Personalized Student Experience Through A Standardized IT Infrastructure

Reinhard Landes[1] and David Rapp[1]
[1] SAP SE, Walldorf, Germany
reinhard.landes@sap.com, david.rapp@sap.com

Abstract

While many students start questioning the value of higher education, universities need to find ways to improve student satisfaction to remain attractive. Offering a personalized experience to students can drive engagement and bring universities in a better position in the competition for new enrollments. By collecting and harmonizing all data across the campus, universities can use intelligent technologies to help build a personalized student experience. For that, we outline the roadmap to build a resilient foundation of back-end tools to drive a single-source-of-truth for all university data forcing clarity into front-end applications that deliver the personalized experience to students providing insights into student sentiment and behavior. By highlighting a recent SAP proof of concept with a renowned US-university, we present an example of how machine learning capabilities can enhance student advising with data-driven, personalized insights.

1 Introduction

In recent years, US universities experienced a decline in student enrollment. According to the National Student Clearinghouse Research Center (NSCRC) more than 1 million students have not enrolled in US higher education in the wake of the recent COVID-19 pandemic (Douglas-Gabriel, 2022). With a continuing low rate of new student enrollments, this short-term pandemic "trend" could evolve into a broader cultural shift threatening the economic stability of some higher education institutions in the long-term. The apparent reason for the enrollment decline is the perception by students that the investment in higher education is not adequately focused on actual student needs.

In European higher education, in contrast, enrolment numbers remained stable. However, the student satisfaction rates have dropped drastically due to remote education during the Covid-19 pandemic. According to the 2021 Student Academic Experience Survey (Neves & Hewitt, 2021), the pandemic and lockdown restriction greatly impacted the overall student satisfaction in universities in the United Kingdom. Like US students, many British students are not satisfied with the value they have received for the amount of tuition paid. 44% of students believe they received poor or very poor value

for money, while only 27% received good or very good value. In comparison to previous years, this is a dramatic change. For the first time in the survey's history, most students believe they received poor value. Although the dropout rates remain stable so far, most students are highly disappointed with their student experience.

To avoid possible economic instability and improve student satisfaction rates again, universities must re-think their value proposition and adjust their teaching models to become more student centric. Institutions need to embrace students as their primary customers (Grajek & The 2021-2022 EDUCAUSE IT Issues Panel, 2021). They must improve the student experience to stay attractive to students and put the student success at the forefront of their thinking. An institution will be successful only if their students are successful.

During the pandemic, higher education has already begun transforming its learning experience. Novel ways to deliver the curriculum, as well as exciting new learning models have evolved. But with those new experiences, the expectations of a great student experience have been emerged (Athens, Evans, Mincheff, & Rakoczy, 2021). Students demand a flexible and personalized experience, that seamlessly blends from in-person experiences to online classrooms. With the right, modern technology systems, the university experience can become more student-centric and seamless than ever before. But is this evolutionary change too little, too late?

At the same time, the world is constantly changing and experiencing new disruptive technological trends in the past. With the world becoming more and more digitalized, enormous amounts of data are being produced. Constant change is the new normal. The same is true for universities. Every student's life happens online, and across the internet, producing data points in all aspects of life. Students use social media and video streaming platforms with recommendation engines ubiquitously. Since the pandemic, students are actively learning online, and thus giving universities access to data like never before. But how can/should institutions make use of this large amount of data?

After collecting student data at one single source of truth, intelligent technologies can then be applied to create recommendation systems. For instance, in a recent proof of concept with a renowned US-institution, the SAP AppHaus has developed an intelligent advising tool that uses machine learning technology to recommend curriculum courses to students based on previous experiences and career aspirations, thus personalizing that students' experience. By analyzing over 10 years of anonymized alumni data and adapting to students' choices and journeys, student advisors can increasingly provide more relevant suggestions to students.

To outline an IT framework that is necessary to personalize a student's experience, this paper seeks to answer the following question. How can a standardized IT infrastructure help higher education institutions to personalize their students' experience?

Central to considerations is the need to collect data from all institutional systems, harmonize it and make it accessible for analytical re-use. To reach this goal, SAP sees a demand to pursue a holistic approach in setting up an IT infrastructure with two application layers – front- and backend systems – and an intelligent technology platform in between. To interact with students, institutions should collect data while providing a modern, digitalized experience with a student-centric interface; frontend applications are critical for an intuitive, easy to use access. Backend tools, on the other hand, build the foundation of an intelligent university and work as single source of truth for all institutional data.

