Digital Learning Technologies – Supporting Innovation and Scalability

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Abstract. Present-day student success is often defined as achieving career goals within a rapidly changing modern workplace, in an educational environment that embraces different lifestyles and learning preferences, makes learning available at any time and place, individually or in teams, and encourages continuous communications with faculty and fellow students. How can technology help to achieve these objectives while assisting faculty in their pursuit of teaching excellence and research quality? How do technology innovations interplay with support scalability, and how to inspire motivation and achieve competitive advantage in the age of cloud computing and SaaS platforms? We provide examples of enhancing the learning ecosystem and streamlining support efforts by leveraging our infrastructure that integrates educational technologies and provides a stage for innovation.

Keywords: Digital learning · Learning technology · Student success · Support scalability · Innovation platform

1 Superior Learning Environment and Scalable Support

Boston University Metropolitan College (MET) has a long and successful history of offering online and hybrid graduate academic programs. Using the fundamental educational principles of achieving an optimal balance of structure and dialog, and leveraging the latest technological capabilities, our programs help students achieve a broad spectrum of educational goals. From building a solid academic foundation to developing their independent learning skills, students consequently learn business competencies, build long-lasting professional relationships, and position themselves for success in their professional careers. We constantly track the latest trends in higher education, trying to combine the proven benefits of online technologies with the effectiveness of face-to-face communications. We believe that our main challenge is positioning these emerging technologies not as obstacles, but instead as tools that help to achieve two objectives. First, they facilitate the creation of a superior learning environment that enables effective communications between faculty and students and makes the learning content interactive and always available – both to learn and to create, at any time and from any place. Second, they enable effective and scalable support for both students and faculty.

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Two classes of digital learning technologies, including Learning Management Systems (LMS) and video conferencing, emerged as the key requirements to ensure structure and dialog [1] in any online or blended academic program. However, digital learning technologies and instructional practices are not limited to online education. In fact, they can significantly enhance traditional on-campus learning [2]. In this paper, we will talk about technology innovation and scalability as it applies to all learning modalities: online, on-campus and hybrid.

2 Innovation Platform

In our modern economy, it is difficult to imagine a business process that is not based on some type of information system. However, recent IT trends have created certain challenges to grass-roots innovation. As on-premises computing infrastructure is being replaced with managed hosting, and ultimately with "…as-a-Service" (SaaS, PaaS, IaaS, etc.) platforms, the ability for customers to experiment and innovate within these platforms often depends on platform vendors, who use the same systems to support all their clients. Functional application changes are possible only within the vendor-envisioned configuration parameters, and any changes beyond this space require platform updates and modifications. Achieving an innovation-driven competitive advantage in this situation is somewhat difficult, as all changes are subject to the vendor's priorities and, when implemented, become instantly available to all platform customers, including the competition.

Fortunately, there is an approach to bypass the *aaS platform limitations. The widely used Application Programming Interface (API) framework allows for a standardized flow of data and commands between heterogeneous systems. Companies can create their own "innovation platforms" while still maintaining focus on their core competencies. Allowing for integrations with "generic" 3rd party systems, these platforms deliver a competitive advantage by combining the best of both worlds: the efficiency of *aaS platforms and the effectiveness of custom core competency applications.

MET applied this "innovation platform" concept [3] to integrate our main digital education platforms: Blackboard LMS, Zoom video conferencing, and other data from the university systems. We leveraged the new platform to deliver the additional functionality that was critical to support our innovative learning initiatives, which are promoting student success and increasing faculty satisfaction. Our innovation platform is integrated with the main transaction platforms in two directions using APIs: we not only automatically get the real-time information we need, but we can also automatically manipulate these platforms based on our business rules and needs. Having these capabilities is critical for our ability to innovate, and the level of automation is critical to achieving scalability (Fig. 1).

In the next sections, we will provide some examples of how we use the MET innovation platform to achieve new learning capabilities and improve student and faculty support.

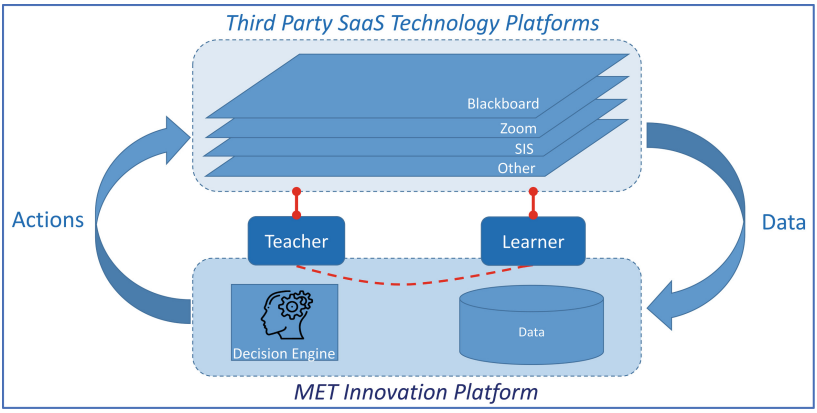

Fig. 1. Maintaining a competitive edge with SaaS clouds: two-way integration between 3rd party technology platform and MET Innovation Platform enables streamlined communications and brings new functionality to create a superior learning environment.

