

CONCEPTUAL FOUNDATIONS, DETERMINANT FACTORS AND EXPLANATORY MODELS OF ACADEMIC PERFORMANCE IN THE CONTEXT OF DIGITAL EDUCATION

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Abstract. This article analyzes in depth the concept of academic performance in the context of contemporary education, marked by accelerated digitalization and the increasingly frequent use of educational technologies, including Artificial Intelligence and Learning Analytics. Starting from the conceptual ambiguities identified in the specialized literature, the paper proposes a rigorous delimitation of the term, distinguishing between academic result, school success and educational performance. Educational, psychological and sociological perspectives are integrated, as well as modern approaches that define performance as a dynamic, contextualized and multidimensional process. The article also advances an integrative conceptual model that reflects the dynamic and data-informed nature of academic performance in digital learning environments.

Keywords: Academic performance, Learning Analytics, academic motivation, school results, digital education, multidimensional model.

FUNDAMENTE CONCEPTUALE, FACTORI DETERMINANȚI ȘI MODELE EXPLICATIVE ALE PERFORMANȚEI ACADEMICE ÎN CONTEXTUL EDUCAȚIEI DIGITALE

Rezumat. Articolul analizează în profunzime conceptul de performanță academică în contextul educației contemporane, marcate de digitalizare accelerată și utilizarea tot mai frecventă a tehnologiilor educaționale, inclusiv Inteligența Artificială și Learning Analytics. Pornind de la ambiguitățile conceptuale identificate în literatura de specialitate, lucrarea propune o delimitare riguroasă a termenului, distingând între rezultat academic, succes școlar și performanță educațională. Sunt integrate perspective educaționale, psihologice și sociologice, precum și abordări moderne care definesc performanța ca un proces dinamic, contextualizat și multidimensional. Articolul propune, de asemenea, un model conceptual integrativ care reflectă natura dinamică și fundamentată pe date a performanței academice în mediile de învățare digitale.

Cuvinte-cheie: Performanță academică, Learning Analytics, motivație academică, rezultate școlare, educație digital, model multidimensional.

1. Introduction

The conceptualization of academic performance represents one of the most widely discussed and, at the same time, controversial topics in contemporary educational research. Although performance is used as a central indicator of the quality of the educational act, the effectiveness of teaching strategies, and the individual progress of pupils and students,

its definition remains ambiguous. This ambiguity derives both from the diversity of theoretical perspectives explaining performance and from the complexity of the variables involved: cognitive, motivational, socio-emotional, contextual, or related to the learning environment. Moreover, recent studies highlight that new forms of digital learning significantly transform the mechanisms through which performance is achieved, assessed, and interpreted, which necessitates a rigorous reconceptualization of the term.

The purpose of this article is to analyze the main theoretical approaches to academic performance from the perspective of educational sciences, to identify its determining factors, and to systematize contemporary explanatory models. Special emphasis is placed on how the digital environment and educational data analysis tools influence the performance of pupils and students. The study aims to provide an integrated and up-to-date understanding of a fundamental concept for empirical research in education. In this regard, the article sets out the following objectives:

- ✓ conceptual delimitation of the notion of academic performance;
- ✓ identification of the main internal and external factors that determine it;
- ✓ analysis of classical and modern explanatory models;
- ✓ formulation of a theoretical synthesis applicable to empirical educational research.

The novelty of this article consists in the development of an integrative conceptual framework of academic performance in the context of digital education. Specifically, the paper proposes a multidimensional model that brings together individual, pedagogical, contextual, and digital determinants within a unified analytical perspective. Unlike previous studies, this approach explicitly emphasizes the dynamic and data-informed nature of academic performance in digitally mediated learning environments.

The method used is conceptual analysis and content analysis applied to relevant specialized literature, with the aim of clarifying conceptual meanings and identifying common elements across different explanatory models.