To personalize a student experience and develop intelligent tools, institutions need to combine both layers into one and unify all institutional data. To tailor its programs towards each individual student, universities should then leverage an intelligent technology platform that combines both layers – the front- and backend systems (see Figure 1).
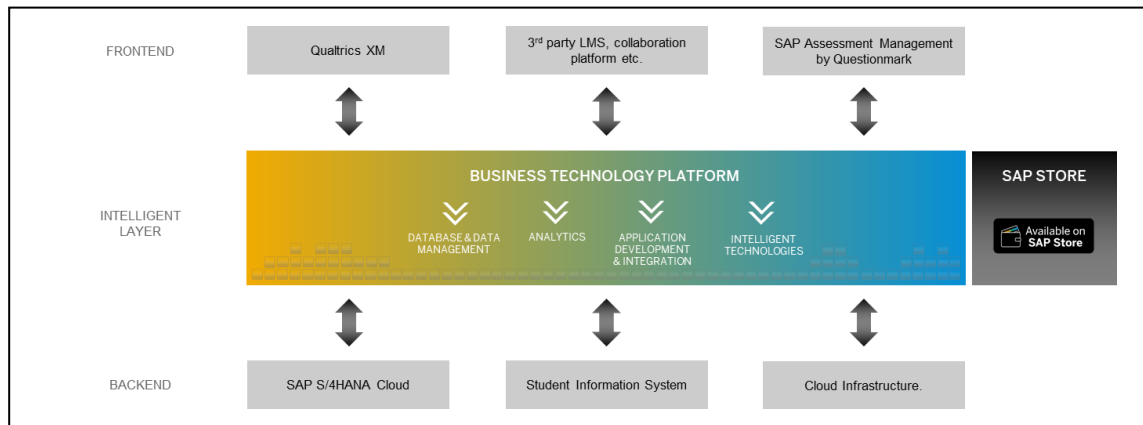
Figure 1: SAP's front- and backend solutions and the SAP Business Technology Platform as intelligent layer

The paper is structured as follows. First, we will introduce into existing research about personalized student experience. Then, we will discuss the implications of new front-end applications being married with backend tools. Third, we will outline a description of how an intelligent layer will help to connect the front and back ends while enabling a personalized student experience. We will conclude with a recent proof of concept that used the system structure and methodology to develop a personalized student advising tool.

2 Moving to a Personalized Student Experience

Today's students grew up through the digital transformation that disrupted much of everyday life we know today. These students grew up with smartphones, social networks, and big data and are now used to digitalized services and personalized digital experiences; in fact, they expect them. Social media providers such as TikTok or Instagram, or entertainment platforms like Netflix use algorithms to analyze their users' digital footprints and make recommendations on individual content for a maximum level of engagement (Hamilton & Singal, 2021). Although the implications of this trend in (oversight) within the entertainment and social media industries requires critical assessment, as does the responsibility of the service providers in ensuring ethical social behavior and wellbeing, the idea of individualized communication and entertainment to improve satisfaction and to generate higher levels of engagement cannot be ignored and can be applied to higher education institutions in like manner.

In times of uncertainty and massive disruptions in the educational sector, the value of higher education is often being questioned (Somashekar, 2021), and the future of digital teaching and learning is still unclear. To attract and retain students, and to engage them at an advanced level is critical in fulfilling the duty of universities, and successfully educating this next generation. To reach students through new levels of communication and to improve the educational quality and student outcomes, personalized content, courses and experiences are key.

The boundaries between traditional education and continuous lifelong learning are becoming increasingly blurred. The switch to online media during the pandemic has also increased the availability of Massive Open Online Courses (MOOCs) both quantitatively and qualitatively (Shah, 2020). These courses are expanding the range of learning opportunities and there is a growing call for them to be credited or recognized in combination with institutional study programs.

Putting it all together, the demand for individualized learning is increasing. Personalized learning is not a new phenomenon and is therefore, widely studied in existing empirical research. Personalized learning can increase the student's motivation, engagement, and understanding (Pontual Falcao, Mendes de Andrade e Peres, Sales de Morais, & da Silve Oliveira, 2017), and can maximize learner satisfaction, learning efficiency, and learning effectiveness (Gómez, Zervas, Sampson, & Fabregat, 2014). To improve the educational quality and increase its reputation, universities remain interested in maximizing student satisfaction through personalized learning approaches.

