Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3433

Submitted : Jan 11, 2024
Accepted : Jan 15, 2024
Published : Jan 16, 2024

Online Tutoring's Technological Foundation and Future Prospects: Enterprise Architecture Development

Sari Ningsih[1)], Bayu Yasa Wedha[2)*], Ira Diana Sholihati[3)]
[1)] Prodi Informatika, Fakultas Teknologi Komunikasi dan Informatika, Universitas Nasional Jakarta
[2,3)]Prodi Sistem Informasi, Fakultas Teknologi Komunikasi dan Informatika, Universitas Nasional Jakarta
[1)] sari.ningsih@civitas.unas.ac.id, [2)*]bayu.yasa.wedha@civitas.unas.ac.id,[3)]ira.diana@civitas.unas.ac.id

ABSTRACT

This study examines the advancement of enterprise architecture with the objective of enhancing the technological infrastructure and long-term strategies in the online student tutoring sector. Online tutoring has emerged as the primary option for supporting the learning process in the rapidly advancing digital age. Identify the essential elements involved in establishing robust groundwork for an online tutoring platform, with a focus on highlighting the strategic significance of enterprise architecture. Examining the technological infrastructure that is customized to fulfill the demands of the tutoring sector constitutes the research methodology utilized in this investigation. Enterprise architecture serves as the fundamental framework that enables smooth integration among different systems, applications, and services used in online tutoring. Creating an enterprise architecture will subsequently generate a well-defined technology roadmap, empowering tutoring companies to innovate with greater precision. This architecture enhances the role of online tutoring in providing a more adaptable and personalized learning experience for students by utilizing advanced technologies like artificial intelligence and data analytics. This study emphasizes the significance of enterprise architecture in facilitating educational transformation and establishing a robust framework for online tutoring companies to progress efficiently. To foster the growth and advancement of the online tutoring industry, it is crucial to strategically enhance the technological infrastructure and implement a well-designed enterprise architecture. This will enable the sector to play a substantial role in shaping a dynamic and forward-thinking educational landscape.

Keywords: Enterprise Architecture; Online Student Tutoring; Online Education Industry; Technology in Learning; System and Application Integration; Innovation in Tutoring

INTRODUCTION

Online tutoring has emerged as the primary option for supporting the learning process in the rapidly advancing digital age. With the progression of technology, the demand for adaptable and practical technological infrastructure grows more significant. This study centers on the significance of enterprise architecture in the online tutoring industry. Enterprise architecture (Trad & Kalpić, 2014) is essential for the seamless integration of systems, applications, and services utilized in tutoring. Nevertheless, there are obstacles in designing sufficient infrastructure that can effectively address the ever-changing needs of the education industry. Online tutoring companies need help in establishing a robust technological framework. It is necessary to identify critical components in establishing a robust framework for a tutoring platform. The utilization of sophisticated technologies such as artificial intelligence and data analysis introduces intricacy. Hence, it is crucial to comprehend how enterprise architecture (Afarini & Hindarto, 2023), (Hindarto, 2023b) can enhance the creation of a tailored and flexible learning experience for students. With the growing importance of online tutoring in education, there is a need for more inventive approaches. Enterprise architecture (Shariati et al., 2011) is crucial in facilitating educational transformation in this context. This entails developing a clearly defined technology plan, facilitating smooth integration, and promoting precise innovation. Nevertheless, there remains to be more comprehension regarding the optimal implementation of this architecture within the realm of online tutoring.

Prior research has demonstrated that incorporating technology into education can enhance the efficiency and efficacy of the learning process. Recent research underscores the significance of technology in education. Nevertheless, the main emphasis is frequently placed on the utilization of technology rather than on constructing the necessary infrastructure or enterprise architecture (Rui et al., 2012), (Hindarto, 2023a) that sustains it. Moreover, prior studies typically focus on investigating the utilization of technologies, such as artificial intelligence or adaptive

* Corresponding author

Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3433

Submitted : Jan 11, 2024
Accepted : Jan 15, 2024
Published : Jan 16, 2024

learning systems, within the framework of online tutoring. Although this research offers valuable insights, it frequently needs to comprehensively explore the integration of enterprise architecture (Judijanto & Hindarto, 2023) in supporting different aspects of these technologies. Consequently, there needs to be more in the existing body of knowledge that comprehensively elucidates the progression of enterprise architecture (Alwi et al., 2023), (Hindarto & Indrajit, 2023) in this industry.

