

Personalized Assessment In Virtual Environments Using The Smart School System

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Abstract:

This article presents a case study applied to the technological work of the assessment process in virtual environments through the functional analysis of the SmartSchool educational platform. A qualitative, descriptive, and exploratory methodology was chosen, as it serves to describe the most important elements of the educational platform related to learning analysis processes, individual student monitoring, automated feedback, and learning traceability. The results of this work show that the platform allows the construction of assessment processes capable of adapting to the student's actual progress and that are supported by visual evidence and interpretable data. It is concluded that, although technology provides a powerful operational framework, its effectiveness will depend on its critical and ethical pedagogical use by the teacher. This study contributes to the understanding of personalized assessment in virtual environments mediated by intelligent systems.

Keywords: Educational analytics; formative feedback; SmartSchool platform; adaptive assessment; educational technology; learning traceability.

Introduction

Improving learning assessment processes is one of the priorities that make up the institutional agenda for educational quality, mainly in those contexts mediated by digital technologies (Ahmed & Sidiq, 2023). In this sense, when institutions use virtual platforms to manage teaching or educational monitoring, it is also necessary to evaluate whether or not these tools contribute to overcoming the

limits of the traditional assessment model (Chaudhry et al., 2023). At the same time, there is a need to move towards more personalized schemes that allow for responses to the diversity of student trajectories, identify performance patterns, and offer the conditions that favor appropriate pedagogical decision-making (Tetzlaff et al., 2021).

Educational learning management platforms that include quality analytics modules have significant potential to transform assessment processes (Isaeva et al., 2025). In particular, platforms that support individualized monitoring, predicting learning problems, and providing recommendations to teachers offer a more adaptive context, where feedback is not only about grading but is used strategically and purposefully to determine pedagogical interventions (Maier & Klotz, 2022). This logic responds to contemporary approaches to learning analytics and formative assessment, which have been widely supported in the scientific literature.

The SmartSchool system, created by the University of Cartagena and Colciencias, is presented as a digital space designed to transform the way learning processes are conducted. Beyond being a conventional educational platform, SmartSchool provides tools that allow monitoring of student progress, personalized feedback, and promotes pedagogical assessment methods aligned with the needs of the current educational context. It also features modules such as academic progress, remediation by indicator, automated recommendations, and comparative visualization of results, allowing teachers and management teams to access real-time data on the progress of each student and their group.

However, the effective use of these tools depends on multiple pedagogical, technical, and organizational factors, so their potential still requires systematic analysis from a research perspective. Therefore, various research papers have reviewed the impact of digital platforms on the individualized assessment of learning, employing, among others, approaches such as learning analytics, educational artificial intelligence, and adaptive systems. Caratozzolo et al. (2025), for example, demonstrate the capacity of intelligent platforms to provide continuous formative feedback, which is determined by each student's performance.

For their part, Wu et al. (2024) propose educational recommendation models that adjust to the student's cognitive load, while Barbare et al. (2025) develop predictive algorithms to anticipate the risk of dropping out of school. Wickramasinghe and Liyanage (2024) also demonstrate that immersive spaces can enhance the degree of personalization of the educational experience; however, they warn about the technical difficulties associated with their implementation. In the Latin American case, there are few empirical works that explore the pedagogical use of platforms such as SmartSchool, which justifies the need for applied studies that systematically analyze their functionalities and their alignment with contemporary principles of adaptive assessment and evidence-based educational management.

For the reasons stated above, this research aims to examine the use of the SmartSchool platform as a tool for the implementation of personalized assessment processes in virtual school environments, so that through a functional analysis of the core modules of the platform, and contrasting it with international theoretical-empirical references in the field of analytical-adaptive assessments, this research manages to obtain evidence on the real possibilities that this type of systems have to improve the quality of academic monitoring, promote greater support in decision-making among teachers, as well as encourage more relevant and contextualized learning.

Theoretical framework

This theoretical framework reviews the conceptual foundations and main current findings on personalized assessment, smart educational technologies, and predictive analytics systems to position the SmartSchool platform within the current ecosystem of digital pedagogical innovation.

Personalized assessment and adaptive learning in virtual environments

The personalization of assessment practices within virtual educational environments has emerged as a necessity to respond to the emotional, cognitive, and rhythmic diversity of students. Unlike typical assessment processes anchored to standardized tests, current existing platforms make it possible to gradually adapt both the content and the assessment system to the student's specific performance (Kovalchuk et al., 2025). This conception of personalized assessment is directly linked to the principles of learning analytics, which propose the intention of transforming generated data into specific pedagogical actions.

