Learning Analytics for Academic Empowerment: Transforming a Siloed Institution into a Real-Time, Data-Driven Higher Education Ecosystem

Tiago H. Moreira de Oliveira[1] [0000-0002-2488-4264],
Miguel de Castro Neto[1] [0000-0002-7265-3890],
Matilde Queiroz Simões[1],
Eduardo Gomes Costa[1] [0009-0008-5236-9615]

NOVA Information Management School (NOVA IMS), Campus de Campolide, Universidade Nova de Lisboa, 1070-312 Lisboa, Portugal

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LEARNING ANALYTICS FOR ACADEMIC EMPOWERMENT: TRANSFORMING A SILOED INSTITUTION INTO A REAL-TIME, DATA-DRIVEN HIGHER EDUCATION ECOSYSTEM

T.H. Moreira de Oliveira, M. de Castro Neto, M.Q. Simões, E. Gomes Costa

NOVA Information Management School - NOVA IMS (PORTUGAL)

Abstract

As higher education institutions increasingly turn to data to enhance academic outcomes and engagement, Learning Analytics (LA) emerges as a key strategic enabler. At NOVA Information Management School (NOVA IMS), we have implemented a comprehensive Learning Analytics ecosystem that places data-driven decision-making at the core of our academic mission, guided by the principle “Data with Purpose”.

This transformation stems from a cross-functional Digital Transformation Project, which began with process reengineering using Business Process Modelling (BPM) to streamline operations and reduce the administrative burden on faculty and staff. A robust data governance model enabled real-time integration of diverse systems and databases, laying the foundation for a suite of seven interactive dashboards. These tools deliver structured, accessible insights tailored to multiple stakeholder profiles:

Faculty Cockpit empowers professors with real-time metrics on course delivery, student profiles, teaching plan adherence, and learner feedback, enabling data-informed pedagogy and reducing reporting workloads.

Program Directors’ Cockpit provides a 360º view of each academic program—including applications, academic performance, satisfaction indicators, and dropout trends—supporting proactive planning and academic success.

Students Cockpit offers personalized academic dashboards with information on grades, attendance, and satisfaction, promoting self-regulation and continuous engagement.

BI@NOVA IMS centralizes institutional Key Performance Indicators (KPIs) in areas such as teaching, research, sustainability, human capital, and internationalization, providing school leadership with strategic oversight.

Satisfaction Levels Dashboard allows faculty and staff to access real-time feedback from students and service users, fostering a culture of continuous improvement.

MagIC BI Dashboard visualizes the research center’s performance and societal impact, including publications and contributions to the UN Sustainable Development Goals (SDGs).

SDG Contribution Dashboard, launched on Earth Day 2024, documents over 1,600 concrete actions aligned with the 17 UN SDGs, showcasing NOVA IMS’s societal commitment.

These dashboards break down data silos and democratize access to meaningful information, enabling real-time, segmented insights across all user groups. From predictive models that identify students at risk to performance benchmarks in sustainability and innovation, this ecosystem has fundamentally reshaped how the institution manages learning, supports faculty, and engages students.

Awarded “Best Education Project” at the 2024 Portuguese Digital Awards by IDC Portugal, this initiative stands as a scalable model for embedding Learning Analytics into the academic DNA of higher education institutions. This paper outlines the methodological foundations, technical architecture, and measurable impact of NOVA IMS’s Learning Analytics framework, offering actionable insights for institutions seeking to operationalize data as a strategic asset.

Keywords: Learning Analytics, Data Science, Digital Transformation, Business Intelligence, Data Governance, Academic Engagement, Higher Education, Predictive Analytics.

1 INTRODUCTION

Higher education institutions (HEIs) are increasingly confronted with complex demands for transparency, agility, personalized learning, and alignment with broader societal impact. In response, Learning Analytics (LA) has become a pivotal strategic mechanism for institutional transformation. LA enables HEIs to generate actionable insights from educational data, enhance learning environments, and support evidence-informed decision-making across all organizational levels [1], [2], [3]

This paper presents the case of NOVA Information Management School (NOVA IMS), a leading Portuguese higher education institution in the field of Data Science and Information Management, that has strategically embedded LA within its broader digital transformation agenda. By designing and implementing an integrated, in-house suite of real-time dashboards, NOVA IMS has institutionalized LA within academic, administrative, and strategic workflows. This transformation aligns with contemporary scholarship advocating for ethical, human-centered, and institutionally integrated LA frameworks [4], [5].

The remainder of this paper is structured as follows: Section 2 presents a literature review and conceptual foundation for Learning Analytics, examining its evolution and current models. Section 3 introduces the institutional context of NOVA IMS and its digital transformation strategy. Section 4 outlines the methodology used for implementing the dashboards. Section 5 describes the LA ecosystem developed at NOVA IMS. Section 6 discusses the impacts and results observed. Section 7 offers a critical discussion, and Section 8 concludes with reflections and future directions.

2 LEARNING ANALYTICS: CONCEPTUAL FOUNDATIONS AND LITERATURE REVIEW

According to the Society for Learning Analytics Research (SoLAR), Learning Analytics refers to "the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" [1], [2]. Learning Analytics (LA) is increasingly being recognized not just as a set of tools and techniques, but as a new epistemological paradigm that reshapes how we understand and support learning processes (Long & Siemens, 2011 [9]).

The literature has evolved to identify key applications of LA including early-warning systems [6], personalized feedback dashboards [4], and strategic monitoring using institutional KPIs [7], [8].