Given the problem description and examination of prior research, a pivotal inquiry emerges: how can the development of enterprise architecture enhance the technological infrastructure and long-term strategy in the online tutoring industry? This entails identifying the essential components necessary for constructing a proficient and flexible infrastructure. Furthermore, it is vital to contemplate how this architectural design can enable the development of a highly customized learning experience and adjust to the individual requirements of students. This problem formulation serves as the foundation for investigating the impact of enterprise architecture on the progress of the online tutoring industry within a dynamic and ever-evolving educational environment.

The primary aim of this research is to analyze and enhance a company's architecture to improve its technological infrastructure and long-term strategy in the online tutoring industry. The objective of this research is to identify and analyze the crucial components required to establish a robust and efficient infrastructure for an online tutoring platform. The advantages of this research are substantial, as it not only offers a framework for tutoring companies to innovate and expand but also improves the overall student learning experience. This research seeks to enhance the learning experience for students by incorporating advanced technologies such as artificial intelligence and data analysis. The goal is to provide a personalized, adaptive, and engaging educational environment. This will ultimately enhance the overall quality of education and facilitate educational transformation in the digital era.

This research introduces novel contributions to the field of online tutoring, particularly in the context of corporate architecture development. In contrast to prior research that primarily examined the practical application of technologies, this study offers a thorough examination of how enterprise architecture can be effectively incorporated and enhanced to facilitate diverse facets of technology in the field of education. The novelty of this research lies in its holistic approach to studying technology infrastructure, which is not only limited to the application of technology but also to the organizational structures and strategies that support it. Increasing the efficiency and effectiveness of building infrastructure is the main goal of this study. Additionally, it wants to improve academic literature by giving a new look at how vital enterprise architecture is in the education sector, particularly in the context of online tutoring.

LITERATURE REVIEW

Enterprise Systems are becoming more popular across industries as cross-functional integration and end-to-end business process management solutions in the post-modern ERP era. In order to meet industry needs and train a skilled workforce, business schools must use case studies, system demonstrations, simulations, workshops, and capstone projects (Ruhi, 2016). This paper answers three fundamental questions about how ICT can change professional architect education. The benefits ICT can offer for teachers and students in architecture programs in higher education from fully developing an ICT-rich learning environment. Pros and cons of using ICT to change architecture education in Taiwan (Wang, 2009). This article covers vehicle communications trends, including current and future developments. New radio access technologies like visible light communications, mmWave, Cellular-V2X, and 5G for connected and autonomous vehicles are discussed in the document, along with US, Japanese, and European intelligent transportation system standards and protocol stacks. This article also discusses innovative research areas like seamless connectivity, edge and fog networking, software-defined networking, named data, and security (Kumar et al., 2019). Based on EA teams' assessments and opinions from three federal-level institutions, this research uses the Analytic Hierarchy Process (AHP) to assess Malaysian public sector Enterprise Architecture (EA) capabilities and priorities. This research found 27 assessment criteria in six categories: Internal Process, Learning and Growth, Authority Support, Cost, Technology, and Talent Management. Internal Process was the top capability, and Authority Support was the top priority. The findings show that AHP is a cost-effective way to assess, prioritize, and plan EA implementation, reducing the risk of failure (Azaliah et al., 2016). This interpretive case study examines Norwegian higher education efforts to implement Enterprise Architecture (EA), finding that a lack of top-level ministry direction, an overarching architecture council, and upper management EA competence hinder progress. According to this research, the most significant perceived benefits of EA are business agility, economies of scale, and better decision-making. This study emphasizes the need to study EA implementation in various sectors, notably higher education, to identify its benefits and most significant challenges (Olsen & Trelsgård, 2016).