On platforms like SmartSchool, personalized assessment is operationalized through modules such as "individual progress" and "remediation," which automatically monitor academic performance and provide appropriate recommendations to each student's achievement level. These functions are consistent with international models that are already incorporating artificial intelligence tools so that assessment actions can analyze behavioral patterns and generate real-time feedback (Jain et al., 2025).

Emerging technologies and smart educational platforms

The literature highlights the advancement of complex digital environments that transcend traditional LMS. Proposals such as the use of the metaverse (Wickramasinghe & Liyanage, 2024) or virtual reality applied to education show how assessment can be contextual, multisensory, and adaptive, providing students not only with grades but also with meaningful feedback experiences (Finseth et al., 2025). Although the SmartSchool platform is not yet available in immersive environments, due to its dynamic data visualization architecture, its alert system, and the automated mode of submitting corrective assignments, functional analogies can be established with these state-of-the-art proposals.

These platforms are also beginning to combine elements of neurotechnology and behavioral analysis to understand how each student interacts with the virtual environment, allowing for more precise intervention in teaching-learning processes (Jain et al., 2025). In this sense, SmartSchool's structured design, supported by pedagogical decision rules, can be considered an early version of these environments based on educational artificial intelligence.

Predictive, analytical and data-driven assessment

Personalized assessment relies on the platforms' capacity to anticipate different performance scenarios. Models such as those proposed by Barbare et al. (2025) and Faramita et al. (2025) prioritize longitudinal data analysis to anticipate dropout risks, as well as critical learning disabilities and automated interventions that can be implemented. In the case of SmartSchool, the existence of consolidated performance modules, as well as the possibility of exporting reports, allow teachers and administrators to have an analytical view that serves to make informed and focused decisions.

The platform also includes didactic recommendation systems in relation to the curriculum, an element that has been identified as fundamental to the evolution of personalized pedagogical design in virtual contexts (Digel et al., 2023). This creates a synergy between pedagogical decision-making and the data generated by student performance.

In summary, the reviewed studies validate the relevance of conducting personalized, evidence-based, traceable, and adaptable assessments through platforms such as SmartSchool. The study presented here falls within this line of research, conducting a systematic exploration of the functionalities and their potential impact on improving the assessment process in virtual environments.

Methodology

This study uses a qualitative approach with a descriptive and exploratory design, since its objective is to exhaustively analyze the pedagogical functionalities of the SmartSchool platform related to

assessment as a personalized pedagogical tool, without intervening in the school contexts in which it is intended to be implemented, nor manipulating variables (Takona, 2024). The choice of the qualitative approach is driven by this study's interest in understanding the meanings, uses, and educational possibilities of a digital system in a specific context, which corresponds to the inductive and contextual nature of qualitative research (Tisdell et al., 2025).

The descriptive nature of the research corresponds to the fact that it seeks to detail the functionalities of the SmartSchool system, and the functionalities related to the personalization of assessment, such as the individual progress module, automated recommendations, analytical reports, and remediation indicators. These dimensions are systematically observed in order to record how the system allows (or limits) the adaptation of the assessment process to the individual needs of students, without establishing causal relations, but rather functional configurations (Sampieri, 2018).

Likewise, the study is exploratory, as it aims to investigate a phenomenon that has been little empirically documented in the Latin American context: the real pedagogical use of digital platforms to implement personalized assessment through learning analytics. The scientific literature has addressed the development of adaptive systems and automatic feedback in international contexts (Caratozzolo et al., 2025), but there are few studies that analyze this type of platform from a functional approach applied to real educational scenarios, particularly in the case of SmartSchool.

To achieve this objective, a structured observation of the platform in a real-life context of teacher access and a review of the platform's functionality in its 2.0 version were carried out. During this process, significant screenshots were recorded for a detailed characterization of the system's capabilities. A bibliographic review of related platforms, educational artificial intelligence, and adaptive assessment was also conducted, allowing for a description of the SmartSchool platform's functionalities based on the theoretical principles identified (Barbare et al., 2025).

On the other hand, the aim is not to generalize the results, but rather to understand and contextualize the object of study (Denzin & Lincoln, 2011), to have useful evidence for future empirical research, and to facilitate decisions both pedagogical and in institutional processes in relation to the use of certain technologies to carry out personalized evaluations.