3 Course-Centric Integration

The extended use of online conferencing technologies, even before COVID-19, created a need for the seamless integration of these technologies into the teaching and learning process. When defining this integration philosophy, MET drew a parallel from the online classroom to a physical space where instructors and students meet. Like a physical classroom or a course conferencing website, our online classroom is always linked to a specific course. This "course-centric" integration is different from a traditional web-approach, where online meetings are scheduled by individual users and are linked (and licensed) to their personal accounts.

Our course-centric integration solution leveraged the MET Innovation Platform to interconnect Blackboard Learn SaaS with Zoom's cloud platform, through API. By having all the necessary data, we facilitated the ability to automatically create, start and join Zoom meetings, and provided this as an add-on to the Blackboard system. In this process, we successfully created and deployed a "Launch Meeting" button to solve two business objectives (Fig. 2):

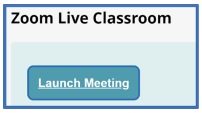

Fig. 2. Automatically created menu and one-click button for faculty and students to enter a course-specific online meeting.

Connection Transparency. Because online classrooms are "hardwired" to courses, anybody in a course is guaranteed to meet in the same online space, which is accessed through the Blackboard course site. It is simply not possible for instructors and students

to end up in the "wrong" meeting, as joining a course meeting is as simple as clicking a button. Even when instructors teach multiple courses, each course has a specific "button" with information dynamically generated for the course in which it is deployed. There is no need for any coding or manipulation of the standard element for faculty or students.

Time Savings. The button eliminates the need for instructors to partake in many standard Zoom processes, including obtaining licenses, using their "personal" account/meeting room, setting up meetings, distributing links to students, ensuring meeting security, downloading and distributing recordings, or tracking attendance. All these tasks are completely automatic. The course-centric Launch button is ideal when a course has co-instructors, substitute instructors and/or teaching assistants. Everyone uses the same button, and instructors and teaching assistants always join the correct meeting with their students, eliminating the need to exchange links in advance.

4 Managing Student Progress

Providing faculty with the tools to achieve teaching excellence, and students with the motivation to absorb the learning material are our key exploration areas for technological innovations. Combining data from multiple systems, we develop new tools to help monitor, visualize, and track student progress in courses. At the same time, we use the functional capabilities of our innovation platform to make the digital learning content more interactive, support different learning preferences, and enable instant feedback.

Managing Prerequisites. To prepare our students for successful careers in the modern workplace, our academic programs make practical knowledge and hands-on skills a priority for learning. This often assumes that students have a solid background in quantitative disciplines, basic programming skills, etc. Because our students have different backgrounds and varying levels of experience, we provide non-credit modules that help students better prepare and succeed in specific graduate courses. Managing this network of pre-requisite relationships between learning modules is challenging. Based on all information available in our innovation platform, we developed an algorithm to automatically enroll students into the relevant modules, so that by the time their courses start, they can catch up on the skills they need to master their course materials. This proactive enrollment gives students more time to prepare, saves faculty and administrators time, and reduces potential errors (Fig. 3).

Providing Additional Motivation. To provide additional motivation for students and to keep track of their progress, we developed a system of "mini-badges" that are tied to workplace-relevant skills acquired during their studies. These badges are automatically awarded upon completion of specific learning modules. Badges are augmented by the automatic distribution of digitally signed electronic certificates that students can use to demonstrate their newly mastered career skills to their colleagues or potential employers. To offer a view of this progress in the course context, we implemented the Badge Dashboard, a tool provided by the innovation platform to show students their course-relevant badge status and to show instructors all their student badge statuses in a particular course.

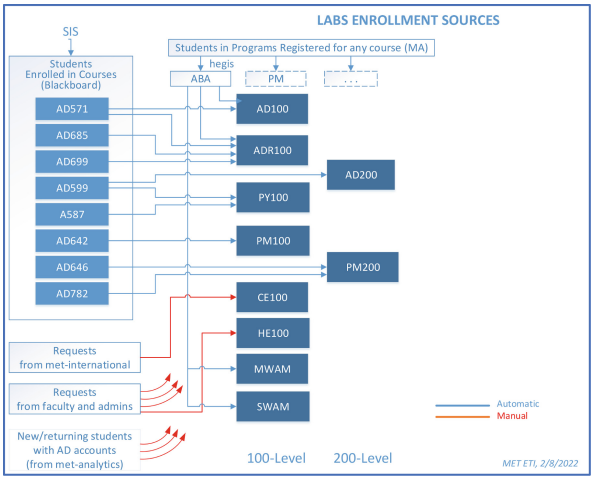

Fig. 3. Complex relationship matrix between academic programs, graduate coursework, and preparatory modules.

