositions data as a structuring element of everyday school life. In this sense, education becomes progressively guided by records, indicators, and digital monitoring flows.

This process is also linked to a performative rationality in which metrics, results, and quantitative evidence gain centrality in the interpretation of educational quality. Viegas and Lamb (2025) argue that the growing presence of digital platforms in teachers' work reinforces forms of control associated with the production and intensive use of data. Therefore, datafication should not be understood merely as support for management and teaching, but as a reconfiguration of pedagogical mediation and power relations within the school context.

Within this framework, learning analytics emerges as one of the main expressions of the educational use of data. In general terms, this approach involves the collection, analysis, and interpretation of information about students and learning environments with the aim of understanding and optimizing educational processes. Paolucci et al. (2024) highlight that learning analytics has been associated with the early identification of learning difficulties, the monitoring of student progress, and support for more responsive pedagogical interventions, especially in technology-mediated educational contexts.

However, the potential of learning analytics does not eliminate its pedagogical and ethical limitations. Sharif and Atif (2024) note that the large-scale use of data expands the possibilities for continuous feedback and personalization, but also requires caution regarding oversimplified interpretations and the risk of reducing learning to strictly measurable patterns. Thus, educational data analysis must be understood as a situated practice, dependent on critical interpretation and qualified pedagogical mediation.

The debate becomes even more sensitive when related to teacher autonomy. Garbin, Ribeiro, and Cipoli (2025) demonstrate that the platformization of teaching intensifies disputes over pedagogical control, since digital systems, protocols, and indicators may narrow teachers' decision-making margins. In this scenario, teacher autonomy becomes tensioned between, on the one hand, the use of data as support for planning and, on the other, the possibility that pedagogical practice becomes subordinated to technical prescriptions and external metrics.

Despite the growing number of studies on datafication, educational platforms, learning analytics, and data-driven assessment, the scientific production in this field remains fragmented. Many studies emphasize operational gains, while others focus primarily on ethical and professional risks. Less frequent, however, are reviews that integrate the impacts of this process on pedagogical practices, assessment, and teacher autonomy, which reveals an important gap in the recent literature.

In light of this scenario, the present integrative review is guided by the following research question: how has recent scientific literature analyzed the impacts of the datafication of education, especially through learning analytics and data-driven assessment practices, on pedagogical practices and teacher autonomy?

Based on this question, the aim of the study is to analyze how recent scientific production has discussed the relationship between the datafication of education, learning analytics, assessment processes, and teacher autonomy, identifying theoretical foundations, analytical trends, and tensions present in the field of pedagogical practices.

The scientific relevance of this review lies in the systematization of a contemporary debate that remains dispersed, yet increasingly strategic for understanding educational transformations mediated by data. Its social relevance resides in the need to critically reflect on the educational use of digital technologies, so that the pursuit of monitoring, efficiency, and predictability does not compromise the complexity of teaching, the quality of assessment, and the professional autonomy of teachers.

II. Material And Methods

This study consists of an integrative literature review, with a qualitative approach and a descriptive-analytical character, a method that allows the gathering and synthesis of findings from previously published studies, thereby enabling a broader understanding of the investigated phenomenon (Mendes, Silveira, & Galvão, 2008; Souza, Silva, & Carvalho, 2010).

The integrative review was chosen because it makes it possible to compile and synthesize scientific productions already published in the field, allowing for a broader understanding of the datafication of education and the identification of trends, gaps, and theoretical contributions related to learning analytics, assessment, and teacher autonomy.

The methodological path was organized into six stages: (1) definition of the theme and guiding research question; (2) establishment of eligibility criteria; (3) definition of the databases and search strategy; (4) selection and screening of studies; (5) extraction and organization of information; and (6) analysis, synthesis, and interpretation of the findings.

The guiding research question of the review was: how has recent scientific literature analyzed the impacts of the datafication of education, especially through learning analytics and data-driven assessment practices, on pedagogical practices and teacher autonomy?

The search for studies was conducted in databases in the field of Education and related interdisciplinary areas, such as SciELO, Scopus, Periódicos CAPES, PubMed, and CAFÉ. To identify the articles, descriptors in Portuguese and English were used and combined with Boolean operators in order to broaden the sensitivity of the search and ensure greater alignment with the object under investigation.

The inclusion criteria considered complete scientific articles published within the last five years, available in full text, and directly related to the themes of the datafication of education, learning analytics, assessment, and teacher autonomy. Duplicated studies, simple abstracts, editorials, and publications not directly related to the objective of the investigation were excluded.

After identifying the studies in the selected databases, titles, abstracts, and keywords were initially read in order to verify thematic relevance in relation to the research proposal. Subsequently, the potentially eligible studies were submitted to full-text reading, considering their scientific relevance and their contribution to understanding the pedagogical implications of the datafication of education.