2. Conceptual delimitations of academic performance

The literature review was carried out using several major academic databases, including SCOPUS, Web of Science, Google Scholar, and EBSCO. The selection process focused on peer-reviewed studies addressing academic performance in both digital and traditional educational contexts. The identified sources were systematically analyzed in order to synthesize the main theoretical perspectives, determinants, and explanatory approaches related to academic performance in contemporary educational research.

The conceptualization of academic performance has evolved significantly in the specialized literature, reflecting influences from educational sciences, psychology, and sociology. Each field emphasizes certain dimensions of performance, contributing to the development of a complex and multidimensional construct.

From an educational perspective, performance is traditionally associated with the level of achievement of learning objectives. In pedagogy, performance is measured by relating student outcomes to curricular standards, targeted competencies, and individual progress achieved.

From a psychological perspective, performance is analyzed as the result of the interaction between cognitive abilities, motivational processes, and self-regulation strategies. Zimmerman B. [1], through his model of self-regulated learning, argues that performance is not merely a final outcome, but an indicator of an individual's capacity to plan, monitor, and evaluate their own learning process.

In sociology, performance is closely linked to the social context, cultural capital, and educational opportunities. Tinto V. [2] in his theory of academic integration, explains performance as the result of a student's integration into the educational environment: institutional support, peer relationships, and a sense of belonging influence academic persistence and results.

Although often used as synonyms, the terms academic result, school success, and educational performance have distinct meanings in the specialized literature.

Academic result refers to the concrete products of learning activity: grades, standardized test scores, marks, theses, or evaluated projects. It strictly measures output.

School success has a broader dimension, encompassing educational pathway stability, promotion, academic progress, participation in extracurricular activities, and adaptation to school requirements.

Educational performance is a complex concept that includes both achieved results and the processes that determine them: motivation, self-regulation, persistence, use of learning strategies, and the capacity to adapt to varied learning environments. Performance reflects the learner's actualized potential within a specific educational context.

The literature provides numerous definitions of academic performance, highlighting the role of cognitive, social, and motivational processes:

- Bloom B. [3] states that performance is *the degree of attainment of educational objectives, correlated with teaching strategies and the level of mastery of competencies*.
- Biggs J. [4], through the 3P model (Presage–Process–Product), defines performance as *the result of the interaction between student characteristics (presage), the learning process, and the final product*. Performance thus becomes an indicator of the quality of the learning process.
- Zimmerman B. [1] considers performance a component of *the self-regulation cycle, influenced by planning, monitoring, and self-reflection*.
- Tinto V. [2] interprets performance as *an indicator of academic and social integration, with an impact on persistence in studies*.

- Deci E. & Ryan R. [5] emphasize that *high-quality performance occurs when the psychological needs for autonomy, competence, and relatedness are satisfied*.

These definitions show that performance has a complex nature, influenced by internal variables (motivation, cognitive strategies, self-regulation) and external variables (institutional context, social relationships, technological environment).

In the era of digital education, academic performance can no longer be reduced to a static score or final grade—it must be approached as a dynamic process reflecting the continuous evolution of learning. For example, the study of Shou, Z., Xie, M., Mo, J., and Zhang, H. [6] demonstrates how longitudinal data analysis (learning behavior, scores, online interactions, and demographic information) can capture different trajectories of performance development, not just isolated final results. Thus, performance becomes not a simple “snapshot” of knowledge, but a narrative reflecting progress, adaptation, fluctuations, and stability over time.

Moreover, recent research in educational analytics supports the idea that academic performance is a multidimensional indicator, combining cognitive, behavioral, emotional, and contextual components. For instance, Liao, Chen-Hsuan and Wu, Jiun-Yu [7] demonstrate that factors such as online group participation, perception of digital distraction, and group engagement predict final grades, suggesting that academic performance depends on multiple dimensions rather than solely on final assessments.