Two prominent conceptual frameworks have influenced the field. The LAK Reference Model [7], [8] comprises four layers: data input, analytics processing, data visualization, and pedagogical action. More recently, the LAVA Model [7] blends LA with Visual Analytics (VA) to create interactive, human-centered tools that enhance sense-making and stakeholder engagement. The LAVA Model emphasizes iterative exploration, hypothesis generation, and actionable feedback, aligning LA with design-based and participatory research paradigms.

Ethical considerations are central to effective LA implementation. Drachsler and Greller [5] proposed the DELICATE checklist, focusing on transparency, informed consent, and data minimization. Selwyn [9], [10] cautions against technological determinism, advocating instead for a values-driven approach grounded in autonomy, inclusivity, and data justice.

Despite the promise of LA, barriers persist. These include fragmented data systems, limited data literacy, resistance to organizational change, and misalignment between analytics outputs and pedagogical practice [3], [11]. Ifenthaler and Yau [4] argue that meaningful adoption depends on participatory co-design processes that embed LA into institutional culture and practice.

The case of NOVA IMS contributes to this discourse by demonstrating how LA can be operationalized in public HEIs through an ecosystem of internally developed dashboards that are aligned with institutional strategy and grounded in Business Intelligence (BI), Business Process Management (BPM), and sustainable governance principles [12], [13], [14]. It also exemplifies the operationalization of LA to map institutional contributions to the UN Sustainable Development Goals [15] and to foster alignment between academic activities and global priorities.

In addition to BI dashboards supporting educational outcomes, the integration of LA at NOVA IMS extends to areas such as research analytics, student engagement profiling, and sustainability metrics. This expanded use of analytics echoes calls from Bajpai and Mani [16] for leveraging big data in education to improve instructional quality, institutional accountability, and equity.

Furthermore, by embedding LA into real-time tools like the Students Cockpit and the SDG Contribution dashboard, NOVA IMS responds to the dual imperative highlighted by Chatti [7] and Deng [17]: to ensure that learners are not only monitored but actively empowered to reflect on their behaviors and learning progress. These student-facing dashboards support self-regulated learning and academic reflection, reinforcing the human-centered ethos central to the LAVA model.

Thus, the LA ecosystem at NOVA IMS serves as a compelling example of what Bajpai and Mani describe as "analytics for empowerment," showcasing how actionable insights can inform not only academic performance tracking but institutional storytelling and public value creation.

3 INSTITUTIONAL CONTEXT AND DIGITAL STRATEGY

NOVA IMS is a school within the Universidade NOVA de Lisboa, internationally recognized for its leadership in information management, data science, and business analytics. Over the past decade, the institution has consistently ranked among the top schools in its field, establishing a reputation for innovation and excellence in digital education. Its commitment to becoming a real-time, data-driven institution is reflected in the institutional motto "Data with Purpose," which underpins all strategic and operational activities.

The digital transformation strategy at NOVA IMS was initiated in 2020 and accelerated during the COVID-19 pandemic. It focuses on enhancing transparency, efficiency, and evidence-based governance through the deployment of agile digital solutions. The strategy follows a Business Process Management (BPM) approach, with over 100 academic and administrative processes mapped and redesigned using BPMN standards. This foundational work enabled the seamless integration of Learning Analytics with institutional processes, ensuring contextual fit and user adoption.

As additional key enablers of this transformation:

- The appointment of a Chief Information Officer (CIO) responsible for institutional digital strategy;
- The establishment of a dedicated Digital Transformation Office;
- A governance model based on co-design, involving faculty, students, and administrative staff;
- The use of Microsoft Power BI as the core platform for dashboard development, chosen for its flexibility, accessibility, and integration with the institution's Microsoft 365 environment.

This strategic vision aligns with business intelligence maturity models, such as that proposed by Neto [18], which emphasize the development of internal capabilities, organizational alignment, and the iterative integration of BI practices to drive institutional improvement.

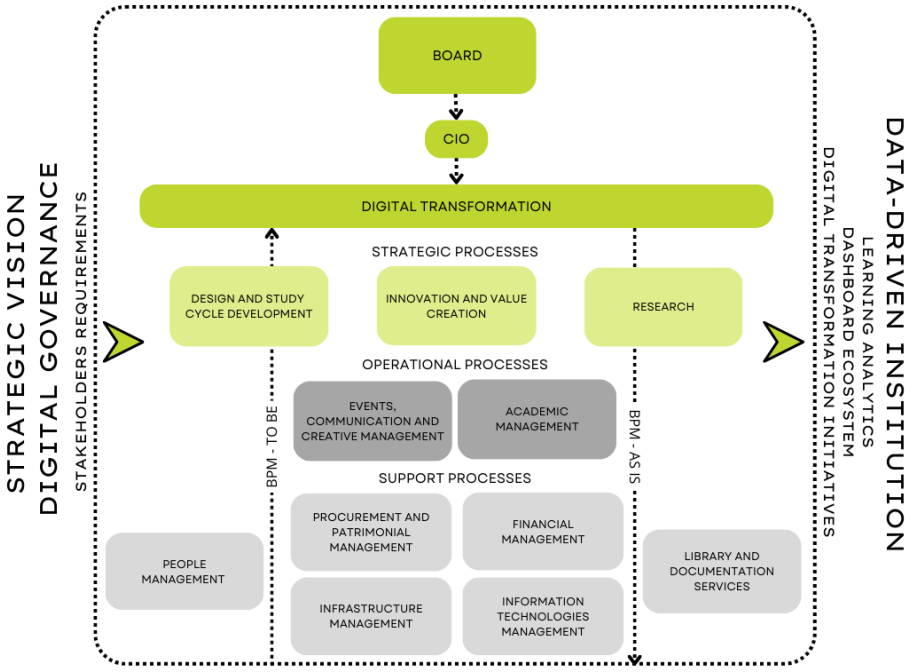

Fig 1. NOVA IMS strategic architecture and DT Governance Model

Strategically, the transformation aligns with broader trends in higher education, including the shift toward continuous quality assurance, sustainable development, and data-informed public accountability. It also reflects a growing recognition that student success and institutional resilience require dynamic, connected, and ethical data ecosystems [15], [19], [20].