However, when personalizing the student experience with personal data, institutions must carefully evaluate the use of such data. Personal data, which includes "any information relating to an identified or identifiable natural person" (GDPR, Article 4 (1)), underlies the strict guidance of the EU's 2016 General Data Protection Regulation (GDPR). Therefore, universities need to consider ethical and data privacy when using machine learning algorithms to improve the student experience. With the student's consent, universities can make use of such tools and deliver next-generation student experiences.

To create a personalized student experience, we see a demand for a holistic approach that considers specific front-end tools coupled with back-end applications that are connected via an intelligent analytical layer.

3   Using Student Centric Tools

Front-end tools in universities are typically used to gather information directly from the student. Yet, to successfully identify and address root causes of essential outcomes and to take action to improve the student experience, continuous feedback mechanisms, through e.g., intelligent survey tools need to be in place (Fisher, 2021). Further, integrated feedback programs can help to understand a student's key experiences across the entire campus journey – from application through studying to alumni. Regular student satisfaction surveys give insights into course evaluations, campus experiences or out-of-class activities, such as internships. Also, in areas of remote education these same tools can not only help to evaluate the online experience but can also be used to keep in touch with students, to help ensure student mental and physical wellbeing and to identify critical health situations more quickly (Taylor, Sanchez, Turk, Chessman, & Ramos, 2021).

A personalized student experience is not only about information flows towards the faculty and teaching staff, but should also provide personalized information, learning dashboards and feedback to students, coming from the faculty. Having real-time insights into all financials, such as on-campus spending and tuition fees, being able to get individual information about submission deadlines and missing documents or having the opportunity to learn more in diverse disciplines by leveraging institution-wide learning platforms, will increase a student's satisfaction drastically.

Critical advancements are being made with Learning Management Systems (LMS), collaboration platforms and digital assessment tools necessary to provide individualized content and student-tailored learning hours and feedback mechanisms (Curtin, 2021). If students get the opportunity to identify areas

of improvement through self-examinations more efficiently, and frequently, than before, an intelligent learning platform can recommend readings, exercises, or learning videos to improve learning outcomes significantly and drive student success. Online assessment tools, specifically, can help to provide detailed feedback in a variety of formats, improving student accessibility (Weleschuk, Dyjur, & Kelly, 2019). Moreover, instant feedback may more acutely motivate students and help to significantly improve grades (McLaughlin & Yan, 2017).

During the Covid-19 pandemic, universities have accelerated the use of digital tools and implemented shorter assessments to track the student progress more carefully, coupled with mitigation plans and personalized support where necessary. Further, the shift to online teaching has accelerated an already growing questioning of the efficacy and fairness of traditional exams (The Chronicle of Higher Education, 2022). Continuous assessment tends to motivate students to keep working towards their goals (Sweeney, et al., 2017) rather than doing some heavy lifting at the end any given semester. In fact, the key to success is to provide a maximum level of accessibility and flexibility for students and instructors through a digital assessment platform to access assessment, when and where they want to do it (Lei & Gupta, 2010).

To match the students' demand for a seamless and flexible user experience, all applications must be accessible across all devices, whether it be mobile, tablet or PC (Gierdowski, Brooks, & Galanek, 2020). A cloud-based IT landscape that enables flexible deployment methods is a must-have to stay attractive to students and should be implemented across all services.

4 Build a Solid IT Foundation

Data is ubiquitous today. Data sources, types and volumes continue to increase as the drive to digitalization becomes more urgent in today's climate. Each year, the world's population produces and consumes an estimated amount of 97 zettabytes of data (Statista, 2021). While cloud-based application that run in large-scale data centers build the necessary foundation, to make use of that large consolidation of data, every company and organization needs the ability to collect, store, and analyze the data.

Intelligent technologies like artificial intelligence, machine learning, and modern analytics tools require fast-paced data processing and large computing capacities that only cloud computing can offer at larger scale. For universities, it would translate to offering personalized learning experiences at a large scale to all students, and to provide enhanced insights into learning, teaching and success to students, their advisors, and the faculty.

With the growing demand of online courses, offers, and MOOCs, universities need to have the ball at their feet in terms of digital, cloud infrastructure. They must be able to fulfill the students demand to get education when and wherever they want. As data traffic will increase with universities offering more online courses and services, the easiest and most cost-effective way to deal with it is to invest into scalable cloud infrastructure and products (Bialas, 2019).