Managing Skills and Tracking Progress. Many of the preparatory pre-requisite modules are offered in a self-paced, rolling enrollment format often without the active presence of an instructor. To help make up for this, we leveraged the data we collect from the innovation platform to develop a set of reports that show weekly student progress since their enrollment. They show both the individual student progress and weekly statistics of completing the different units of the learning module, including awarded badges. These statistics help to identify situations where individual students might need help or encouragement, as well as specific parts of the learning content that are more difficult to learn and might require updates. They also help to identify situations when adding an active instructor for a few weeks would be beneficial, to provide additional guidance to the struggling students. The conceptual reporting structure is described in Sect. 5 below.

5 Scalability of Support

With a focus on streamlining consistent delivery of a quality course experience across hundreds of annual course offerings, spanning multiple content delivery formats, we leveraged the capabilities of the innovation platform to construct a set of scalable course support tools targeted at specific business needs. These tools aid in the direction of support actions and provide insight in a form that dramatically increases the efficiency of our internal support activity and maximizes the support leveraged from our support partners. Both proactive and responsive support activities benefit from this implementation. The tools draw on data aggregated from heterogeneous sources, provide new aggregated information, manage access based on our organizational roles, and enable automation across platforms in response to defined business rules.

We will present here two examples of these scalable support resources. The first is an educational technology dashboard that draws on aggregated data resources. The

second is a functional reporting model that brings process and data visibility to relevant actors with specific business needs and process requirements. Together, these provide transparent and efficient data access in service of both college-level and individual/group level oversight and support activities.

Course Site Dashboard. The course site dashboard draws on data aggregated from the university systems and 3rd party platforms to provide a technology deployment overview for the entire college across a given semester. In addition to centralized access, the course site dashboard provides direct links to specific external resources. This saves time by reducing the need to rely on often disconnected and incompatible user interfaces, and workflows across multiple systems, to execute routine academic support tasks.

The dashboard serves a set of processes performed proactively by support staff to prepare and maintain the learning infrastructure. These processes principally concern the timely availability of course content, collaboration technologies, schedules, etc. This availability is viewed from the faculty, student, and cross-functional support perspective. The range of support staff capable of performing tasks has broadened as a result, reducing the load on faculty and staff with administrator roles on 3rd party technology platforms. This is possible because the dashboard's access is managed by our innovation platform, and not through the restrictive roles that are defined in the 3rd party platforms. The implementation of the dashboard vastly reduced both the time elapsed to resolve support requests and the time spent by faculty and staff working around suboptimal access control mechanisms.

Functional Reports. Functional reports are built on the same set of aggregated data that feeds the course site dashboard but are targeted at more individualized business requirements. The innovation platform design (see Fig. 4) allows data queries to be developed quickly, independent from the presentation views, which are shared across all reports and controlled by function-specific access rules. Three examples of such functional reports are provided below.

- Report for support staff without high-level administrative LMS access to obtain visibility into enrollment information across all supported courses.
- Report for faculty and teaching assistants to facilitate assignment of students to teams working on course assignments.
- Exceptions report to ensure all registered students have access to the corresponding course sites, the sites had been properly prepared and open for students, and access is promptly removed when students drop or change courses.

These reports bridge the gap between the flexibility of the application programming interfaces and the ease of use provided by a dashboard optimized to match the internal support processes. Time is saved by providing access to views not available on the 3rd party platforms due to the lack of implementation or user-level access controls. The result has greatly increased our support process effectiveness and efficiency.

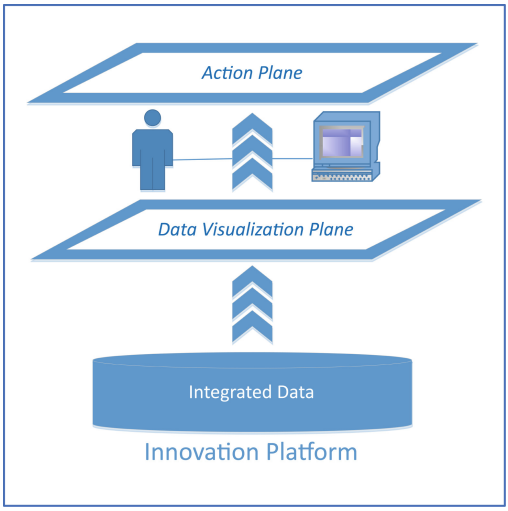

Fig. 4. Integrated data is visualized for subsequent decision-making performed by a human actor or a computerized algorithm.

6 Future Work

Data providing visibility into the learning process helps faculty analyze and manage student progress. Additionally, it provides an opportunity to automate some routine functions related to sending timely reminders, tracking due dates, etc. We believe that adding a rule-based algorithm to automate such routine tasks will provide value for faculty and students. The innovation platform allows us to experiment in this area and explore the opportunities of applying emerging artificial intelligence technologies to education.

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