4 METHODOLOGY

This study employs a qualitative case study methodology rooted in the principles of Design Science Research (DSR) [21], which is particularly suitable for evaluating complex socio-technical interventions in real-world institutional settings. The research draws upon multiple sources of evidence: 1) Institutional documentation (e.g., strategy papers, BPM diagrams); 2) Dashboard usage data and metadata logs; 3) Interviews and surveys with faculty, students, and management users; 4) Comparative benchmarking against national and international LA initiatives.

The research process followed the five phases of the DSR model: awareness of the problem, suggestion, development, evaluation, and conclusion [22]. The iterative development cycles were guided by agile principles and structured around user feedback loops, usability testing, and performance validation.

Each dashboard in the ecosystem was designed to address specific institutional goals and mapped to one or more strategic KPIs. Data sources were integrated via a centralized data architecture using SQL Server and SharePoint connectors. Where necessary, data cleaning and transformation routines were developed to ensure semantic alignment, accuracy, and update frequency. The dashboards were versioned and rolled out progressively, with training and support provided through workshops and helpdesk documentation.

Through this methodology, the study ensures that the LA implementation is not merely descriptive but analytically grounded in institutional context, stakeholder needs, and real-world impact assessment.

5 THE NOVA IMS LEARNING ANALYTICS DASHBOARD ECOSYSTEM

The Learning Analytics (LA) ecosystem at NOVA IMS comprises seven interconnected dashboards that collectively support academic planning, operational management, research oversight, student engagement, and societal reporting. Each dashboard is aligned with specific user groups and institutional objectives, forming a layered data architecture that facilitates real-time, role-based access to critical information.

Table 1. Overview of dashboards by Strategic Goals, Features, and main purpose

Dashboard	*Users*	*Purpose*	*Primary Objective*	*Strategic Relevance*	*Feature highlights*
BI@NOVA IMS Global Dashboard	NOVA IMS Community, both students, Professors, Staff and Researchers	Institutional overview	Visualize overall institutional performance	Aligns with global KPI's and accreditation	Aggregates more than 80 indicators across teaching, research, HR, financial performance and sustainability. Offers benchmarking against previous years. Includes filters by program, cycle, department, and demographic variables.
Program Directors Cockpit	Course coordinators	Student performance and engagement	Support course coordination and curricular quality	Ensures academic performance monitoring	Enables directors to monitor student progression, dropout risks, and feedback trends. Presents comparisons across cohorts, courses, and instructors. Supports data-informed curriculum redesign. Contains complete information regarding the Applicants.

Faculty Cockpit	Professors	Feedback, evaluation, teaching support	Empower teaching staff with real-time insights	Enhances pedagogical decision-making	Integrates teaching load, student satisfaction, attendance patterns, and learning outcomes. Assists in workload planning and pedagogical reflection. Facilitates transparent performance feedback loops.
Students Cockpit	Students	Personal performance and learning metrics	Provide students with personalized analytics	Supports retention, engagement and autonomy	Offers personalized dashboards with progress tracking, feedback history, and exam analytics. Reinforces student agency and encourages reflective learning habits. Is actively used during academic advising sessions.
SDGs Dashboard	Public Access	Contribution to UN Sustainable Goals	Track institutional contribution to UN goals	Aligns DT with social responsibility Agenda	Maps institutional activities (projects, theses, teaching units) to each of the 17 Sustainable Development Goals. Features a public-facing interface, promoting transparency and societal impact. Serves as a compliance and communication tool for external reporting.
MagIC BI	Public Access	Monitor scientific production and research activity	Monitor scientific output and research networks	Informs funding, partnerships, and rankings	Visualizes research production, citations, co-authorship networks, and funding opportunities. Supports strategy formulation for publication and collaboration. Includes filters by thematic area, year, and researcher.
Students' Satisfaction Levels	Academic directors, faculty, quality assurance teams, executive board	Quality assessment	Improve teaching quality, program design, and service responsiveness based on student feedback	Improve teaching quality, program design, and service responsiveness based on student feedback	Monitor and analyze students' satisfaction levels with professors, curricular units, academic programs, and support services. Improve teaching quality, program design, and service responsiveness based on student feedback.

The dashboards are not standalone tools, they are embedded into regular workflows such as:

- Weekly executive board meetings;
- Curriculum design reviews;
- Faculty evaluations;
- Student orientation and advising;
- Sustainability reporting.

This integration ensures that data is not just collected but acted upon.

Figure 2 illustrates the data flow architecture connecting each dashboard to its respective data sources and users.