* Corresponding author

Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3433

Submitted : Jan 11, 2024
Accepted : Jan 15, 2024
Published : Jan 16, 2024

The research gap pertaining to the implementation of Enterprise Architecture (EA) and Sectoral Applications (ESA) is predominantly due to insufficient attention given to EA competencies at the management level and specific sectoral applications, particularly in higher education. In contrast to practical contexts, such as applications in the education sector, contemporary research tends to place greater emphasis on technical aspects, including new technologies and system standards. Additionally, while the advantages of incorporating Information and Communication Technology (ICT) into architectural education are acknowledged, there still needs to be more scholarly investigations examining the optimal approaches to ICT integration, specifically with regard to surmounting the obstacles encountered in regions like Taiwan. In conclusion, further research on the development of EA competencies, specific industrial and educational applications, and effective ICT integration strategies is urgently required.

METHOD

The research aims to develop the blueprint for online tutoring, focusing on the technological foundation and prospects of this field. The proposed research methodology comprises several primary stages, encompassing surveys, consultations with stakeholders, and the formulation of a roadmap for the EA blueprint. Each of these steps is specifically devised to guarantee that the research findings will be pertinent, functional, and capable of being put into practice within the framework of online tutoring. The procedure is visually depicted in Figure 1.

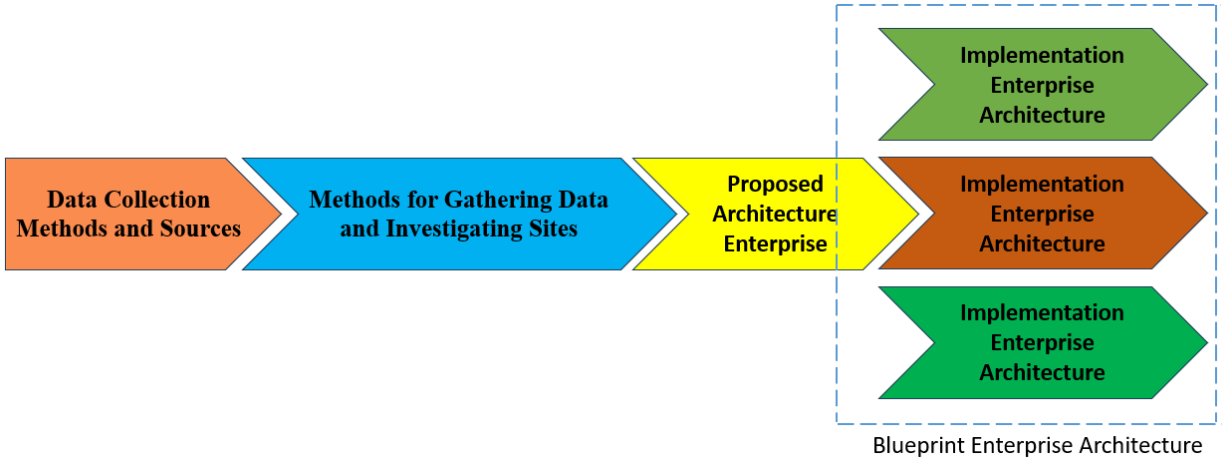

Figure 1. Enterprise architecture research methods

Data Collection Methods and Sources

The normative methodology employed in this research is the appropriate approach for gaining a comprehensive understanding of company architecture within the realm of online tutoring. By prioritizing the analysis of documents, literature, and secondary data sources through careful planning and research, you can lay the groundwork for an enterprise architecture by creating a path forward for your company. Utilizing diverse data sources, including scientific publications, industry reports, case studies, and related company documents, is crucial for collecting pertinent insights. Scholarly publications offer valuable information on the most recent advancements in online tutoring. Industry reports disclose emerging patterns within the industry. Case studies offer tangible instances of enterprise architecture implementation. Related company documents provide an internal perspective on the strategy being executed. By employing this method, you can assess past perspectives and discoveries while also recognizing exemplary standards and techniques that have been effectively implemented in the field. This will provide you with a comprehensive understanding of the strategies that have been empirically demonstrated to be successful in the realm of online tutoring.