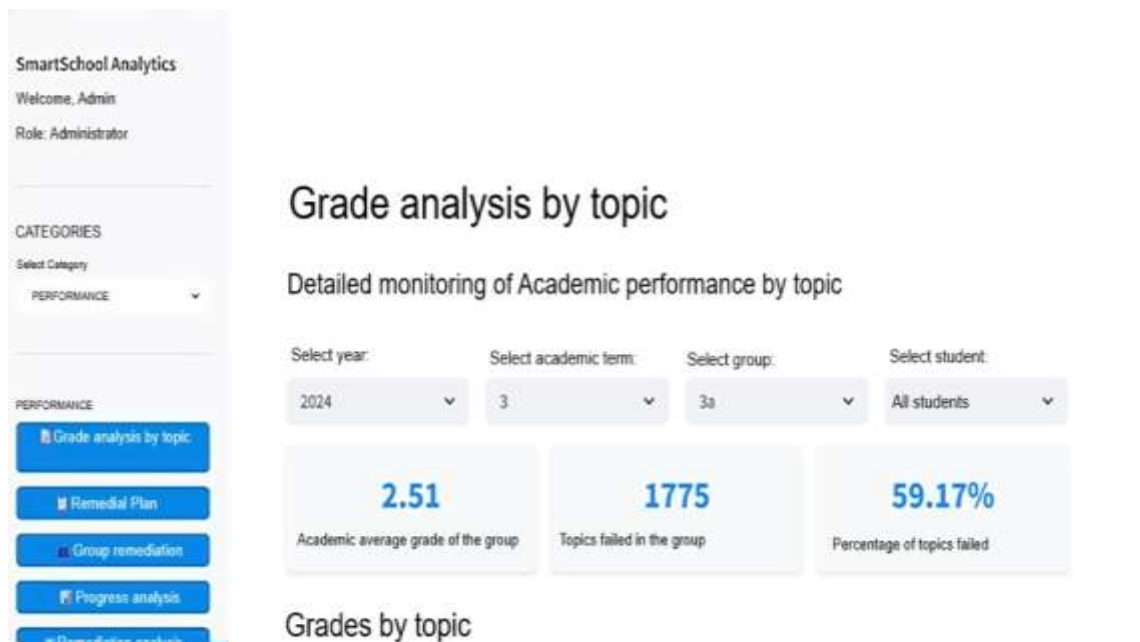
Results

Personalized assessment requires digital systems not only to collect data, but also to structure functions oriented toward individual monitoring, differentiated intervention, and continuous improvement. From this perspective, SmartSchool, based on the automated indicators module and educational analytics, provides teachers with tools to diagnose, intervene, and provide feedback, as well as to monitor each student's performance. Below are the findings of the comprehensive analysis of the SmartSchool v2.0 platform, which was implemented based on direct observation of its operating environment, within the framework of five functional dimensions that shape this adaptive pedagogical architecture.

Individual diagnosis and comparative visualization

The personalized assessment process begins with a detailed diagnosis of the student's individual performance and its comparison with the group's performance. Figure 1 shows the initial screen of the performance module, where the teacher can filter the information by subject, student, period, and topic evaluated. This segmentation allows for the construction of a contextualized picture of each case, moving away from the idea of uniformity.

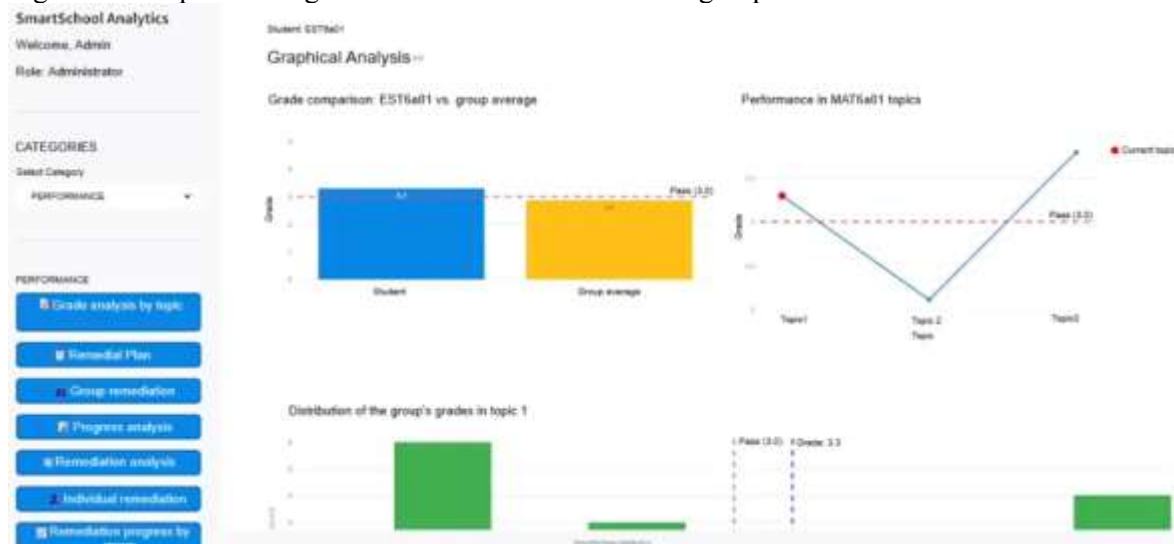
Figure 1. Monitoring and analysis of student performance



Source: Own capture from SmartSchool environment.