An interesting conceptual approach is offered by Cardozo-Gaibisso, Lourdes & Hodgesq, Georgia & Mardones-Segovia, Constanza & Cohen, Allan [8] in the Multidimensional Assessment Performance Analysis (MAPA) framework, which proposes a school performance evaluation model integrating multiple modes of analysis from language use analysis to the identification of thinking and reasoning structures through topic models.

Despite the wide range of existing definitions, the literature still reveals considerable conceptual fragmentation. Many studies tend to approach academic performance either as an outcome indicator or as a process variable, while only rarely integrating these perspectives within a unified analytical framework. In addition, the rapid expansion of digital learning environments is increasingly challenging traditional ways of conceptualizing and measuring performance.

3. Determinant factors of academic performance

The literature in educational sciences, psychology, and educational analytics shows that performance cannot be explained by a single factor, but rather by the convergence of multiple, often interdependent influences:

- 3.1. **Individual factors.** These include cognitive, motivational, and self-regulatory personal characteristics, considered major determinants of academic performance.

- ✓ *Cognitive abilities* such as general intelligence, working memory, attention, and critical thinking directly influence information processing capacity and learning strategy efficiency. Numerous studies show that students with well-developed working memory and superior reasoning skills solve complex academic tasks more effectively.
- ✓ *Academic motivation*, both intrinsic and extrinsic, is a key indicator of engagement and persistence in learning. According to Self-determination [5], high-quality performance occurs when the needs for autonomy, competence, and relatedness are satisfied.
- ✓ *Self-regulated learning* conceptualized by [1] involves planning, monitoring, and evaluating one's own cognitive and behavioral processes. Self-regulated learners manage tasks more efficiently, adapt strategies to difficulties, and maintain persistence.

3.2. ***Pedagogical and curricular factors.*** Instructional quality and the use of varied, active learning-centered teaching strategies foster cognitive and metacognitive competencies. Formative feedback—specific, timely, and progress-oriented—has a strong impact on performance by clarifying objectives and supporting self-regulation. Authentic assessment, focusing on real tasks, complex problems, and applicability, contributes to the development of critical thinking and knowledge transfer. Adaptive assessments allow the identification of learning needs and the personalization of educational interventions.

3.3. ***Contextual and socio-emotional factors.*** Family, school, and socio-cultural contexts directly influence motivation, emotional state, and learning opportunities. Family environments provide emotional support, material resources, and learning models. In school settings, educational climate and teacher–student relationships influence engagement and motivation.

3.4. ***Digital and technological factors.*** Digital technologies significantly redefine how performance is achieved, monitored, and supported. Digital resources, e-learning platforms, multimedia tools, and interactive applications expand learning opportunities and provide instant feedback. Learning Analytics enables teachers to monitor learning behaviors and intervene adaptively. Artificial Intelligence plays an emerging role through intelligent tutoring systems, personalized recommendations, and early difficulty detection.

Additional influencing factors include physical and mental health, socio-economic status, and organizational factors such as institutional structure, educational policies, and leadership.

Table 1. Classification of the determining factors of academic performance

Dimension	Determined factors
Individual	Cognitive abilities (intelligence, working memory, attention, critical thinking), academic motivation (intrinsic and extrinsic), self-regulation and metacognitive skills, physical and mental health
Pedagogical / Curricular	Teaching strategies and instructional quality, formative feedback, authentic and adaptive assessment, curriculum relevance and alignment with learning objectives.
Contextual / Socio-emotional	Family and socio-cultural background, emotional support and well-being, teacher–student relationships, school climate and peer interactions.
Digital / Technological	Digital educational resources and e-learning platforms, use of Artificial Intelligence in education, learning Analytics and data-driven decision-making, Personalization of instruction through technology.

The proposed classification (Table 1) underscores the multidimensional nature of the factors influencing academic performance. Notably, digital and technological variables are gaining increasing importance, interacting in complex ways with traditional individual and contextual factors. This evolving interplay points to the growing need for more integrative analytical models.