Many universities possess a centralized and integrated ERP system that is run on-premise or in the cloud. A pure SaaS deployment allows for a highly scalable IT landscape that is extendable through other cloud application, such as LMS, SIS, etc. (Prause, 2022). The system collects and harmonizes all available data to provide a single source of truth for all institutional analysis. Through a cloud deployment, a next-generation ERP system provides the opportunity to run real-time financial analyses

and enables universities to rapidly adopt and modify processes and models in response to changing business conditions. Decision-making is completely changed, leading to faster decision-making based on better, real-time data.

With a high degree of automation via machine learning and robotic process automation, workflows can be standardized and tailored to support a journey towards the provisioning of personalized learning experiences. With the help of standard APIs, it is possible to run applications from various venders that provide the software capabilities that are needed to personalize the student experience – without having siloed data. In times of uncertainty and past-paced change staying up to date without having to invest in new technology or time- and resource-intensive modifications is crucial. Through a standardized cloud deployment, it is possible to always stay ahead of innovations and use the latest technology available.

To manage all student related data, and to draw more holistic conclusions from that data, a connected student information system (SIS) is crucial. It should be running on the same technology platform to take advantage of all existing APIs that connect to other systems. Additionally, a cloud-deployed application that offers the same benefits of cloud products as described before is of use too.

5 Unified Platform to Connect and Use All Available Data

Today all universities operate in increasingly complex IT environments. The system landscape usually consists of multiple vendors, platform, and open-source technology. It is deployed both on-premise and, in the cloud, and creates friction for users. With a growing cloud application market, new niche applications that specifically solve one business problem emerge every day.

Intelligent universities need additional flexibility to move their assets to the cloud, integrate their IT landscape and extend their application portfolio. A unified platform is necessary to connect all available data from the whole IT landscape and make it available. While back-end applications provide the backbone to run and standardize all operations along end-to-end business processes, and tightly aligning to the front-end tools is critical in gaining actual insights into student sentiment and satisfaction.

A unified technology platform provides four core objectives:

- Connect, manage, and govern all data to enable data-driven decisions

- Analyze all data to accelerate insights and transform the data available into the answers that are needed

- Integrate and extend applications – build new ways to access and interact with the data

- Data is the fuel propelling intelligent technologies forward to optimize processes and resources

To compose an end-to-end business process with one seamless experience, integration is key. A unified platform can help to refine and enhance operations along the entire value chain by connecting processes, data, and experiences across the existing portfolio at speed. Further, a multi-model support to natively manage structured as well as unstructured data is crucial to connect all data at speed. With memory-powered data virtualization an intelligent technology platform can integrate data from anywhere in real-time. Smart data integration, smart data access and smart data quality enable universities to connect and ingest trusted data from any source, whether it be cloud or on-premise, from an existing software vender or from a new third-party solution.

To make use of all data that is collected from across the solution landscape, a single insights layer provides a maximum of visibility across all data sources and applications. This layer helps to a get advanced insights and to decide with confidence. By embedding machine learning capabilities into applications, it is possible to automate manual processes and to get enriched real-time insights across all systems e.g., to help advising the student population.

As it become increasingly clear during the Covid-19 pandemic, the education world is in constant change; new teaching models are emerging quickly, and universities need to differentiate to attract students. Universities must be able to act quickly, re-imagining their core processes and models with intelligent software. With one single platform that can help deliver new applications efficiently at scale while leverage data of any type, universities can truly innovate at scale, stay ahead of time, and provide the best possible student experience. Further, with truly integrated machine learning capabilities, universities can build unique applications to provide unique, student tailored services that are based on large amounts of data and encourage data-driven decision-making.

6 Personalized Student Advising with Intelligent Technology

As outlined above, a recent proof of concept by the SAP AppHaus has shown, that students trust advice from their peers more than faculty and advisors, due to their relatable experiences. Many students simply do not know what courses to take when exploring possible pathways, nor which courses may give them a competitive edge. Advisors foresee data-driven insights as one of the means to boost advice confidence, since they may not be trained in the same industry or professional background that the student is reviewing.

The SAP AppHaus team took a human centered approach to innovation that started with understanding the end-users' needs via Design Thinking. A to-be-journey was created and reflected in a storyboard showcasing a new student advising process based on intelligent insights drawn from anonymized university's data. While exploring the students' needs for a personalized advising tool, it became clear that students are more likely to trust "evidence-based" guidance. Students talk with experienced peers or do online research to choose their classes. Knowing what courses graduates had taken and which activities they had participated in also influences the course selection process. Furthermore, students are heavily interested in building their network and making valuable connections through the university ecosystem.