The system then generates graphical representations that allow the student to be compared to the group average. As shown in Figure 2, SmartSchool graphically describes the student's position on a performance scale, indicating whether they passed or failed. This comparison is not for disciplinary reasons, but for educational reasons, and therefore serves as a starting point for making the corresponding pedagogical decision based on the student's achievement level.

Figure 2. Comparison of grades between a student and the group



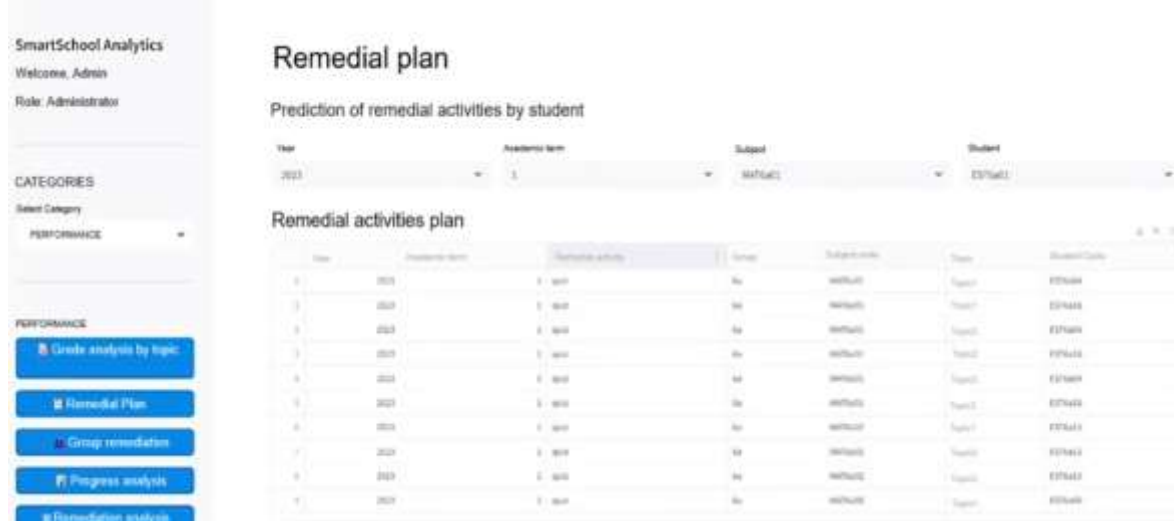
Source: Own capture from SmartSchool environment.

In addition, the system provides a breakdown of grades by subject and allows for the identification of students' specific strengths and weaknesses. A pedagogical interpretation of this breakdown allows for the construction of differentiated learning profiles, which is one of the inputs required for an assessment focused on individual progress.

Personalized intervention through automated remediation

Once difficulties are detected, SmartSchool also includes an automatic remediation module. This module allows for establishing a list of students who do not meet the achievement criteria and also accurately identifies the content that needs to be reinforced or remediated. Figure 3 shows how the system has the option to select indicators and suggests remediations, filtering the information by group, subject, and thematic unit. This procedure, incorporated into the evaluation system, contributes to more efficient teacher intervention targeting.