Moreover, utilizing secondary data to comprehend present trends and forthcoming advancements in enterprise architecture for online tutoring will empower you to formulate a business roadmap that is grounded in precise data and information. By following this approach, the blueprint you generate will be more accurate and aligned with the specific requirements of the organization. Thoroughness and accuracy are crucial when conducting secondary data collection and analysis. Moreover, possessing the ability to connect research outcomes to the requirements of an

* Corresponding author

Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3433

Submitted : Jan 11, 2024
Accepted : Jan 15, 2024
Published : Jan 16, 2024

organization within the framework of enterprise architecture is crucial for creating a successful plan and design. By employing a meticulous and all-encompassing strategy, you will establish a strong foundation for suggesting a business roadmap and blueprint that can serve as a valuable reference in constructing enterprise architecture within the realm of online tutoring. May your research yield fruitful results and significantly advance the progress of this industry.

Methods for Gathering Data and Investigating Sites

To gather data for this research, an extensive search was conducted in electronic databases, specifically targeting academic journals, conferences, and other scientific publications that Scopus indexed. The selection of the Scopus database as the primary data source was made due to its high credibility and comprehensive coverage of up-to-date information, particularly in the domains of educational technology and corporate architecture. Scopus is a renowned reference database that grants access to peer-reviewed scientific publications, offering trustworthy and dependable data for academic research. Researchers can utilize this database to retrieve the most recent and pertinent studies, encompassing the latest research findings and emerging trends within the educational technology industry. This study does not establish a direct correlation between the research site and a specific geographical region. The reason for this is that normative research prioritizes theoretical analysis over direct field engagement. This approach enables researchers to engage in a more extensive exploration of theories and concepts unrestricted by geographical variables. This approach is also compatible with the worldwide scope of educational technology and enterprise architecture, which is not limited by any boundaries. Hence, this study offers a broader and more versatile viewpoint that can be implemented in diverse educational settings worldwide. The choice of this approach was made due to its capacity to provide a thorough analysis of the fundamental principles and theories of enterprise architecture, which form the foundation of this research. The normative approach enables researchers to examine and evaluate different theories and models that have been previously established and to assess their relevance and applicability to the current conditions and challenges encountered by the online tutoring industry. Comprehending the adaptability and application of enterprise architecture principles in evolving and dynamic contexts is crucial.

Furthermore, this approach affords researchers the chance to discern deficiencies in the current body of literature. Through the examination of diverse data sources from Scopus, researchers can evaluate the degree to which the subject of enterprise architecture in online tutoring has been investigated and pinpoint areas that necessitate additional research. It is crucial to ensure that the research conducted not only generates novel insights but also has practical applicability and significance for professionals and stakeholders in the education sector. The researcher's dedication to creating scientific work is evident in their adherence to established theories and concepts, as well as their responsiveness to current advancements and requirements in the educational technology industry. This research approach makes a significant contribution to enhancing knowledge of enterprise architecture in the context of online tutoring. It also offers practical recommendations that can be implemented in the field.

Enterprise Architecture Proposed

Within the realm of online tutoring, the establishment of a proficient Enterprise Architecture (Wedha & Hindarto, 2023) assumes excellent significance to guarantee the streamlined and productive dissemination of educational resources. The proposed Enterprise Architecture aims to combine different elements of technology, human resources, and business processes to create a harmonious and flexible system. The proposal commences by implementing an all-encompassing Enterprise Architecture framework comprising various components such as technology infrastructure, applications, data, and business strategy. This framework is specifically tailored to cater to the unique requirements of online tutoring, such as accommodating different operational sizes and addressing the ever-changing needs of users. Regarding the technological infrastructure, the focus is on creating platforms that are both scalable and secure. This entails the implementation of cloud computing to guarantee adaptability and availability, along with the implementation of rigorous security protocols to safeguard user data and privacy. This infrastructure must possess the capability to accommodate the escalating number of users and expanding requirements for data storage. Furthermore, the infrastructure needs to be able to support the integration of state-of-the-art technologies like AI and machine learning, with the aim of enhancing the student learning experience.