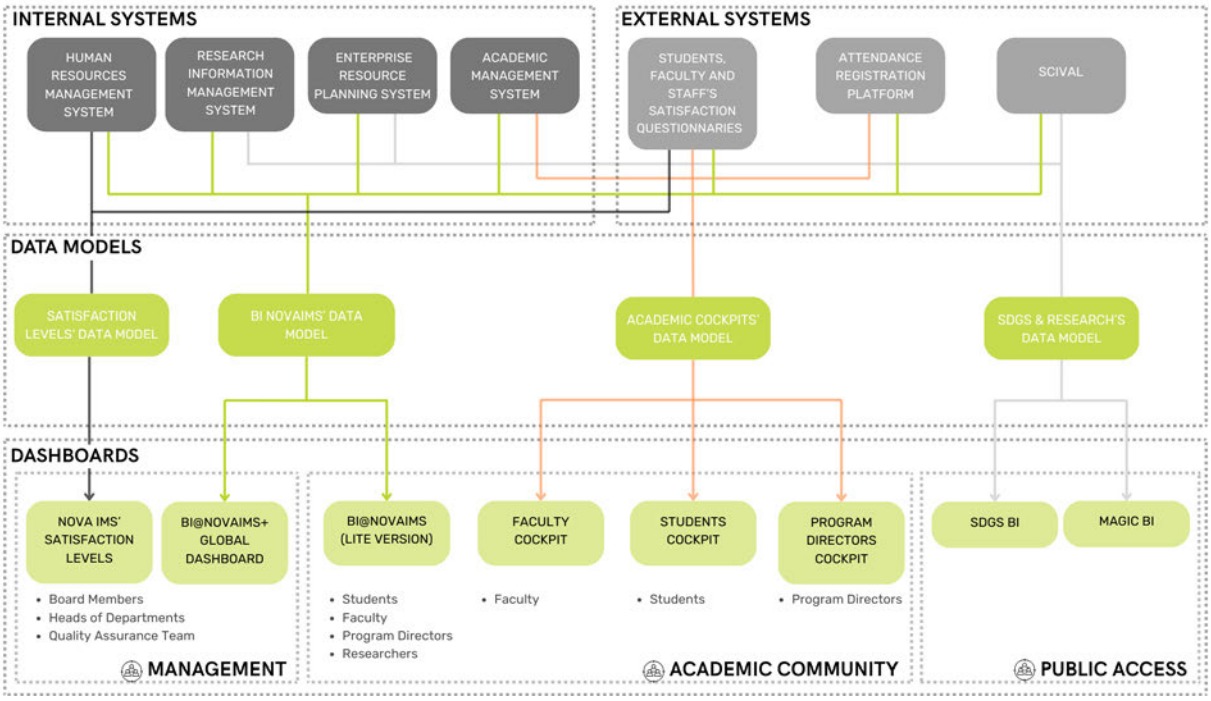

Fig 2. BI@NOVA IMS data flow architecture

The data infrastructure behind BI@NOVA IMS is built on Microsoft's data stack – using: SQL Server for centralized storage; Power BI for visualization and dashboard logic; Power Automate for notifications and scheduled updates; Active Directory + SharePoint for access control and document embedding.

All dashboards operate under a single sign-on (SSO) system, ensuring seamless user experience and role-based security. The ETL pipelines are fully automated and monitored daily by the internal transformation team.

A metadata governance schema ensures traceability, data quality validation, and audit readiness – supporting both internal assurance and external accreditations (e.g., AACSB, USGIF) – while there's also a Monitoring Dashboard which certifies that all the information is up to date, validated, while identifying the involved department.

With this expanded view, the BI@NOVA IMS platform not only supports performance monitoring but constitutes a strategic asset for institutional intelligence, enabling NOVA IMS to operate as a truly data-driven higher education institution.

Together, these dashboards dismantle data silos, foster a shared language of indicators, and ensure that Learning Analytics becomes a living practice rather than a one-off project. Their in-house development allowed NOVA IMS to achieve contextual precision, internal capacity building, and a culture of agile innovation in the use of data for academic empowerment.

5.1 BI@NOVA IMS

Serving institutional leadership and governance bodies, BI@NOVA IMS aggregates over 200 KPIs across teaching, research, human capital, finance, and sustainability domains. It provides comparative views between departments and longitudinal trends for strategic planning. Integrated with SharePoint, it functions as a core reporting interface for quality assurance cycles and public accountability frameworks.

