The Use of SAP in Education: A Review of Current Practices and Future Directions

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Abstract

Enterprise resource planning (ERP) systems have become increasingly important in managing organizational operations, including those in education. One of the most widely used ERP systems in education is the SAP system. This paper presents a review of the current practices and future directions of SAP in education. The paper examines the various ways in which SAP has been used in education, including student information systems, financial management, and human resource management. SAP can bring significant advantages to the education sector, successful implementation requires careful planning, adequate training, and consideration of the unique needs of educational institutions. Additionally, privacy and security concerns must be addressed to ensure the protection of student and institutional data. The paper also discusses the challenges and benefits of using SAP in education and provides recommendations for future research and practice.

1. Introduction

ERP systems, such as SAP (Systems, Applications, and Products), have gained prominence in various industries for their ability to streamline and integrate business processes. In recent years, there has been a growing interest in utilizing SAP in the field of education [1]. This research paper aims to provide a comprehensive review of the current practices and applications of SAP in education, highlighting its benefits, challenges, and potential future directions. The SAP system is a widely used ERP system that has been adopted by various organizations, including those in education. SAP provides a range of modules that support different business processes, including financial management, human resource management, procurement, and supply chain management [2]. In education, SAP has been used to support various processes, including student information systems, financial management, and human resource management [3].

2. Background

SAP is a leading ERP software suite designed to integrate and streamline various business processes within an organization. Originally developed in the early 1970s by German engineers at SAP AG, the software has evolved into a comprehensive solution used by businesses worldwide [3]. The integration of technology in education has become essential for enhancing efficiency, productivity, and overall educational outcomes. SAP, a leading ERP system, offers a robust platform for managing various administrative and academic functions within educational institutions [4]. This paper explores the current landscape of SAP implementation in education and the potential it holds for transforming educational processes.

2.1 Evolution of ERP in Education

The evolution of ERP systems in educational institutions has undergone significant changes over the years, driven by the need for streamlined processes, improved efficiency, and better management of resources. The adoption of SAP in the education sector is part of this evolution. Here's a general timeline of the key developments [4]:

2.1.1 Early Management Information Systems

In the early days, educational institutions primarily relied on manual and paper-based systems for managing administrative tasks such as student enrollment, financial accounting, and human resources. Basic Management Information Systems (MIS) started to emerge, incorporating early computer technologies to automate certain processes [5].

2.1.2 Integration of Modules

As technology advanced, educational institutions began integrating different modules to manage various aspects of their operations. These modules included student information systems, finance, human resources, and more. This integration aimed to improve data accuracy, reduce redundancy, and enhance overall efficiency in administrative processes [5].

2.1.3 Introduction of ERP System

In the late 1990s and early 2000s, ERP systems gained popularity in various industries, including education. ERP solutions offered a comprehensive suite of integrated applications that covered a wide range of functions, from finance and HR to student services. These systems allowed for real-time data access, improved collaboration, and better decision-making [6].

2.1.4 Customization of ERP Sector

ERP vendors recognized the unique needs of educational institutions and started customizing their solutions to address these specific requirements. Features such as student enrollment, grading, scheduling, and academic reporting became integral components of ERP systems tailored for the education sector [6].

2.1.5 Adaptation of SAP in Education

SAP, a leading ERP vendor, gained prominence in the education sector due to its robust and scalable solutions. Education institutions began adopting SAP ERP to streamline their operations, improve data accuracy, and enhance overall organizational efficiency. SAP's solutions for education cover a range of modules, including Student Lifecycle Management, Finance, HR, and Analytics [6].

2.1.6 Cloud based ERP Solutions

With the advancement of cloud computing, educational institutions started moving towards cloud-based ERP solutions. This shift offered benefits such as flexibility, scalability, and reduced infrastructure costs. SAP introduced cloud-based solutions, including SAP S/4HANA Cloud, which catered to the evolving needs of educational institutions [7].

2.1.7 Focus on Analytics and Business Intelligence

Recent trends involve a stronger emphasis on analytics and business intelligence within ERP systems for educational institutions. This enables institutions to make data-driven decisions, enhance student outcomes, and optimize resource allocation [7].