The extracted data were organized and analyzed systematically, making it possible to identify convergences, trends, and gaps in the literature reviewed, thereby contributing to the construction of a critical synthesis of the effects of data use, metric-driven assessment practices, and learning analytics systems in the educational context.

III. Result

The analysis of the selected studies made it possible to identify four central axes in the recent literature on the datafication of education: the reconfiguration of pedagogical practices, the monitoring of learning through learning analytics, data-driven assessment, and the tensions produced in relation to teacher autonomy. Taken together, these axes show that the incorporation of platforms, metrics, and data analysis systems is not restricted to the technical domain, but directly affects pedagogical work, assessment processes, and professional relationships in the educational context.

Datafication of education and the reconfiguration of pedagogical practices

Recent literature indicates that the datafication of education does not correspond merely to the presence of technologies in everyday school life, but rather to the reorganization of pedagogical practices around platforms, records, and indicators that begin to guide the planning, implementation, and monitoring of teaching. In this movement, data no longer occupy an accessory position and instead become integrated into the

very rationality that structures teaching activity, influencing content selection, task organization, and forms of pedagogical mediation (Matta, Ribeiro, & Pamplona, 2025; Silva & Couto, 2024; Seki, 2025).

Studies also show that platformization reconfigures the classroom by shifting part of pedagogical work to digital infrastructures that articulate communication, activity distribution, personalization, and performance monitoring. However, this transformation does not occur uniformly, since the appropriation of platforms depends on pedagogical values, institutional conditions, and the concrete forms of mediation carried out by teachers within the school context (Hangartner, Hürzeler, & Aebli, 2024; Silva & Couto, 2024; Hartong, 2024).

At the level of practice, the literature shows that digital technologies are often incorporated in an instrumental way, linked to routine management, the fulfillment of demands, and the expansion of educational monitoring. Even so, teachers make efforts to produce pedagogically meaningful uses of these resources, seeking to prevent teaching from being reduced to operational flows, algorithmic commands, or uncritical promises of innovation and personalization (Matta, Ribeiro, & Pamplona, 2025; Duci et al., 2025; Hangartner, Hürzeler, & Aebli, 2024).

Thus, the findings suggest that datafication reconfigures pedagogical practices while simultaneously expanding possibilities for organization and monitoring and intensifying tensions related to the standardization of teaching. Rather than functioning as simple technical support, platforms and data become structuring mediations of school work, competing with pedagogical judgment and requiring critical interpretation so that teaching practice is not subordinated to the performative and market-oriented logic of digital infrastructures (Seki, 2025; Duci et al., 2025; Matta, Ribeiro, & Pamplona, 2025).

Learning analytics and the monitoring of learning

In recent literature, learning analytics appears as one of the main developments of the datafication of education, as it transforms digital traces into inputs for monitoring student participation, engagement, performance, and progression. The studies indicate that this field has been mobilized to broaden the understanding of learning processes and to support more continuous interventions, both in Basic Education and in Higher Education (Paolucci et al., 2024; Pan et al., 2024; Sharif & Atif, 2024).

The findings also show that the monitoring of learning has been operationalized through dashboards, predictive systems, and alert mechanisms designed to provide actionable information to students and teachers. In this regard, learning analytics has been associated with the early identification of students at risk, the production of more timely feedback, and the possibility of evidence-informed pedagogical interventions, although such resources depend on contextualized interpretation and qualified pedagogical use (Susnjak, Ramaswami, & Mathrani, 2022; Herodotou et al., 2023; Dai et al., 2025).

However, the literature does not present a fully convergent picture regarding the effects of these devices. Some studies point out that many dashboards still focus on superficial descriptive analyses, while recent reviews indicate modest or inconclusive effects on performance, motivation, and participation, suggesting that the mere availability of data does not automatically guarantee educational improvement (Susnjak, Ramaswami, & Mathrani, 2022; Kaliisa et al., 2024; Wiley, Dimitriadis, & Linn, 2023).

Thus, the studies reviewed converge in indicating that learning analytics can strengthen the formative monitoring of learning, but its effects depend on human mediation, pedagogical design, and the institutional conditions of use. When subordinated solely to predictive logic or to the mechanical reading of indicators, this resource tends to impoverish the understanding of learning; when articulated with teacher-centered and context-sensitive approaches, it may foster more responsive monitoring and more consistent pedagogical decision-making (Wiley, Dimitriadis, & Linn, 2023; Herodotou et al., 2023; Sharif & Atif, 2024).