Building on this multidimensional classification, the following section reviews the main explanatory models of academic performance.

4. Explanatory models of academic performance

4.1. **Classical models.** Classical models provide the initial framework for understanding academic performance, emphasizing the relationship between resources, the learning process, and outcomes.

- ✓ *The input–process–output model* [9] conceptualizes performance as the result of the interaction between student characteristics, effective learning time, and instructional quality.
- ✓ *The ecological model of development* [10] explains performance as the result of interdependent social systems: family, school, community, and society.

However, classical models were largely developed within predominantly face-to-face educational contexts and may therefore fall short of capturing the full complexity of performance in digitally mediated learning environments. This limitation highlights the need for updated, integrative frameworks that explicitly incorporate technological and data-driven dimensions.

4.2. **Modern psychological models.** Recent psychological models emphasize the cognitive and motivational processes that influence performance:

- *The motivational–cognitive model* [11] integrates motivation and cognitive strategies, highlighting how self-regulation and personal goals determine performance.
- *Self-determination theory* [5] explains performance as the result of satisfying fundamental psychological needs: autonomy, competence, and relatedness.

- *The academic self-regulation model* [1] views performance as part of a continuous cycle of learning planning, monitoring, and self-evaluation.

4.3. **Contemporary educational models.** In the current digital context, academic performance is also explained through models that integrate educational technologies and educational data:

- *The learning analytics model* [12] uses data generated by digital platforms to track students' progress and to adapt educational interventions in real time. Performance is viewed as a dynamic process and a multidimensional indicator, captured through multiple types of data (engagement, interactions, time on task, etc.).
- *Data-driven learning models* refer to approaches in which pedagogical decisions and performance assessment are guided by the quantitative analysis of educational data. Recent studies in this field [13]; [8] employ predictive models and machine learning analyses to identify patterns of success or risk among students. These models enable not only the evaluation of final outcomes, but also an understanding of the processes that generate them.
- *The digital competencies model as an indirect determinant of performance* highlights the fact that students' digital skills influence how they interact with technological resources, participate in online activities, and leverage digital learning tools, thereby having an indirect impact on academic performance.

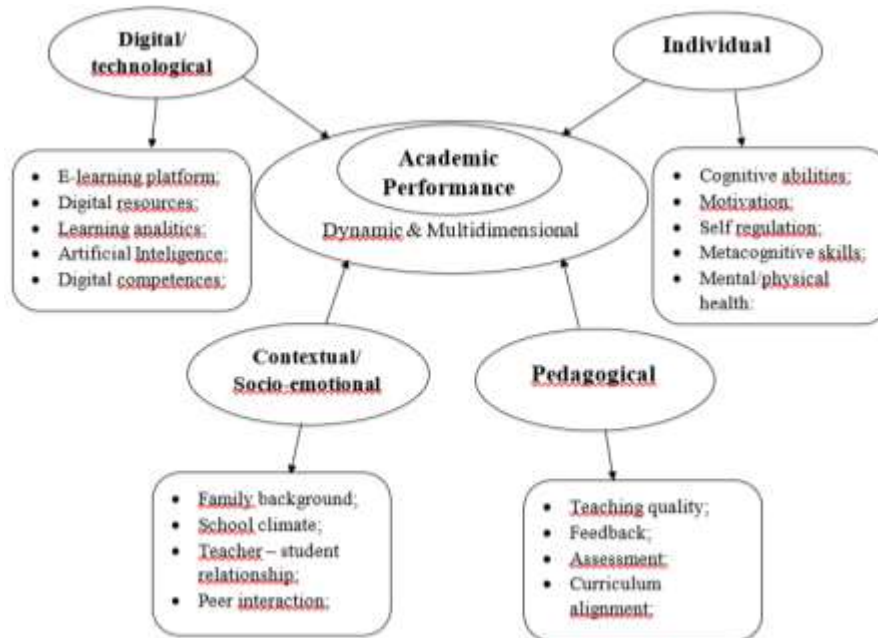


Figure 1. Integrated model of academic performance in digital education

Figure 1 illustrates the proposed integrative model of academic performance in digital education. The framework highlights the dynamic interaction between individual, pedagogical, contextual, and technological determinants, positioning academic performance as a multidimensional and evolving construct.