2.2 Overview of SAP In Education

The software has evolved into a comprehensive solution used by businesses worldwide. SAP provides a suite of integrated education modules applications that cover a wide range of functions within an organization. These applications are organized into modules, each addressing specific sectional processes. Some of the key SAP modules include [8]:

2.2.1 New Higher Education Technology

Proactive institutions are transforming, using smart education technology to deliver the new skills, tools, and job experiences students will need – and the personalized, interactive tools they expect [8].

2.2.2 Intelligent Finance and Accountability

Using next-generation finance solutions, higher educational institutions can make the most of finite resources – and meet demands for transparency around affordability, value, and learning outcomes [8].

2.2.3 Smart Campus

To keep pace with digitally native students, and to stay sustainable, institutions are evolving into smart campuses transforming everything from entrance admissions and student experiences to parking [8].

2.2.4 Always on Student Engagement

Colleges and universities create student information systems resembling video gaming to gauge student interests and sentiments using the data to tailor meaningful recruitment messaging and outreach [8].

2.2.5 Changing faculty and staff paradigm

Teaching talent from the business world is rebalancing tenured university faculty models. Contingent workforces support learning areas most in need and departments are integrating to form agile hubs [9].

2.2.6 Accelerate Research Process

Advancements in AI, analytics, and computing power help research institutions to automate functions, integrate digital processes, streamline projects and finance and accelerate vital discoveries [9].
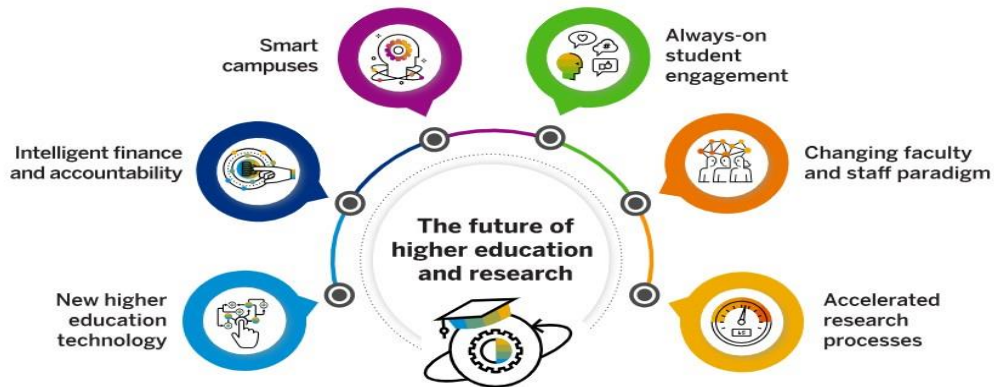

Figure 1: SAP in Education [2]

3. Current Practices of SAP in Education

3.1 Administrative Process

SAP is a widely used enterprise resource planning (ERP) software suite that plays a crucial role in streamlining administrative tasks across various industries, including education. In the context of education, SAP Analytics Cloud and SAP Success factor solutions can be applied to streamline administrative tasks, by integrating analytics and planning functionality with SAP applications, this solution can provide direct insights into administrative, HR, Payroll, and financial data [10].

3.1.1 Finance

SAP helps educational institutions manage their finances more efficiently by providing tools for budgeting, accounting, and financial reporting. It helps in tracking expenses, managing revenue streams, and ensuring compliance with financial regulations. SAP enables educational institutions to streamline procurement processes, automate purchase orders, and manage vendor relationships [10].

3.1.2 Human Resources

AP facilitates the management of employee data, including personal information, job roles, and employment history. This helps in automating HR processes and ensures accurate and up-to-date records. SAP's payroll module automates payroll processing, including calculations, deductions, and compliance with tax regulations.

SAP supports talent acquisition, performance management, and employee development. It helps educational institutions attract, retain, and develop skilled personnel, contributing to overall organizational success [10].

3.1.3 Student Enrollment

SAP streamlines the student enrollment process by providing tools for managing admissions, registration, and student records. This ensures that the process is efficient, accurate, and aligned with institutional policies. SAP's Student Information System (SIS) module helps in managing student data, academic records, and grading [11]. It enables educational institutions to track student progress, manage transcripts, and generate reports. Some SAP solutions support learning management systems, aiding in the delivery of online courses, content management, and student collaboration [12].