When it comes to applications, it is imperative to create a learning system that is both interactive and intuitive. This application must possess the capability to deliver tailored and flexible content based on the individual requirements and educational advancement of every student. Using AI, this app can dynamically adapt its lesson plans to each student's unique strengths and weaknesses, making it easier to meet their unique learning needs. In addition,

* Corresponding author

Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3433

Submitted : Jan 11, 2024
Accepted : Jan 15, 2024
Published : Jan 16, 2024

the application should possess a user-friendly interface, facilitating seamless and effective interaction between students and teachers. The primary emphasis in the realm of data lies in the management and analysis of data to facilitate strategic decision-making. To enhance the quality of tutoring, it is essential to gather and analyze data pertaining to student interactions, learning outcomes, and user feedback on an ongoing basis. Examining this data is crucial for discerning patterns, requirements, and possibilities for enhancing the educational system.

The business strategy for this EA should incorporate a comprehensive plan for ongoing development, encompassing enhancements to features, expansion of services, and innovation of products. The strategy must align with the tutoring company's vision and mission, focusing on enhancing the quality of education and addressing evolving learning requirements. EA's proposal seeks to establish a comprehensive, streamlined, and enduring online tutoring ecosystem. Through the incorporation of technology, individuals, and operational procedures, Enterprise Architecture can assist tutoring companies in addressing educational obstacles in the digital age while simultaneously delivering an exceptional learning encounter for students.

Application Architecture

When developing an Application Architecture (Hindarto, 2023a) for online tutoring, it is crucial to consider factors such as usability, interactivity, adaptability, and technology integration. The objective of this Application Architecture is to develop a learning platform that surpasses mere efficiency and effectiveness by offering each user a captivating and individualized learning path. A primary consideration is the usability aspect. Educators and students alike must be able to utilize the application with ease and without difficulty due to its user interface (UI). Simple and unambiguous navigation must be incorporated into the user interface to facilitate access to all available features.

Furthermore, responsive design is essential to ensure convenient access to applications across a wide range of devices, including desktop and mobile options. Second, the enhancement of the learning experience is dependent on the interactivity of these applications. Students should be able to collaborate and interact through a variety of interactive features provided by these applications, including online discussions, interactive quizzes, and group projects. These attributes must be intentionally crafted to facilitate active learning and empower students to apply the knowledge they earn practically. Moreover, to deliver personalized learning experiences, these applications must be adaptable. This goal can be achieved by combining machine learning and artificial intelligence (AI) technologies, which can automatically adjust educational materials and monitor students' learning patterns. Consequently, instructional resources can be tailored to the individual pace and learning style of each pupil. In addition, the technological integration within this application should possess the capability to facilitate a multitude of educational functions. Integration of external learning resources, including digital libraries and other online resources, and integration with learning management systems (LMS) (Manivannan, 2024), (Iqbal et al., 2023) (Strakos et al., 2023)and data analysis tools for monitoring student learning progress are all encompassed within this.

A final consideration should be given to the application's security and privacy mechanisms. To protect the personal information of users and guarantee that all platform-based interactions occur in a secure environment, applications must be outfitted with robust security features. In addition to supporting present educational requirements, the proposed Application Architecture for online tutoring endeavors to establish a learning environment that is versatile enough to accommodate forthcoming technological advancements and global educational demands. This is achieved through an emphasis on usability, interactivity, adaptability, technology integration, and security. By adopting this methodology, online tutoring platforms can deliver a vibrant and engaging educational encounter that caters to the unique requirements of every user.