Data-driven assessment and its effects in the educational context

Recent literature shows that data-driven assessment has become one of the most visible effects of the datafication of education, especially in contexts mediated by virtual learning environments and digital platforms. In this scenario, records of access, participation, performance, and progression become part of continuous monitoring systems, expanding the use of dashboards, indicators, and automated feedback to support pedagogical and assessment-related decisions (Banihashem et al., 2022; Paulsen & Lindsay, 2024).

Studies indicate that this movement may strengthen formative assessment, especially when data are translated into understandable and actionable feedback for students and teachers. Analytical tools can foster self-regulation, the visualization of one's own learning pathway, and the more rapid identification of difficulties, but their effects tend to be greater when they are integrated into study routines and existing pedagogical processes, rather than treated as isolated resources (Susnjak, Ramaswami, & Mathrani, 2022; De Vreugd et al., 2024).

However, the findings also reveal important limitations. In a quasi-experimental study, Cabı and Türkoğlu (2025) observed that a feedback system based on learning analytics did not produce a significant difference in academic performance or self-regulation, although students perceived the monitoring of their

learning as useful. In addition, studies on teachers' use of dashboards show that data interpretation requires training, analytical literacy, and pedagogical mediation, since the mere availability of indicators does not automatically guarantee improvement in assessment practices (Cabı & Türkoğlu, 2025; Alzoubi & Baran, 2024).

Thus, the literature suggests that data-driven assessment constitutes a field of tension between pedagogical potential and technical rationality. Although data may enrich the monitoring of learning and diversify forms of feedback, their uncritical use tends to reinforce more instrumental assessment practices centered on measurement and the visualization of patterns, which requires contextualized interpretation so that assessment is not reduced to an automated process of classification and control (Banihashem et al., 2022; Paulsen & Lindsay, 2024; Alzoubi & Baran, 2024).

Teacher autonomy, pedagogical control, and professional tensions

The literature reviewed indicates that the datafication of education produces direct effects on teacher autonomy, insofar as pedagogical work becomes mediated by platforms, protocols, and indicators that organize routines, records, and forms of monitoring. In this context, part of the decisions previously centered on teachers' professional judgment tends to be displaced to digital systems that guide the planning, monitoring, and implementation of school activities (Garbin, Ribeiro, & Cipoli, 2025; Viegas & Lamb, 2025).

Studies also show that this process is linked to the reconfiguration of teaching work amid the expansion of educational technologies and the platformization of education. Rather than functioning merely as technical support, these mediations begin to shape time, priorities, and modes of pedagogical action, increasing demands for adaptation and reinforcing logics of standardization, control, and rationalization of teaching practice (Seki, 2025; Duci et al., 2025; Matta, Ribeiro, & Pamplona, 2025).

In addition, recent studies point out that the use of algorithmic tools and highly digitalized platforms may narrow the margin of teachers' professional agency, especially when pedagogical decisions start to be guided by recommendation systems, data visualizations, and bureaucratized monitoring routines. In such cases, autonomy does not disappear entirely, but becomes tensioned by new forms of technical coordination and by devices that reorganize teaching action in everyday school life (Röhl, 2025; Löfving, 2025; Hangartner, Hürzeler, & Aebli, 2025).

Thus, the findings suggest that teacher autonomy becomes a contested field between the pedagogical potential of data use and the expansion of broader forms of surveillance, accountability, and control. The literature shows that teachers' relationship with data and platforms is marked by affective, professional, and institutional tensions, which reinforces the need for policies and practices that recognize teachers not as mere executors of digital prescriptions, but as central subjects in pedagogical decision-making.

(THIELE; HEIMANS, 2025; GARBIN; RIBEIRO; CIPOLI, 2025; VIEGAS; LAMB, 2025).

IV. Discussion

The findings of this integrative review show that the datafication of education has become established as a process that goes beyond the mere incorporation of digital technologies into everyday school life, producing deeper effects on the organization of teaching, the assessment of learning, and teachers' work. The literature analyzed indicates that platforms, monitoring systems, and learning analytics devices have come to occupy a strategic role in pedagogical mediation, reconfiguring practices that were previously centered mainly on teachers' professional judgment and shifting part of educational decision-making toward logics oriented by data, performance, and traceability (Matta, Ribeiro, & Pamplona, 2025; Viegas & Lamb, 2025; Seki, 2025).

In the field of pedagogical practices, the results show that datafication introduces new ways of organizing teaching, monitoring students, and distributing activities, making data an increasingly present reference in pedagogical planning and intervention. This movement may expand possibilities for continuous monitoring and personalized teaching, but it also tends to strengthen processes of standardization, especially when platforms begin to impose rhythms, protocols, and forms of record-keeping that reduce the flexibility of teachers' actions. In this sense, technology no longer functions merely as support, but rather as a structuring mediation of pedagogical work, producing tensions between innovation, control, and professional autonomy (Garbin, Ribeiro, & Cipoli, 2025; Hangartner, Hürzeler, & Aebli, 2024; Duci et al., 2025).