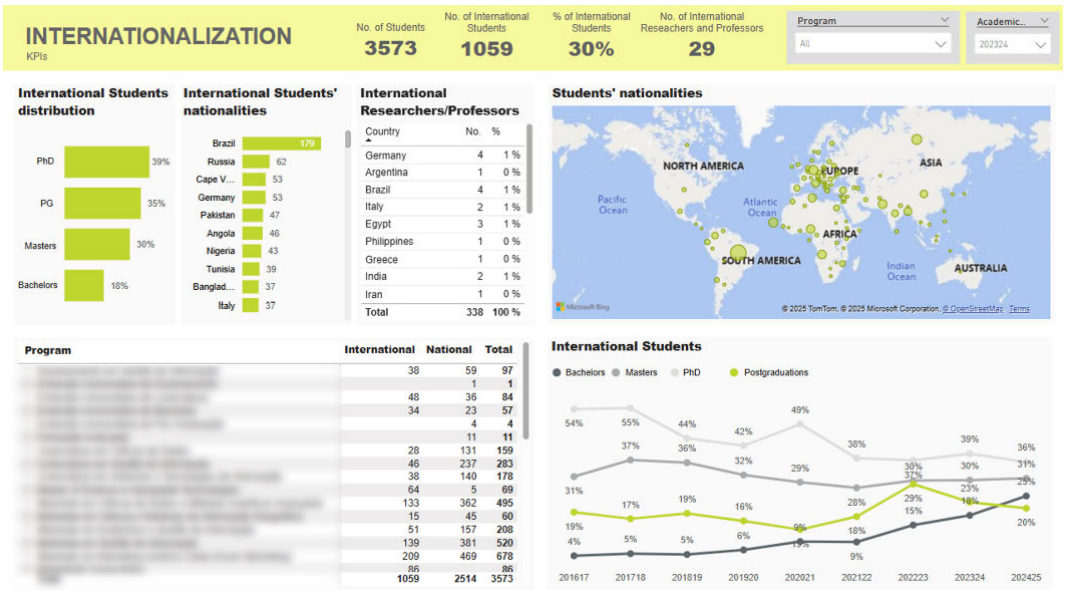

Fig 3. BI@NOVA IMS Global Dashboard interface example, with KPIs regarding internationalization

5.2 Program Directors' Cockpit

This strategic tool supports degree, post-graduation, master, and PhD program directors in monitoring academic performance, student success and attrition patterns, satisfaction scores, and course-level KPIs. It consolidates data from application systems, curricular structures, and student records to provide a holistic overview of program health. Directors can compare programs longitudinally, explore dropout root causes, and plan interventions aligned with accreditation standards and institutional benchmarks.

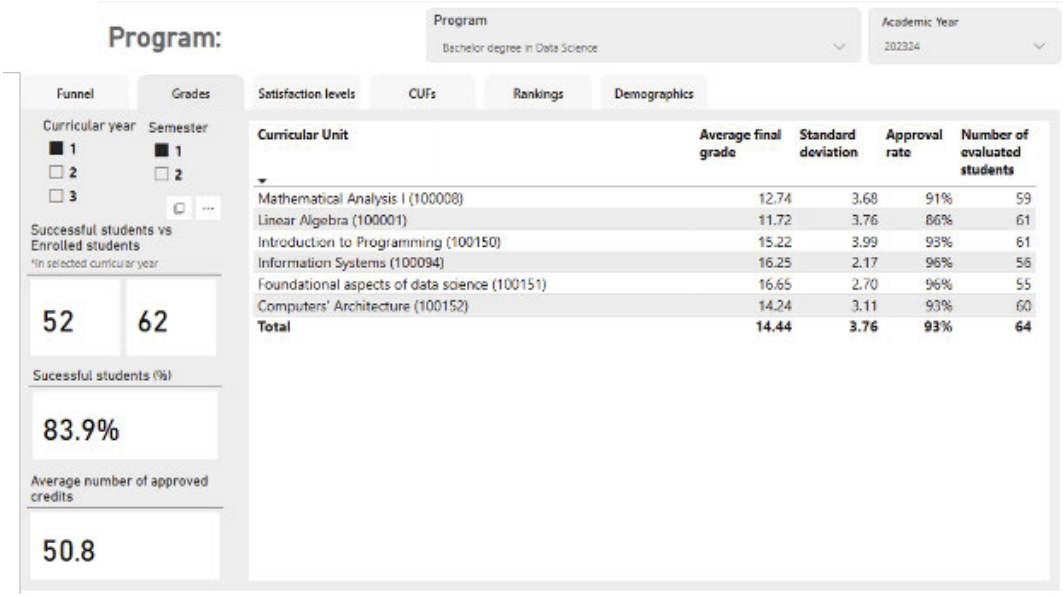

Fig 4. Program Directors Cockpit – grading KPI example

5.3 Faculty Cockpit

Designed for course instructors, this dashboard integrates data from the Academic Management System, Moodle, attendance systems, and evaluation surveys. It provides detailed insights into teaching workload, course performance, student segmentation, and feedback analysis. Instructors can monitor absenteeism, track progress across learning outcomes, and access longitudinal feedback trends. The dashboard promotes reflective practice and data-informed pedagogical adjustments.

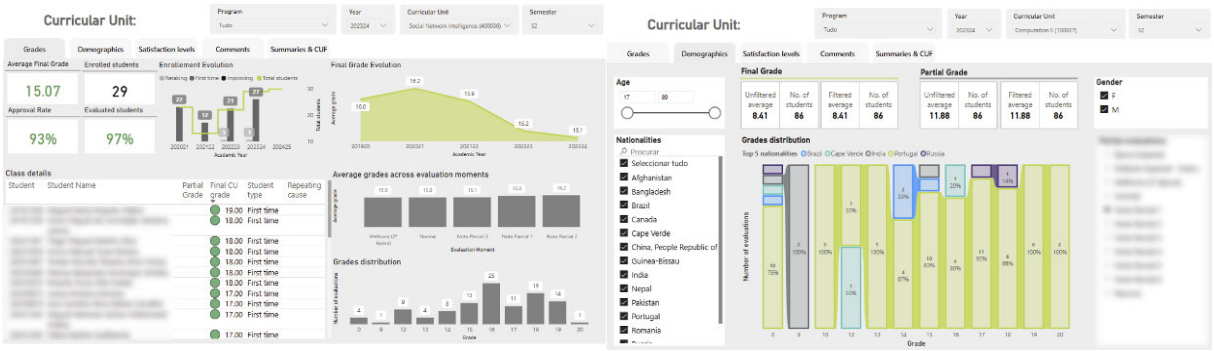

Fig 5. Faculty Cockpit – grading and demographics KPIs example

5.4 Students Cockpit

Empowering students through transparency and autonomy, this dashboard offers personalized academic profiles with visual summaries of performance, attendance, satisfaction, and course engagement. It reinforces principles of self-regulated learning and complement academic advising sessions. Built with accessibility and usability in mind, the dashboard integrates with Microsoft Teams, facilitating mobile-first access and proactive engagement.