Information Architecture

When designing the Information or Data Architecture for online tutoring, there is a focus on ensuring that data management, storage, and processing are done in a way that is both effective and efficient. This structure is specifically designed to facilitate the gathering, examination, and application of data in enhancing the process of learning and teaching. The fundamental components of this Data Architecture encompass data storage, data security, data analysis, and data integration. Efficient data storage necessitates the implementation of a meticulously structured and orderly system. This includes the utilization of databases that are both scalable and accessible to all stakeholders, including educators and administrators. The database must possess the capacity to manage extensive and diverse quantities of data efficiently, encompassing student profile data, learning interaction data, feedback data, and evaluation results. The integration of this data storage system with learning applications is crucial to ensure prompt and precise data accessibility. It is critical to prioritize the protection of data. For the safety of data from cyber threats and unauthorized

* Corresponding author

Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3433

Submitted : Jan 11, 2024
Accepted : Jan 15, 2024
Published : Jan 16, 2024

access, Data Architecture requires the implementation of robust security protocols. These measures encompass data encryption, robust user authentication, and periodic security audits. Data security is crucial for protecting student privacy and ensuring the integrity of learning information.

Data analysis is crucial for comprehending and enhancing the learning process. The data architecture should be designed to facilitate the utilization of sophisticated analytical tools for interpreting educational data. This encompasses the utilization of artificial intelligence and machine learning to discern learning patterns, ascertain student requirements, and evaluate the efficacy of educational resources. This analysis can assist educators in adapting instructional methods and tailoring instructional materials to meet the individual needs of each student. Effective data integration among diverse systems and applications within the online learning ecosystem is a crucial element. This guarantees the smooth transfer of data between learning management systems, learning applications, and analytics platforms. This efficient data integration facilitates rapid and precise dissemination of information, thereby simplifying overall data administration. The proposed Information Architecture for online tutoring prioritizes streamlined data management, robust data security, comprehensive data analysis, and seamless data integration. The objective of this approach is to establish a learning environment that is bolstered by precise and pertinent data, thereby enhancing the caliber of teaching and the educational experiences of students. By effectively managing all facets of data, online tutoring can fully leverage the potential of data to enhance and optimize the learning process.

Technology Architecture

When developing Technology Architecture (Karim et al., 2017) for online tutoring, it is imperative to adopt a holistic and cohesive approach. A variety of technological components must be supported by this architecture for it to function as an effective and efficient online learning system. In the first paragraph, network infrastructure will be discussed. A robust and dependable network infrastructure serves as the fundamental support for all online learning systems. The ability of this infrastructure to sustain substantial and uninterrupted data traffic is critical, particularly because data volumes continue to grow in tandem with the number of users. To guarantee the availability and dependability of services, the infrastructure must incorporate redundancy and disaster recovery mechanisms to reduce periods of inactivity. Cloud computing can serve as a viable solution by offering the necessary scalability and flexibility to accommodate evolving requirements. In online tutoring, the learning platform is a fundamental element of the technology architecture. It should be possible to access the platform with minimal effort, and it should be compatible with a wide variety of devices. The incorporation of diverse learning tools, including multimedia, video, and interactive elements, is critical for establishing a captivating educational environment. Furthermore, this platform should possess the capability to incorporate a learning management system (LMS) that facilitates assessment, monitoring of learning progress, and efficient administration of educational resources.

Regarding online tutoring, privacy and data protection are non-negotiable requirements. Technology Architecture must incorporate stringent security protocols to safeguard users' personal information and data. This encompasses the implementation of security protocols, data encryption, and user authentication in accordance with applicable regulations and industry standards. Consistently updating and integrating the most recent security technologies are imperative for preserving the system's integrity and fostering confidence. Considering swift technological advancements, Technology Architecture must be conceived with a sustainable perspective and the capacity to accommodate forthcoming innovations. This entails contemplating the implementation of emerging technologies like artificial intelligence and big data to enhance the efficacy of learning and the overall user experience. By incorporating an architecture that is both adaptable and expandable, the online tutoring system can guarantee its sustained relevance in the face of forthcoming challenges and requirements. By approaching the design of a Technology Architecture for online tutoring from a holistic perspective, it is possible to develop a system that not only satisfies present requirements but also lays the groundwork for forthcoming advancements and progress. This methodology guarantees that the technology employed will perpetually facilitate expansion and development within the realm of online education.