This transformation becomes even more evident in the expansion of learning analytics and practices aimed at monitoring learning. The studies reviewed suggest that the collection and interpretation of digital traces may help identify difficulties, generate alerts, support more timely feedback, and foster more responsive pedagogical interventions. However, the literature also makes clear that data alone do not explain the complexity of the educational process. Indicators of access, participation, or time spent on platforms provide important signals, but they require contextualized interpretation and qualified pedagogical mediation, otherwise they risk producing reductionist interpretations of learning and student performance (Paolucci et al., 2024; Sharif & Atif, 2024; Susnjak, Ramaswami, & Mathrani, 2022; Herodotou et al., 2023).

With regard to assessment, the results indicate that a data-oriented rationality tends to reinforce assessment models increasingly centered on metrics, visualizations, and performance patterns. Although this movement may improve feedback processes and expand the capacity for formative monitoring, it may also narrow the understanding of learning by privileging quantitative and observable dimensions to the detriment of more complex aspects, such as critical thinking, interpretation, authorship, and the reflective construction of knowledge. In this way, the literature suggests that data-driven assessment constitutes a field of dispute between its pedagogical potential and the risk of turning assessment into a technical mechanism of measurement and classification (Banihashem et al., 2022; Paulsen & Lindsay, 2024; Alzoubi & Baran, 2024; Cabı & Türkoğlu, 2025).

Another central point concerns teacher autonomy, which appears in the literature as one of the dimensions most strongly tensioned by the datafication of education. At the same time that data may support pedagogical decisions and provide new elements for monitoring teaching, the growing presence of platforms, dashboards, and digital protocols also expands forms of surveillance, accountability, and control over teachers' work. In this context, autonomy does not disappear, but becomes increasingly contested in a scenario in which pedagogical judgment must coexist with technical prescriptions, institutional demands, and algorithmic mechanisms that reorganize time, priorities, and modes of professional action (Garbin, Ribeiro, & Cipoli, 2025; Viegas & Lamb, 2025; Röhl, 2025; Löfving, 2025).

Overall, this review makes it possible to understand that the datafication of education should not be interpreted merely as a technical advance or administrative modernization, but rather as a transformation that redefines pedagogical and professional relationships within the school context. The findings show that the educational use of data may contribute to more informed practices and more continuous forms of monitoring, provided that it is guided by critical interpretation, clear pedagogical purposes, and recognition of the central role of the teacher in the educational process. Without such mediation, however, the tendency is for the logic of data to override the complexity of teaching, reducing education to a dynamic of monitoring, performance, and control (Matta, Ribeiro, & Pamplona, 2025; Paolucci et al., 2024; Garbin, Ribeiro, & Cipoli, 2025; Viegas & Lamb, 2025).

V. Conclusion

This integrative review made it possible to understand that the datafication of education has become established as a process that goes beyond the adoption of digital tools, producing concrete impacts on pedagogical practices, modes of assessment, and teacher autonomy. The literature analyzed showed that the growing centrality of data in the educational context has reconfigured pedagogical work, making platforms, indicators, and monitoring systems increasingly present in the organization of teaching and the monitoring of learning.

The findings reveal that the use of data and learning analytics resources may contribute to more continuous pedagogical interventions, the identification of learning difficulties, and the expansion of feedback possibilities. However, the review also showed that such potentialities are not realized automatically. When guided by a strictly technical logic, datafication tends to reinforce standardized practices, increase the centrality of metrics, and reduce the complexity of the educational process to quantifiable records.

With regard to teacher autonomy, the study showed that this dimension occupies a central place in the contemporary debate on the datafication of education. Although data may function as support for planning and pedagogical mediation, the growing presence of platforms and digital protocols may also narrow teachers' margin of decision-making, strengthening mechanisms of control, surveillance, and accountability. In this sense, the educational use of data must remain subordinated to formative purposes and to teachers' critical interpretation, rather than to the mere reproduction of technical prescriptions.

Thus, it can be concluded that the datafication of education has the potential to improve pedagogical monitoring and enrich teaching and learning processes, provided that its incorporation occurs in a critical, ethical, and pedagogically oriented manner. More than defending or rejecting the use of data in education, the challenge lies in understanding under which conditions such data may contribute to strengthening, rather than weakening, the complexity of teaching work and educational relationships.

Finally, the importance of further research is emphasized in order to deepen the analysis of the effects of datafication across different levels of education, institutional contexts, and school realities. Future investigations may broaden the debate on teacher education, the pedagogical use of platforms, ethics in the treatment of educational data, and the development of policies capable of ensuring a democratic and reflective integration of digital technologies into education.

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