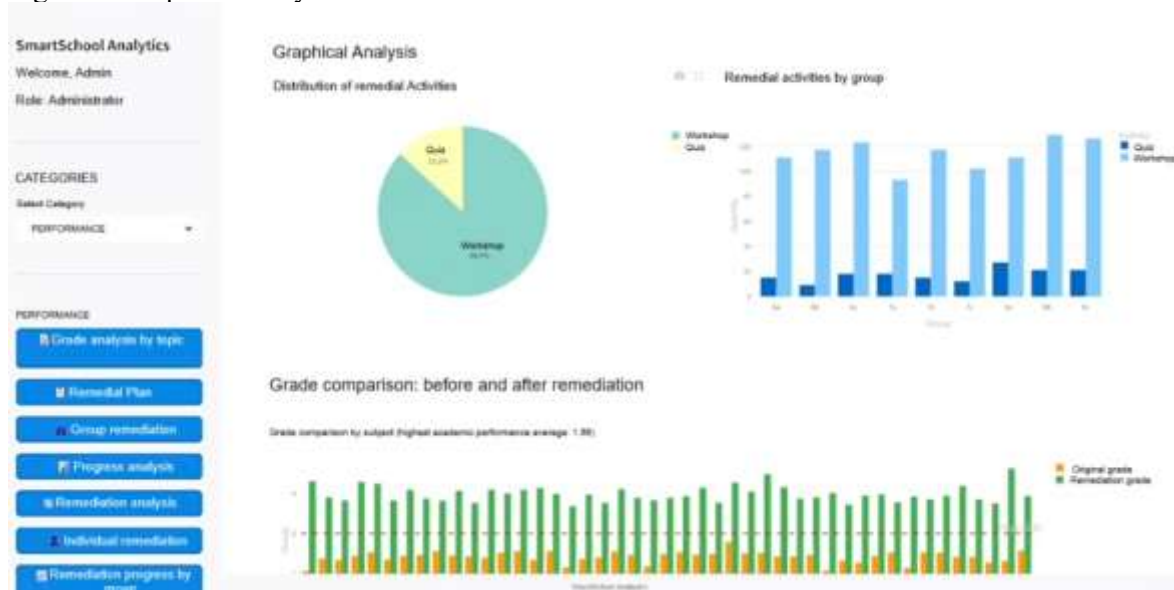
Figure 3. Differentiated remedial plan



Source: Own capture from SmartSchool environment.

The interface where the types of recovery activities applied, the number of students involved, and the effectiveness rate of each resource can be consulted is shown in Figure 4. Aside from recording the intervention process, the system allows for evaluating the pedagogical effectiveness of the intervention strategies implemented.

Figure 4. Graphical analysis of remediation activities



Source: Own capture from SmartSchool environment.

On the other hand, the group remediation module, represented in Figure 5, presents a prioritized list of lower-performing students, color-coded based on their grades. This view allows for quick decisions regarding which students require support and also allows for the mass submission of differentiated assignments.

Figure 5. Individual student progress in the course.

Progress analysis by student

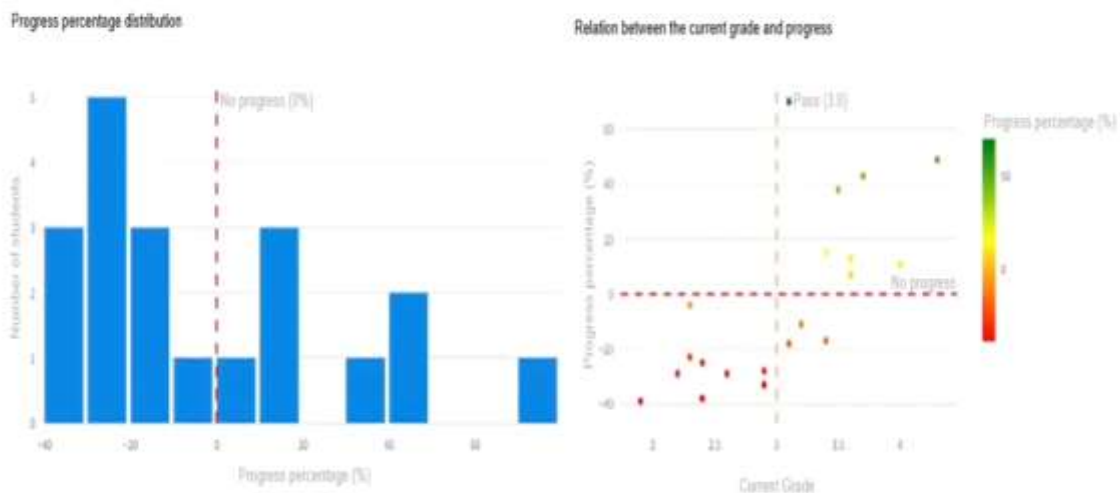
	Year	Academic term	Subject code	Topic	Subject code	Exam grade	Progress percentage
1	2021	2	MAT7061	Topic4	EST7061	75	2.400000
2	2021	2	MAT7061	Topic4	EST7062	75	4.800000
3	2021	2	MAT7061	Topic4	EST7063	75	2.400000
4	2021	2	MAT7061	Topic4	EST7064	75	3.600000
5	2021	2	MAT7061	Topic4	EST7065	75	3.600000
6	2021	2	MAT7061	Topic4	EST7066	75	3.600000
7	2021	2	MAT7061	Topic4	EST7067	75	2.400000
8	2021	2	MAT7061	Topic4	EST7068	75	2.400000
9	2021	2	MAT7061	Topic4	EST7069	75	2.400000

Source: Own capture from SmartSchool environment.

Building trajectories through thematic progression

Another fundamental dimension of personalization is the ability to build differentiated learning paths. SmartSchool allows activities to be distributed so that each thematic block can be enabled using achievement criteria. Figure 6 shows student progress by thematic unit, allowing students to visualize not only the final result but also progress relative to the starting point.