5.5 SDG Contributions Dashboard

This innovative tool quantifies institutional contributions to the United Nations (UN) Sustainable Development Goals (SDGs). It maps over 1,600 records – Including curricular units, theses, research projects, and public events – against the 17 SDGs. The dashboard supports reporting to global frameworks and informs internal strategy by identifying underrepresented goals and areas of opportunity.

Fig 6. SDG Dashboard example – Public interface with ODS contribution mapping

5.6 MagIC BI

Focused on research analytics, this dashboard supports the MagIC Research Center in tracking scientific outputs, funding distribution, and international collaborations. It incorporates metadata from Scopus, FCT, and internal systems, enabling researchers and administrators to align activities with institutional goals and funding mandates. The dashboard also maps publications to the SDGs, extending its value beyond traditional scientific indicators.

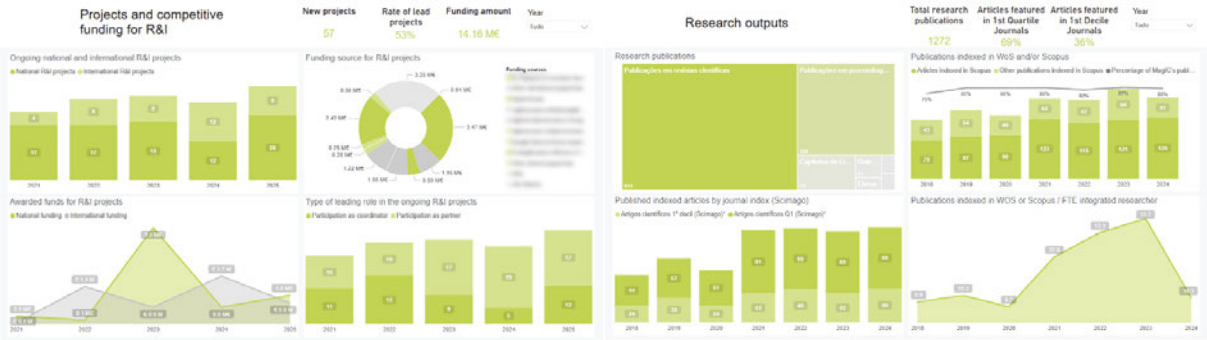

Fig 7. MagIC BI – research projects and research outputs KPIs example

5.7 NOVA IMS Satisfaction Levels

This dashboard visualizes satisfaction data collected from students and service users across academic units and administrative services. It facilitates benchmarking, detects outliers, and supports continuous improvement through dynamic filters by program, year, and service. Actionable insights derived from this tool feed into periodic service reviews and pedagogical councils.

6 MAIN RESULTS AND MEASURABLE IMPACT

The deployment of the Learning Analytics (LA) ecosystem at NOVA IMS has resulted in measurable and transformative outcomes across pedagogical, operational, and strategic domains. These results have significantly enhanced institutional responsiveness and efficiency, while cultivating a pervasive culture of data-informed decision-making.

From an academic perspective, faculty members report marked improvements in their ability to monitor, adapt, and personalize teaching strategies. Tools such as the Faculty Cockpit and Students Cockpit have facilitated the early identification of at-risk students, allowing for timely interventions that contribute to improved retention and academic performance. Instructors are now better equipped to refine their pedagogical approaches based on real-time feedback and student performance data, while also achieving greater alignment with intended learning outcomes. The dashboards have become integral to the instructional process, incorporated into class planning and course evaluation routines.

At the student level, the Students Cockpit has empowered learners by enhancing transparency and ownership of their academic journey. More than 85% of students engage with their dashboards regularly throughout the semester. This engagement has fostered the development of self-regulated learning habits, as students actively use personalized performance feedback to reflect on progress and co-construct goals during academic advising sessions.

For institutional leadership and program management, the BI@NOVA IMS and Program Directors' Cockpit offer powerful tools for strategic oversight and operational optimization. The dashboards have contributed to a significant reduction in the time required to prepare institutional reports and accreditation documentation. They have also improved the evaluation of academic programs by providing access to longitudinal trends and performance indicators, thereby informing curriculum redesign and enhancement. The governance of satisfaction metrics has also improved, as data visualizations are now routinely used during Academic Boards and Quality Councils to support service monitoring and improvement.

In the realm of research and societal contribution, the MagIC BI and SDG Contributions dashboards have had a tangible impact on institutional alignment with broader missions. The research-focused dashboards have strengthened oversight by linking outputs to funding lines and strategic goals, while the SDG dashboard has enabled NOVA IMS to clearly articulate and monitor its contributions to the United Nations 2030 Agenda. This integration facilitates the alignment of theses, projects, and academic initiatives with global sustainability priorities.

The value of this Learning Analytics initiative has also been recognized externally. In 2024, the ecosystem was awarded "Best Education Project" at the Portuguese Digital Awards, organized by IDC Portugal, as well as the ADN Prize in the category of "ICT and Digital Transformation" by Universidade NOVA de Lisboa, with the project "Digital Transformation at NOVA IMS: A 360° Vision". Additionally, the

project has been showcased in academic conferences and professional networks as a benchmark case for digital transformation and educational innovation.