3.1.4 Integrating and Reporting

SAP allows for integration across different modules, ensuring seamless flow of information between finance, HR, and student enrollment systems. This integration reduces manual data entry, minimizes errors, and enhances overall efficiency. The reporting capabilities of SAP enable educational institutions to generate custom reports for various stakeholders. This helps in data-driven decision-making and compliance reporting [12].

3.1.5 Mobile Accessibility

Many SAP solutions offer mobile accessibility, allowing administrators, faculty, and staff to access relevant information and perform tasks remotely. This contributes to increased flexibility and responsiveness [12].

Figure 2: SAP Module for Education [3]

3.2 Academic Management

The integration of SAP in academic management can streamline various processes, including course planning, scheduling, and grading. SAP S/4HANA Cloud offers a comprehensive suite of ERP solutions that can be customized to meet the specific needs of educational institutions [13]. Modern ERP system with embedded analytics, AI, and machine learning supports efficient and agile processes to maximize resource value and help you deliver measurable cross-campus and online campus results. Here's how SAP can be integrated into academic management [14].

3.2.1 Student Information System (SIS)

SAP can automate the student enrollment and registration process. It can manage student data, track academic history, and ensure accurate information for course planning. SAP SIS maintains detailed student records, including personal details, academic achievements, and attendance. Instructors and administrators can track student progress through integrated dashboards and reports [14]. Implementing analytics modules could provide insights into student performance trends, helping educators identify areas for improvement. It extended to include parents, SAP could enable communication about student progress, events, and other relevant information [15].

3.2.2 Course Planning

SAP enables academic institutions to define and manage academic programs, courses, and curriculum. It facilitates the planning of courses and ensures alignment with academic goals. The ERP system helps in allocating resources such as classrooms, faculty, and materials based on the course requirements. SAP can automate the process of creating class schedules based on factors like faculty availability, room availability, and student preferences. Any changes to the schedule can be reflected in real-time, and notifications can be sent to relevant stakeholders, reducing confusion [15].

3.2.3 Grading

SAP can automate the grading process, reducing the manual effort required by instructors. SAP can provide a centralized gradebook where instructors can enter grades for assignments, exams, and other assessments. It can calculate grades based on predefined criteria and ensure consistency in grading practices. The system can generate reports and transcripts, making it easier for students to access their grades and for institutions to comply with reporting requirements [16]. SAP can provide a centralized gradebook where instructors can enter grades for assignments, exams, and other assessments. SAP can assist in generating official transcripts and academic records for students, ensuring accuracy and consistency. SAP's reporting tools enable educational institutions to analyze data related to student performance, resource utilization, and overall academic management. Key performance indicators (KPIs) can be defined and monitored to assess the efficiency and effectiveness of academic processes [17].

3.2.4 Integration with LMS System

SAP can provide a centralized portal for students, faculty, and administrators, facilitating communication and collaboration. It can integrate with LMS platforms to ensure a seamless flow of information between academic management and online learning systems providing a centralized platform for communication between students, faculty, and administrators. Integration with an LMS could enhance the educational experience by providing a platform for course content, assignments, and assessments. Integration with communication tools could streamline announcements, discussions, and notifications for students, parents, and faculty. Automated notifications can be set up to inform students and faculty about important dates, changes in schedules, or academic updates. Ensuring the security of student data is crucial. SAP, if adopted, would need robust security measures to protect sensitive information. The system must comply with relevant educational regulations and data protection laws [17].
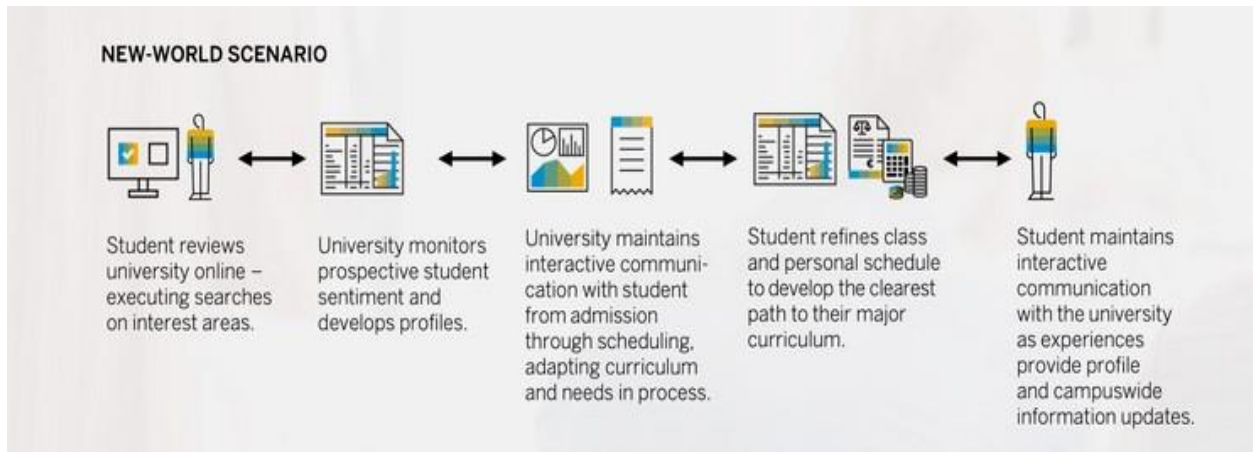
Figure 4: Academic Management System Module of SAP [17]