5. Discussions and theoretical–practical implications

The analysis of explanatory models of academic performance highlights both areas of convergence and significant differences among theoretical perspectives. Classical input–process–output models [9] and the ecological theory of development [10] emphasize contextual structure and systemic influences, whereas modern psychological models focus on the internal dynamics of learning—motivation, self-regulation, and cognitive processes [11]; [1]. In contrast, contemporary educational models such as Learning Analytics or data-driven learning extend the analysis to the digital dimension of the educational process, proposing the interpretation of performance as an emergent indicator based on data that are collected, processed, and analyzed in real time. Conceptual divergences arise particularly with regard to the nature of performance: a static outcome (score, grade) versus an evolving, multidimensional, and context-dependent process.

A major challenge identified in the specialized literature is the lack of a unified framework that integrates individual, pedagogical, contextual, and digital factors into a comprehensive model of academic performance. Although each category of models explains a part of the phenomenon, gaps remain between perspectives: insufficient integration of socio-emotional influences in digital models, the absence of links between digital competencies and self-regulation in psychological models, or the oversimplification of pedagogical factors in data-driven predictive models. These theoretical inconsistencies indicate the need for a transdisciplinary approach that connects perspectives from educational psychology, school sociology, data science, and digital pedagogy.

Within the context of current educational research, the dominant trend is the development and use of academic performance prediction models through Learning Analytics and artificial intelligence methods. In this regard, the design of empirical research is recommended to include: clarification of the theoretical constructs employed (performance, motivation, self-regulation, etc.), the valorization of multimodal data (behavioral, digital, affective), the inclusion of socio-emotional environments as moderating variables, and the use of hybrid models that combine predictive analyses with conceptual frameworks validated in the educational sciences.

Conclusions

Beyond synthesizing the existing literature, this article advances the field by proposing an integrative perspective that bridges classical educational theories with emerging digital and data-driven approaches to academic performance.

The article proposed a conceptual clarification of academic performance by integrating educational, psychological, sociological, and digital perspectives, highlighting its multidimensional and dynamic nature. The analyzed definitions suggest that performance cannot be reduced to outcomes alone, but should instead be understood as a

complex process of interaction among students' competencies, pedagogical strategies, the educational environment, and the technologies used in learning.

Furthermore, four central categories of determining factors were identified: individual factors (cognitive, motivational, and self-regulatory), pedagogical and curricular factors (quality of instruction, instructional strategies, assessment), contextual and socio-emotional factors (school climate, socio-emotional support, cultural context), and digital and technological factors (digital educational resources, artificial intelligence, Learning Analytics). The integration of these dimensions enables the formulation of a comprehensive view of academic performance within the context of contemporary education.

Based on the literature and the proposed synthetic framework, academic performance can be defined as *a dynamic, multidimensional, and contextualized process resulting from the interaction between students' capacities and dispositions, the quality of the pedagogical environment, socio-emotional influences, and the use of technological resources, reflected in the level of achievement of learning objectives and educational progress in the short and long term.*

Future research directions include the further development of data-driven models for predicting and monitoring academic performance, the advancement of AI-based methods for performance measurement (including adaptive models and multimodal analyses), and the integration of digital and socio-emotional competencies as central determinants of academic success. Given the rapid evolution of digital educational environments, future research should focus on constructing flexible conceptual frameworks capable of adapting to technological developments and providing relevant indicators for educational practice and public policy.

The proposed framework provides a foundation for future empirical validation in digitally enriched educational settings.

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