Figure 6. Graphical analysis of remediations per student



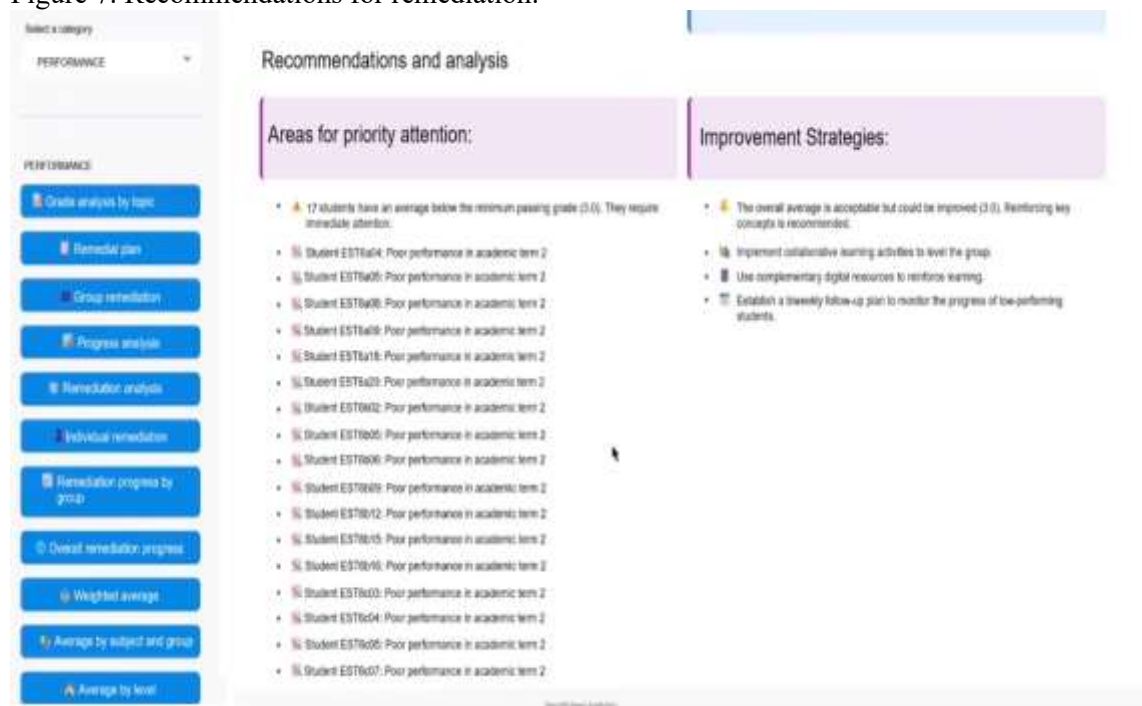
Source: Own capture from SmartSchool environment.

This feature allows teachers to organize students into distinct learning paths: those who have failed an indicator can be redirected to remedial activities, while those who have passed can advance to more complex content. The platform's modular structure, combined with the visual logic of progress by topic, reinforces the adaptive teaching approach.

Automated pedagogical recommendations and feedback

Another distinctive contribution of SmartSchool to personalized assessment is its automatic recommendation module. Based on the analysis of performance data, the system suggests specific pedagogical actions for the teacher, aligned with the unmet indicators. Figure 7 presents examples of these suggestions, which include remedial activities, methodological adjustments, or reinforcement strategies.

Figure 7. Recommendations for remediation.



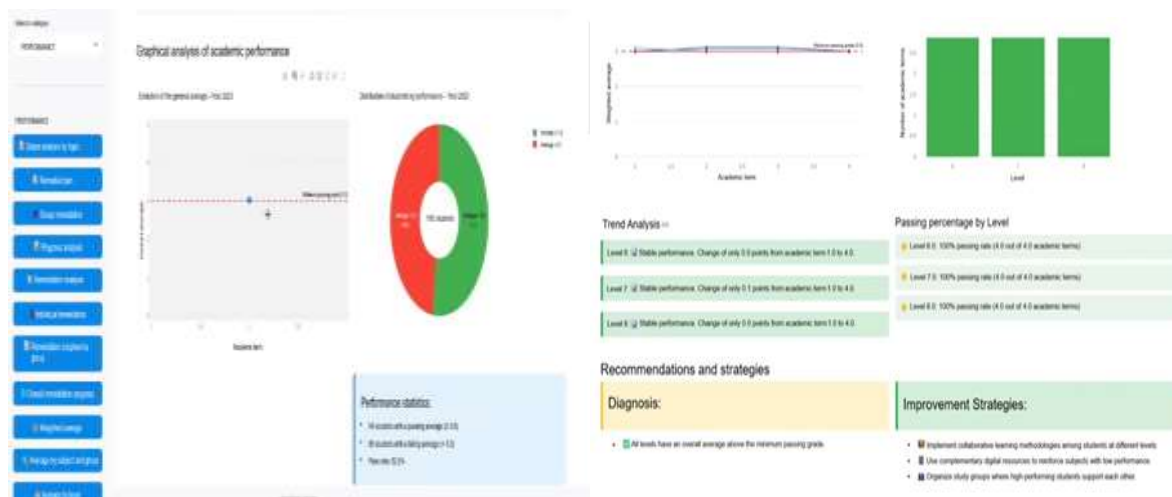
Source: Screenshot of the “Academic Remediation” module in SmartSchool.