3.3 Case Studies

These examples showcase the diverse ways in which educational institutions globally have leveraged SAP to enhance their operations, streamline processes, and make data-driven decisions. However, in Bangladesh AIUB, Asian University for Woman, Bangladesh University of Textiles, University of Dhaka, University of Liberal Arts are adopting SAP base on December 2023 SAP university alliances report [18]. Here are some case studies given below for some specific university:

Case-1: The University of Kentucky implemented SAP to streamline its financial and administrative processes. Outcome is the better Improved efficiency in financial management, reduced manual workload, enhanced reporting capabilities, and better decision-making support [18].

Case-2: The University of Pretoria adopted SAP ERP to integrate its various systems and improve overall operational efficiency. Enhanced communication and collaboration across departments, streamlined administrative processes, and better data-driven decision-making [18].

Case-3: The University of Sydney implemented SAP to modernize its student information systems, human resources, and finance operations. Increased transparency, improved data accuracy, enhanced reporting capabilities, and a more user-friendly interface for students and staff [18].

Case-4: The University of Duisburg-Essen implemented SAP ERP to integrate its administrative processes and improve resource management. Streamlined workflows, reduced duplication of efforts, improved financial reporting, and better alignment with industry best practices [18].

Case-5: King Saud University adopted SAP to enhance its financial management and human resources processes. Improved budgeting and forecasting, enhanced payroll and HR processes, increased transparency, and better compliance with regulatory requirements [18].

Case-6: The University of São Paulo implemented SAP to improve its financial management and human resources functions. Increased efficiency in processing financial transactions, better tracking of expenses, and improved overall financial control [18].

Case-7: UC Berkeley implemented SAP to modernize and integrate its financial, procurement, and HR systems. Increased efficiency in financial operations, reducing manual processes. Improved data accuracy and reporting for budgeting and forecasting. Enhance compliance with regulatory requirements [18].

4. Benefits of SAP in Education

4.1 Improved Efficiency

SAP helps organizations streamline their business processes by providing a comprehensive suite of integrated applications. These applications cover various functions such as finance, human resources, supply chain, manufacturing, and more. By automating and integrating these processes, SAP eliminates redundancies, reduces delays, and ensures smoother operations [9].

SAP allows for the automation of routine and repetitive tasks across different departments. This automation not only saves time but also minimizes the likelihood of errors associated with manual data entry and processing. For example, SAP can automate invoice processing, purchase order creation, and inventory management [11].

SAP provides a centralized platform for data management, ensuring that information is stored in a consistent and accessible manner. This centralized approach eliminates the need for manual data entry into multiple systems, reducing the risk of errors and ensuring data integrity. This, in turn, improves decision-making processes and overall efficiency [12].

By digitizing and automating various business processes, SAP contributes to the reduction of paperwork. For instance, electronic document management systems within SAP enable organizations to move towards paperless workflows. This not only saves physical storage space but also facilitates quicker document retrieval and sharing [12].

SAP provides powerful reporting and analytics tools that enable organizations to generate real-time insights into their operations. This allows decision-makers to access accurate and up-to-date information, facilitating faster and more informed decision-making. This real-time visibility enhances overall operational efficiency by identifying areas that require improvement or optimization [13].