Taken together, these impacts confirm that Learning Analytics, when institutionally embedded and strategically deployed, can drive a fundamental shift in how universities govern, teach, and learn. By integrating dashboards into everyday academic life, NOVA IMS has moved beyond descriptive reporting toward a model characterized by continuous reflection, data-driven adaptation, and collective responsibility for learning outcomes.

7 DISCUSSION

The case of NOVA IMS demonstrates that Learning Analytics, when institutionally embedded and strategically aligned, can serve as a transformative force in higher education. Rather than treating dashboards as static reporting tools, the institution positioned them as dynamic instruments of academic engagement, reflection, and empowerment. This approach reflects a broader shift toward what Chatti [8] describe as Human-Centered Learning Analytics (HCLA), which places stakeholder needs, agency, and interpretability at the core of the analytics process.

The evolution from compliance-based reporting to empowerment-focused analytics is a defining characteristic of the NOVA IMS model. While many LA initiatives worldwide have focused on institutional oversight or predictive modeling alone (Deng et al., 2024), the dashboards at NOVA IMS actively enable behavioral change and decision-making across roles. This supports Ferguson's [3] assertion that LA is most impactful when embedded into daily routines and aligned with pedagogical goals.

By granting students real-time access to their learning data, NOVA IMS fosters self-regulated learning behaviors and a stronger sense of academic ownership. For faculty, dashboards offer immediate insights that would otherwise require extensive administrative time. This aligns with the LAVA Model's principles [7], where visual interactivity and user-driven exploration are key to adoption and impact.

The success of the ecosystem also reflects enabling institutional conditions: 1) Strategic governance: The presence of a CIO and a dedicated Digital Transformation Office created a centralized coordination mechanism; 2) Internal capacity: In-house development ensured contextual adaptation and iterative design; 3) Process reengineering: BPM efforts prior to dashboard design helped align data flows with actual workflows, increasing the accuracy and usability of the analytics.

These findings reinforce previous studies [14] that highlight organizational readiness, leadership engagement, and digital maturity as critical enablers of LA adoption.

A distinctive dimension of the NOVA IMS case is its integration of sustainability and public value into the LA ecosystem. The SDG Contributions Dashboard operates global commitments by translating abstract goals into measurable institutional actions. This goes beyond standard applications of LA and aligns with recent calls to extend analytics to societal accountability and impact [15].

Furthermore, the ability to integrate multiple dashboards into a cohesive and navigable ecosystem offers a benchmark for other institutions. While international exemplars often emerge from Anglo-Saxon or large-scale online learning contexts (e.g., Purdue, Open University UK), the NOVA IMS case provides a replicable model within a medium-sized, European, public university context—adding geographic and organizational diversity to the field's case literature.

Despite its success, the implementation process was not free of obstacles. Data heterogeneity, integration of legacy systems, and the need to build data literacy across roles were all ongoing challenges. As identified by Greller and Drachsler [5], ethical and interpretative issues also emerge, particularly around student profiling and consent.

To address these, NOVA IMS adopted the DELICATE principles [5] and developed internal policies on responsible analytics usage. Still, future iterations of the system will need to engage further with adaptive and predictive analytics, interoperability with LMS platforms, and student feedback loops to refine both function and ethics.

In sum, the discussion confirms that Learning Analytics can act as a cornerstone for institutional transformation—if it is designed not just as a technology project, but as a cultural and governance shift that connects data to purpose, people, and practice.

8 CONCLUSIONS

This paper presented the case of NOVA IMS as an exemplar of how Learning Analytics (LA) can be harnessed to empower students, support faculty, inform strategic governance, and align higher education institutions with global development agendas. The implementation of a comprehensive ecosystem of dashboards—each addressing specific user needs—enabled the school to break down data silos and foster a culture of real-time, evidence-based decision-making.

Key to this transformation was a multi-layered strategy grounded in Business Process Management (BPM), co-design principles, and internal development capacity. The ecosystem reflects the current best practices in literature, including the human-centered principles articulated by the LAVA Model [7], and illustrates how LA can move beyond monitoring to become a tool for engagement and autonomy.

By embedding dashboards into daily academic routines, NOVA IMS succeeded in shifting the institutional mindset from retrospective evaluation to proactive intervention and reflection. This shift not only supports pedagogical innovation and operational efficiency but also strengthens accountability and alignment with the Sustainable Development Goals (SDGs).

The experience highlights several critical success factors for other institutions seeking to replicate such efforts: strong digital governance, stakeholder involvement, semantic data integration, and a phased approach to rollout. However, it also signals ongoing challenges, particularly in areas such as data ethics, predictive modeling, and cross-platform interoperability.

Future work at NOVA IMS will focus on deepening integration with Learning Management Systems (LMS), advancing predictive and adaptive analytics models, and incorporating student-generated data to enrich personalization. Additionally, continued emphasis will be placed on maintaining transparency, consent, and inclusivity in how learning data is interpreted and applied.

Ultimately, the NOVA IMS model demonstrates that Learning Analytics is not only a technical or administrative innovation, but a cultural and institutional shift toward democratized, actionable, and meaningful use of data in higher education. The insights offered in this paper provide a roadmap for other institutions aspiring to evolve into agile, data-driven ecosystems for academic excellence and societal contribution.

REFERENCES

[1] G. Siemens, “Learning Analytics: Envisioning a Research Discipline and a Domain of Practice,” in *Proceedings of the 2nd International Conference on Learning Analytics and Knowledge*, ACM Digital Library, 2013.