On the other side, student advisors benefit from data-driven insights when guiding students. Knowing what skills students gain from which course and how graduates perform after building a specific skill set can enhance a personalized course selection process based on pre-defined personal goals.

To satisfy the students' needs and enable student advisors to personalize their recommendations with data-driven insights, the SAP AppHaus has streamlined the connection between the students' goal setting and course recommendation. The solution simplifies the access to desirable recommendation results while providing a single point of truth for the student advisors. A "high-fidelity" prototype shows how a new solution may look like. Students are asked to enter their goal profile detailing their interests and aspirations, tracks and certificates, and career objectives. Based on the direct student information, program advisors would have a richer experience when advising students on what courses to consider based data-driven insights generated and supported by machine learning technologies.

Following privacy by design principles, the data used to perform student course recommendations is anonymized and only considers university curriculum and options without any personal or unnecessary data. Before students schedule an appointment with their advisors, the students provide ONLY information they are willing to share to improve their learning journey; This information may/may not include areas of interest, career objectives, or program goals. Based on the provided interests and goals, courses and activities are recommended that match with similar successful journeys. The solution remains fully compliant with GDPR regulations throughout the process. Additional student consent would be necessary where that student chose to extend the application and process. Note: A general consent to the use of data is presented to each student upon enrollment and includes an agreement for secondary use of data in an anonymized way. If the student does not wish to participate, they may simply opt out.

While creating the proof of concept, the SAP AppHaus worked closely with the universities' faculty and staff to build a solution focused on solving real-life challenges. With transparent communications, input from the employees clearly outlined that the benefits of creating a new solution that changed the running process clearly outweighed the fear of disruption and/or risk.

7 Conclusion

To increase the value proposition of higher education to students, a personalized student experience is critical. Comprehensive data collection mechanisms need to be in place. With the help of an intelligent technology platform, data sources from front-end applications as well as back-end tools can be connected and used in unified manner. Through a standardized IT infrastructure with consistent data across an institution, intelligent technologies such as recommendation engines based on machine learning capabilities can be used to provide a scalable and personalized student experience. For this seamless and personalized student experience, universities need to consider the following:

- Having a system that is the single source of truth for institutional data and is scalable beyond students to research faculty and all university employees

- Implementing tools to get insights into student behavior, feelings, and needs

- Harmonizing all institutional data to get clean data structures

- Creating systems to be accessible from all available devices

- Using intelligent technology, such as machine learning or recommendation engines to analyze the available student data

- Developing easily accessible, pre-configured analyses for teaching staff to foster personalized learning experiences

- Leveraging historic data analyzing it with machine learning technology to improve student advising and recommend students' learning paths

- Assessing students continuously through online testing to provide regular feedback, improve learning outcomes, and increase the student satisfaction

- Complying with GDPR and data security standards to ensure student data is only used for improving the student's learning journey with individual consent

Where universities shift their investments towards a more student-centric approach for engagement and guidance, student satisfaction should only increase, and will help to reinforce the comprehensive value of their higher education experience. Standardizing all available data and leveraging it to personalize the student experience is the key to a successful program.

When following our approach of implementing new technology at a university, challenges, especially around change management, occur. However, with clear communication and the action items described below, they can be overcome:

- Reinforcing trust with/between the faculty, staff and students

- Ensuring the security of all data approved for the program, with full transparency into regulations and management

- Fostering a culture of technology openness through investment with dedicated change management experts

- Providing continuous learning opportunities with new technologies for employees, so they can grow with their program

- Communicating clearly about system landscape changes

- Providing sufficient time and resources for employees to ensure successful change management

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9 Author biographies

Reinhard Landes is part of the Industry Business Unit for Higher Education and Research at SAP. As Global Solution Director he is responsible for industry solutions, best practices and SAP's Industry Cloud for the higher education and research industry. He supports a wide range of international customers and partners and is well connected with SAP sales, marketing and product development. Reinhard holds a diploma in Business Administration, which he obtained in a dual study program at IBM. Additionally, he obtained his MBA in Business and Managerial Economics from The Open University in 2001. He is based in SAP headquarters in Walldorf, Germany.

David Rapp is also part of the Industry Business Unit for Higher Education and Research at SAP. He is leading the teams' social communication activities, supports a wide range of internal and external customer events globally, and helps customers and partners on their SAP cloud journey. David holds a bachelor's degree in Political Science and Business Administration from the University of Mannheim, Germany. He is based in SAP headquarters in Walldorf, Germany.