SAP's integrated platform enhances collaboration among different departments and teams. This integration ensures that information flows seamlessly across the organization, reducing the need for manual communication and coordination. Improved collaboration leads to faster decision-making and more agile responses to changing business conditions [14].

SAP includes features for regulatory compliance and risk management. By automating compliance checks and incorporating risk management functionalities, organizations can ensure that they adhere to industry regulations and standards. This reduces the risk of legal issues and associated paperwork [14].

40% of higher education institutes all over the world now adopt and use this SAP solution. Most of the institutes are renowned worldwide and in best university based on QS based and the times institute world rankings.

4.2 Data Integration and Accuracy

Integrating data from different departments allows organizations to create a comprehensive and holistic view of their operations. This integrated perspective enables a deeper understanding of how different departments and functions interconnect, fostering better strategic decision-making [11].

Timely and accurate information is essential for effective decision-making. Data integration ensures that decision-makers have access to up-to-date and relevant data from various sources, helping them make informed choices that align with the organization's goals and objectives [11].

Data integration facilitates collaboration among different departments by breaking down silos and promoting a culture of information sharing. When departments can access and utilize each other's data seamlessly, it fosters better teamwork and communication, leading to more cohesive and collaborative efforts [13].

Integrated data systems streamline business processes by reducing manual data entry, duplication, and errors. Automation and synchronization of data across departments lead to more efficient workflows, saving time and resources that can be redirected towards more value-added activities [14].

A unified view of customer data is critical for delivering a personalized and seamless customer experience. Integrating data from sales, marketing, customer service, and other departments enables organizations to gain insights into customer behavior, preferences, and feedback, allowing for more targeted and effective customer engagement [15].

Data integration helps in optimizing resource allocation and reducing operational costs. By eliminating redundant systems and processes, organizations can achieve cost savings through increased efficiency and improved resource utilization [19].

Many industries face regulatory requirements regarding data management and reporting. Data integration ensures that organizations can compile and report accurate information, helping them stay compliant with industry regulations and standards [19].

In a rapidly changing business environment, organizations need to adapt quickly to market trends and opportunities. Integrated data systems are more adaptable and scalable, allowing businesses to respond promptly to changes and scale their operations without significant disruptions [20].

Integration supports real-time data analytics, providing organizations with insights into current market conditions, customer behavior, and operational performance. Real-time analytics empower businesses to make agile decisions and respond promptly to emerging trends [20].

5. Challenges and Limitations of SAP in Education

Using SAP in education presents several challenges and benefits. One of the main challenges is Acquiring SAP licenses involves an upfront cost, and educational institutions need to consider the number of users and modules required. Implementing SAP may necessitate additional or upgraded hardware to support the software, leading to additional costs [21]. SAP typically charges annual maintenance fees for software updates, patches, and technical support. Periodic upgrades and updates may be necessary to keep the system current, and these can involve costs for testing, implementation, and potential retraining. The cost of implementing and maintaining the system can be high [22].

Another challenge is the complexity of the system, which can require extensive training for users. Develop training programs that are specific to the roles and responsibilities of different staff members. This ensures that employees receive training relevant to their job functions. SAP systems are often updated, and new features are

introduced. Provide ongoing training sessions to keep staff up to date with the latest functionalities. Tailor the SAP interface to meet the specific needs of your organization and users [23]. A user-friendly interface reduces the learning curve and encourages adoption. Conduct regular surveys and feedback sessions to understand the challenges faced by users. Use this information to make continuous improvements and address specific pain points. Another Problem is Customization Issue Educational institutions can vary significantly in terms of their structure, processes, and workflows [24]. Universities, schools, vocational institutions, and training centers may have different needs and expectations. Customization efforts need to account for diverse educational models, including variations in academic calendars, grading systems, and course structures. Educational institutions are subject to various regulations and compliance requirements, depending on their location and type. Customizing SAP to meet these regulatory standards can be time-consuming and complex. SAP regularly releases updates and new versions. Customized solutions may require adjustments and retesting to remain compatible with the latest SAP releases [25]. Educational institutions need to have a strategy for keeping their customized SAP systems up to date without causing disruptions, which is very difficult.