[2] B. Phil Long and G. Siemens, “Penetrating the Fog: Analytics in Learning and Education,” *EDUCASE Review*, no. 46 (5), pp. 30–40, 2011.

[3] R. Ferguson, “Learning analytics: drivers, developments and challenges,” *International Journal of Technology Enhanced Learning*, vol. X, no. 4 (5/6), pp. 304–317, 2012.

[4] D. Ifenthaler and J. Y. K. Yau, “Utilising learning analytics to support study success in higher education: a systematic review,” *Educational Technology Research and Development*, vol. 68, no. 4, pp. 1961–1990, Aug. 2020, doi: 10.1007/s11423-020-09788-z.

[5] H. Drachsler and W. Greller, “Privacy and analytics - it’s a DELICATE issue a checklist for trusted learning analytics,” in *ACM International Conference Proceeding Series*, Association for Computing Machinery, Apr. 2016, pp. 89–98. doi: 10.1145/2883851.2883893.

[6] Z. Papamitsiou and A. A. Economides, “Learning Analytics and Educational Data Mining in Practice: A Systematic Literature Review of Empirical Evidence,” *Educational Technology & Society*, vol. 17, no. 4, pp. 49–64, 2014.

[7] M. A. Chatti, A. Muslim, M. Guliani, and M. Guesmi, “THE LAVA MODEL: LEARNING ANALYTICS MEETS VISUAL ANALYTICS,” 2023.

[8] M. A. Chatti, A. L. Dyckhoff, U. Schroeder, and H. Thüs, “A Reference Model for Learning Analytics,” *International Journal of Technology Enhanced Learning*, no. Special Issue on "State-of-the-Art in TEL, pp. 312–331, 2012, [Online]. Available: https://tekri.athabascau.ca/analytics/

[9] N. Selwyn, “Digital degrowth: toward radically sustainable education technology,” *Learn Media Technol*, vol. 49, no. 2, pp. 186–199, 2024, doi: 10.1080/17439884.2022.2159978.

[10] N. Selwyn *et al.*, “What’s next for Ed-Tech? Critical hopes and concerns for the 2020s,” in *Learning, Media and Technology*, vol. 45, no. 1, Routledge, 2020, pp. 1–6. doi: 10.1080/17439884.2020.1694945.

[11] B. Hinings, T. Gegenhuber, and R. Greenwood, “Digital innovation and transformation: An institutional perspective,” *Information and Organization*, vol. 28, no. 1, pp. 52–61, Mar. 2018, doi: 10.1016/j.infoandorg.2018.02.004.

[12] R. Hajishirzi, C. J. Costa, and M. Aparicio, “Boosting Sustainability through Digital Transformation’s Domains and Resilience,” *Sustainability (Switzerland)*, vol. 14, no. 3, Feb. 2022, doi: 10.3390/su14031822.

[13] R. Hajishirzi, C. J. Costa, M. Aparicio, and M. Romão, “Digital Transformation Framework: A Bibliometric Approach,” *Lecture Notes in Networks and Systems*, vol. 3, pp. 427–437, 2022, doi: 10.1007/978-3-031.

[14] F. Cruz-Jesus, T. Oliveira, and M. Naranjo, “Understanding the Adoption of Business Analytics and Intelligence,” vol. 745, pp. 1094–1103, 2018, doi: 10.1007/978-3-319.

[15] I. B. B. Chande, “NOVA IMS Contribution for SDGs Achievement: A Business Intelligence Approach,” NOVA Information Management School, Universidade NOVA de Lisboa., 2021. Accessed: Apr. 16, 2025. [Online]. Available: https://run.unl.pt/handle/10362/130839

[16] S. Bajpai and S. Mani, “Big Data in Education and Learning Analytics,” *TechnoLearn: An International Journal of Educational Technology*, vol. 7, no. 1and2, p. 45, 2017, doi: 10.5958/2249-5223.2017.00005.5.

[17] T. Deng, S. Chen, and T. Zhou, “The Analysis of Student Learning Behavior Based on Teachermate Data,” in *2024 4th International Conference on Educational Technology (ICET)*, IEEE, Sep. 2024, pp. 532–537. doi: 10.1109/ICET62460.2024.10868065.

[18] N. Côrte-Real, M. Neto, and F. Neves, “Business Intelligence Maturity Assessment Model for organizations,” in *Iberian Conference on Information Systems and Technologies, CISTI*, Jun. 2012. Accessed: Apr. 09, 2025. [Online]. Available: https://www.scopus.com/record/display.uri?eid=2-s2.0-84869072573&origin=inward&txGid=cc3ced2d0b595d5e0bf15c9051836f92

[19] G. Vial, “Understanding digital transformation: A review and a research agenda,” *Journal of Strategic Information Systems*, vol. 28, no. 2, pp. 118–144, Jun. 2019, doi: 10.1016/j.jsis.2019.01.003.

[20] P. C. Verhoef *et al.*, “Digital transformation: A multidisciplinary reflection and research agenda,” *J Bus Res*, vol. 122, pp. 889–901, Jan. 2021, doi: 10.1016/j.jbusres.2019.09.022.

[21] A. R. Hevner, S. T. March, J. Park, and S. Ram, “Design Science in Information Systems Research,” *MIS Quarterly*, vol. 28, no. 28 (1), pp. 75–105, 2004, [Online]. Available: https://www.jstor.org/stable/25148625

[22] V. K. Vaishnavi, *Design Science Research Methods and Patterns*, 1st Edition. New York, New York, USA, 2007. doi: https://doi.org/10.1201/9781420059335.