These recommendations represent a step toward prescriptive educational analytics, as they not only describe the problem (e.g., poor performance in inferential reading), but also provide guidance on how to address it didactically. This mediation between information and actions represents one of the most important aspects that allow personalized assessment to be implemented on a large scale.

Learning traceability and personalized documentation

Finally, the SmartSchool tool also allows for monitoring over time through exportable reports and integrated data visualizations, as can be seen in Figure 8, which presents a global view that includes the group average, the trajectory of academic progress, and active recommendations for a group of students or a particular student.

Figure 8. Overall academic performance of students

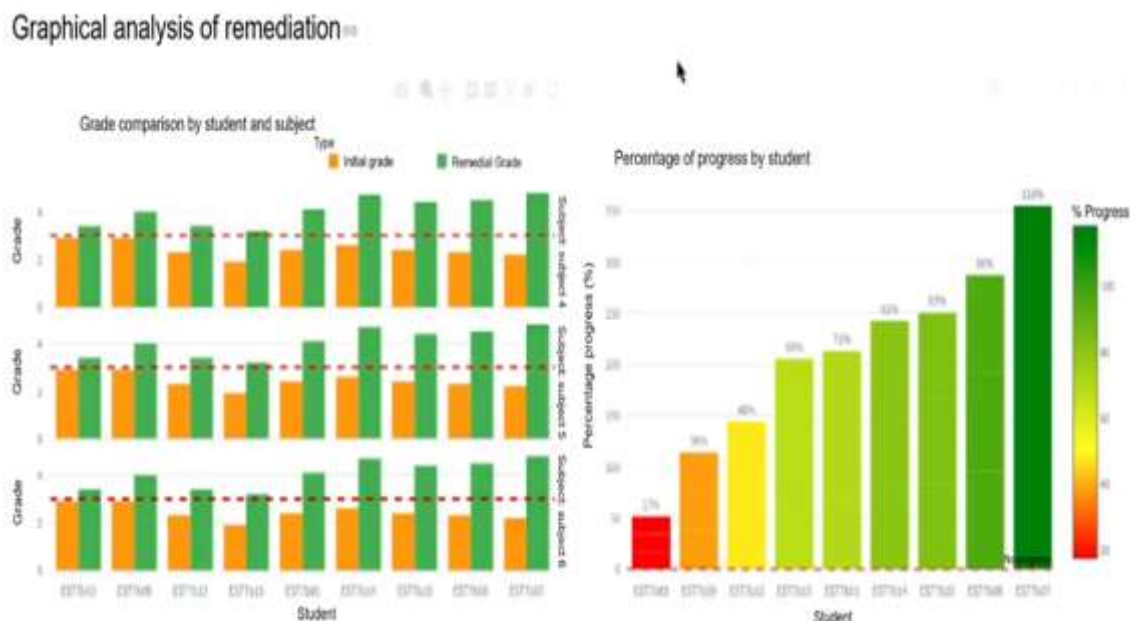


Source: Own capture from SmartSchool environment.

The capacity to generate reports by student, course, or academic term allows for assessment traceability, allowing for documentation of the process, helping to inform educational decisions, and also enabling dialogue with families based on documented and verifiable information. All of these tools contribute to transparent, continuous, and educationally focused assessment aimed at improving outcomes.

Figure 9 shows an example of a before-and-after comparison graph following a remedial intervention, which allows the immediate impact of the pedagogical interventions to be observed. This visualization can be used to validate the effectiveness of the implemented strategies and adjust future decisions.

Figure 9. Before-and-after comparison graph of a remedy intervention



Source: Own capture from SmartSchool environment.