6. Future Directions and Recommendations

AI and ML can be integrated into SAP systems to analyze historical data on student performance, engagement, and behavior. This allows educational institutions to predict students at risk of falling behind or dropping out. Early identification enables timely intervention, personalized support, and the implementation of strategies to improve student success rates. By leveraging AI and ML algorithms, SAP systems can analyze individual student learning patterns and preferences. This data can be used to create personalized learning paths, recommend relevant courses or resources, and adapt instructional content to meet the specific needs of each student. This personalization can enhance the overall learning experience and improve academic outcomes. AI-powered chatbots integrated into SAP systems can provide instant support to students for routine queries related to admissions, registration, financial aid, and other administrative processes. This enhances the student experience by providing quick and accurate information 24/7, freeing up administrative staff for more complex tasks. AI can enhance the assessment process by providing adaptive testing that adjusts difficulty levels based on the student's performance. SAP systems can integrate ML algorithms to analyze student responses and dynamically adapt assessments, ensuring that they align with individual learning levels and provide a more accurate representation of student knowledge.

Continued research and development (R&D) in optimizing SAP (Systems, Applications, and Products) for educational contexts is crucial for several reasons. SAP, a leading enterprise resource planning (ERP) software, has the potential to significantly enhance efficiency, effectiveness, and data management in educational institutions. Educational institutions handle sensitive student and staff information. Ongoing research is necessary to strengthen data security and privacy measures within SAP to protect against cyber threats and ensure compliance with data protection regulations. Ongoing advancements in technology, such as artificial intelligence, machine learning, and the Internet of Things, present opportunities for further optimizing SAP in educational contexts. Research is needed to explore and implement innovative features that leverage emerging technologies to enhance educational processes. Educational institutions often operate within budget constraints.

Research and development efforts should focus on optimizing SAP to be cost-effective, ensuring that institutions with varying financial resources can benefit from the technology.

7. Conclusion

The use of SAP in education has become increasingly important in managing organizational operations. SAP has been used for various purposes, including student information systems, financial management, and human resource management. Using SAP in education presents challenges and benefits, including cost and complexity, but can provide greater efficiency and data accuracy. It is a leading enterprise software solution that is widely used in various industries for managing business operations and customer relations. While SAP itself may not be directly associated with education, its potential in revolutionizing education lies in its ability to streamline and enhance administrative processes, provide data-driven insights, and support the development of skills needed in the modern workforce. SAP's blockchain capabilities can be used for secure and transparent credential verification, reducing fraud and ensuring the integrity of academic qualifications. Future research and practice should focus on addressing these challenges and maximizing the benefits of using SAP in education, including its potential in supporting teaching and learning processes.

Acknowledgements

References

[1] SAP Team, "Higher Education and Research" [Online]. Available:https://www.sap.com/industries/higher-education-research.html.[Accessed 1st February 2024].

[2] SAP Team, "SAP For Higher Education and Research" [Online]. Available: https://www.eunis.org/eunis2008/programme/files/sap. [Accessed 1st February 2024].

[3] Allied Market Research, "ERP Software Market: Global Opportunity Analysis and Industry Forecast 2018-2026," 2019. Available: https://www.alliedmarketresearch.com/erp-market [Accessed: 3rd February 2024]

[4] Statista, ERP-Software -Marktanteile der Anbieter weltweit 2017 | Statista. [Online]. Available: https://de.statista.com/statistik/daten/studie/262342/umfrage/marktanteile-der-anbieter-von-erp-software-weltweit/ [accessed: 3rd February 2024]

[5] Soellner, S. (2021). Digital Elements for SAP ERP Education and Training: Results from a Systematic Literature Review. *International Journal of Engineering Pedagogy (iJEP)*, *11*(4), pp. 115–129. https://doi.org/10.3991/ijep.v11i4.21843

[6] A. N. Ambrajei, N. M. Golovin, A. V. Valyukhova, N. A. Rybakova, and V. Y. Zorin, "Use of hybrid learning model for SAP-related technology education," Proceedings of the ICID-2019 Conference, pp. 1–9, 2019

[7] S. Jacques, A. Ouahabi, and T. Lequeu, "Remote Knowledge Acquisition and Assessment During the COVID-19 Pandemic," Int. J. Eng. Ped., vol. 10, no. 6, p. 120, 2020, https://doi.org/10.3991/ijep.v10i6.16205

[8] D. K. McCann and D. Grey, "SAP/ERP Technology in a Higher Education Curriculum and the University Alliance Program," IIS, X, no. 1, pp. 176–182, 2009, https://doi.org/10.48009/1_iis_2009_176-182

[9] Govan Mark, 2016, Enterprise Resource Planning for Higher education platform, Vol 2, International Journal of Business trends.