In summary, as explained above, the features provide evidence that SmartSchool is more than just a grade-recording tool; it is a personalized formative assessment system, where each module, from the initial diagnosis to the delivery of reports, serves as input to adapt teaching to the students' actual

trajectories, allowing for the construction of an assessment that is tailored to learning. This approach represents a significant advance compared to traditional models, as it transforms data into differentiated teaching actions that adapt to the diversity of the virtual classroom.

Discussions

The results obtained in this research show that the SmartSchool platform has a consistent set of features for implementing personalized assessment strategies in virtual environments. This assertion is contrasted with various recent studies that observe the value of smart technologies in transforming not only the traditional assessment paradigm, but also a model focused on continuous improvement and adaptation to the student.

One of the main axes of personalization in SmartSchool is that it enables real-time individual diagnoses through segmented filters, progress diagrams, and automatic reports comparing a specific student with the group. This feature reiterates what Chawla et al. (2025) assert, who argue that these smart platforms must allow, within their structure, not only data storage but also the creation of automated pedagogical readings that facilitate the interpretation of each student's progress and guide differentiated interventions. Likewise, authors McCarthy et al. (2023) affirm that the digital transformation of education requires proactive educational analytics, not just descriptive ones.

Continuing along this line of work, the research showed that SmartSchool enables the automation of the supervision of students who are at academic risk, as well as generating remedy proposals adapted to the level and subject. This capacity of the system connects with what Shevchuk & Hunaza (2025) call intelligent support systems, whose function is to guarantee personalized learning paths through algorithms that make changes in response to specific performance indicators. Their research concludes that incorporating AI in virtual environments allows the content, feedback, and assessment activities to be adjusted to the profile and pace of each student.

Similarly, SmartSchool's capacity to automatically make pedagogical recommendations would be consistent with the conclusions reached by Klochko et al. (2025), who state that effective virtual environments should not be limited to data representation but must provide support to teachers when making decisions and designing adaptive interventions that guarantee adequacy based on evidence. This principle was clearly observed in the analyzed system, in the sense that not only does the teacher observe the problem, but also receives suggestions related to the action.

On the other hand, the results reinforce the idea that personalized assessment should not be understood exclusively as content differentiation but also as longitudinal monitoring, as highlighted by Caratozzolo et al. (2025) in their study on adaptive continuing education: the use of traceable reports, individual progress analysis and temporal comparisons allow for the construction of an evaluative history that favors equity, by valuing the process more than the single result.

Furthermore, the functionalities observed in SmartSchool coincide with what was proposed by Hussain and Shah (2025), who underline the value of virtual environments powered by educational analytics to detect, anticipate, and accompany divergent learning trajectories, through visual tools, dynamic reports, and intervention algorithms.

The SmartSchool approach also resonates with the findings of Barbare et al. (2025), who highlight that data-driven platforms should integrate prediction, personalization, and dropout risk analysis functions, all of which are present in the architecture of this platform through its differentiated alerts and recommendations module.

Finally, it is worth highlighting that the most recent literature agrees that the success of these systems lies not only in the technical existence of intelligent functions, but also in the responsible and ethical pedagogical use that the teacher knows how to make of them. In this regard, Cabezuelo and San Juan

(2025) argue that technology is only personalized to the extent that it is accompanied by an instructional design that is sensitive to diversity and committed to meaningful learning.

Ultimately, the SmartSchool platform aligns with international trends in personalized assessment based on educational analytics, providing evidence that, when implemented pedagogically, its functionalities can contribute to transformative and appropriate assessment tailored to the students' level. However, its impact is not limited to technology; it also involves teacher professional development and an institutional educational framework that enables the critical use of information obtained from technological data to make sound educational decisions.

Conclusions

Personalized assessment in virtual environments represents a contemporary challenge that requires the integration of technology, pedagogy, and data analysis. A case study conducted with the SmartSchool platform confirms that digital environments can be designed not only to store and manage academic information but also to operate as intelligent assessment ecosystems, capable of diagnosing, intervening, providing feedback, and documenting differentiated learning processes.

The analyzed features, including individualized visual monitoring, automated remediation, pedagogical recommendations, thematic block organization, and traceability through reports, demonstrate that it is possible to build assessment processes centered on the student's progress, rather than reducing performance to standardized final grades. This structure promotes a logic of equity and continuous improvement, allowing teachers to make informed and timely pedagogical decisions.

However, it is recognized that the potential of these platforms does not unfold automatically. Their effectiveness depends largely on the pedagogical use made by teachers, institutional support, and an ethical approach to data processing. In this sense, personalized assessment should not be understood as a technological solution, but rather as an educational practice supported by digital tools.

This study provides empirical and conceptual evidence on the operationalization of evaluative personalization through digital educational systems, and raises the need to continue researching the impact of these tools on improving learning, educational equity, and teacher professional development.

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