[10] Akkaya, M, 2017, Educational Attitude toward the Using of Cloud ERP. International Journal of Communications, P540.

[11] Silver Touch Team "Role of SAP During Digital Transformation Journey, 18th January 2024 [Online]. Available:https://sap.silvertouch.com/blog/role-of-sap-during-digital-transformation-journey. [Accessed 5th February 2024].

[12] Australian Deans Council. (2010). Learning and Teaching Academic Standards Project, Business, Management and Economics: Learning and teaching academic standards statement for ACCOUNTING December 2010. Retrieved September 7, 2015, from http://www.abdc.edu.au/data/Accounting_LS/Accounting_Learning_Standards_February_2011.pdf

[13] Becerra-Fernandez, I., Murphy, K. E., & Simon, S. J. (2000). Enterprise resource planning: Integrating ERP in the business school curriculum. *Communications of the ACM*, *43*(4), 39–41. doi: 10.1145/332051.332066

[14] Boulianne, E. (2014). Impact of accounting software utilization on students' knowledge acquisition: An important change in accounting education. *Journal of Accounting & Organizational Change*, *10*(1), 22–48. doi: 10.1108/JAOC-12-2011-0064

[15] Chen, C. S., Liang, W. Y., & Hsu, H. Y. (2015). A cloud computing platform for ERP applications. *Applied Soft Computing*, *27*, 127–136. doi: 10.1016/j.asoc.2014.11.009

[16] Corbitt, G., & Mensching, J. (2000). Integrating SAP R/3 into a College of Business curriculum: Lessons learned. *Information Technology and Management*, *1*(4), 247–258. doi: 10.1023/A:1019181210298

[17] G2 Company Team Member, "Top 10 SAP for higher education and Research Alternatives and Competitors" Available:https://www.g2.com/products/sap-for-higher-education-and research/competitors/alternatives. [Accessed 7th February 2023].

[18] A. Uskov and B. Sekar, "Serious games, gamification and game engines to support frame-work activities in engineering: Case studies, analysis, classifications and outcomes," in IEEE International Conference on Electro/Information Technology, Milwaukee, WI, USA, 2014, pp. 618–623, https://doi.org/10.1109/eit.2014.6871836

[19] T. Johnson, A. C. Lorents, J. Morgan, and J. Ozmun, "A Customized ERP/SAP Model for Business Curriculum Integration," Journal of Information Systems Education (JISE), vol. 15, no. 3, pp. 245–254, 2004

[20] H. A. Yamani, "A Conceptual Framework for Integrating Gamification in eLearning Sys-tems Based on Instructional Design Model," Int. J. Emerg. Technol. Learn., vol. 16, no. 04, p. 14, 2021, https://doi.org/10.3991/ijet.v16i04.15693

[21] T. Tsiatsos, "Virtual University and Gamification to Support Engineering Education," Int. J. Eng. Ped., vol. 10, no. 2, p. 4, 2020, https://doi.org/10.3991/ijep.v10i2.13771

[22] L. Prifti, M. Knigge, A. Löffler, S. Hecht, and H. Krcmar, "Emerging Business Models in Education Provisioning: A Case Study on Providing Learning Support as Education-as-a-Service," Int. J. Eng. Ped., vol. 7, no. 3, p. 92, 2017, https://doi.org/10.3991/ijep.v7i3.7337

[23] S. Foster and J. Hopkins, "ERP Simulation Game: Establishng Engagement, Collaboration and Learning," PACIS 2011 Proceedings, Paper 62, 2011.

[24] M. Alavi and D. E. Leidner, "Research Commentary: Technology-Mediated Learning—A Call for Greater Depth and Breadth of Research," Information Systems Research, vol. 12, no. 1, pp. 1–10, 2001, https://doi.org/10.1287/isre.12.1.1.9720

[25] P.-M. Leger, J. Robert, G. Babin, D. Lyle, P. Cronan, and Charland. Paul, "ERP Simula-tion Game: A Distribution Game to Teach the Value of Integrated Systems," Development in Business Simulation and Experiential Learning, vol. 37, pp. 329–334, 2010.