RESULT

These primary results emphasize that the success of online tutoring platforms is contingent upon the creation of an effective and efficient enterprise architecture. An effectively structured enterprise architecture facilitates the seamless integration of diverse technological systems, including but not limited to learning platforms, database management, and communications infrastructure. Critical in a dynamic and fast-paced educational environment, this facilitates the management of IT infrastructure and resources. This study presents a novel perspective on the significance of holistic integration and adaptability in EA, in contrast to prior publications, which primarily addressed the technical facets of

* Corresponding author

Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3433

Submitted : Jan 11, 2024
Accepted : Jan 15, 2024
Published : Jan 16, 2024

the field. EA must be capable of adjusting to evolving technological developments and shifting educational requirements, as evidenced by the requirement for adaptability. Furthermore, the results of this study indicate that when system administrators, students, and instructors adopt a holistic perspective on EA, it can foster greater collaboration. In summary, these results validate that the accomplishment of successful EA development is contingent not solely on technical factors but also on the capacity to seamlessly incorporate diverse system components within a learning environment that is both dynamic and adaptable.

Essential insights into the key components that need to be considered in the process of developing an Enterprise Architecture for online tutoring can be gained through the analysis of data obtained from surveys and meetings with stakeholders. Technological infrastructure, a learning platform, data security, and application integration are the four primary aspects that are revealed by the findings of this analysis. In order to ensure that the learning platform is able to function in a manner that is both hassle-free and effective, it is necessary to have a technological infrastructure that serves as a durable foundation. In order to facilitate productive communication between students and instructors, the learning platform itself should be user-friendly and understandable. Data security is a rising concern due to the proliferation of cyber threats targeting online learning platforms. To ensure that a variety of educational tools and resources can operate in harmony on a single platform, it is necessary to integrate applications efficiently. The findings of this study represent a departure from those of earlier research that placed less importance on data security and application integration. This suggests that these aspects are becoming increasingly important in today's educational context. To establish a learning environment that is secure, productive, and well-integrated, a good enterprise architecture for online tutoring needs to incorporate all these considerations.

Based on the findings of this research, it has been determined that the primary obstacles in the process of developing Enterprise Architecture (EA) for online tutoring are not only technical in nature but also associated with the dynamics of organizations and managers. The presence of resistance to technological change is frequently observed at a variety of organizational levels, which is indicative of a gap between the requirement for technological innovation and the readiness of the organization's culture or structure. This challenge is made even more difficult by the fact that an organization's capacity to implement and manage enterprise architecture effectively is frequently hindered by resource constraints, both financial and human. A further factor that contributes to the complexity of the situation is the requirement for stringent data security, which calls for the implementation of robust and ongoing security protocols. These protocols frequently call for the investment of additional resources.

Previous research tends to concentrate on the technical aspects of enterprise architecture, and it frequently needs to pay more attention to factors such as organizational resistance and resource constraints. These results signify a substantial deviation from prior investigations. This indicates that to develop a successful EA, a more holistic approach is required. This approach should take into consideration not only the technological aspects but also the organizational dynamics and the number of resources that are available. Taking this into consideration, change management strategies become extremely important, as organizations must cultivate a culture that encourages technological innovation and the ability to adapt to change. In conclusion, the findings of this research demonstrate that achieving success in the development of enterprise applications (EA) requires more than just technical solutions. The key to overcoming the challenges that are encountered is to devise an all-encompassing strategy that incorporates technology, management, and organizational strategy.

When it comes to developing an efficient Enterprise Architecture (EA) for online tutoring, the findings of this study highlight the significance of integrating various learning methods and technological advancements as an essential component. According to these findings, the Education Administration (EA) must not only be able to support the technological infrastructure, but it must also be adaptable and flexible enough to accommodate a variety of learning methods. This includes adaptive learning, which modifies instructional materials in accordance with the pace and manner in which a student learns, as well as collaborative learning, which encourages students to interact with one another and work together. These findings represent a significant departure from conventional methods, in which technology is frequently regarded as a supplementary instrument that is distinct from the learning strategy itself. This research indicates that the integration of technology and learning methodology should become an inseparable whole, where technology becomes a catalyst for more effective and exciting learning methods. This is the conclusion that can be drawn from the findings of this research. Therefore, Educational Automation (EA) needs to be designed, considering not only the technical aspects but also the ways in which technology can improve and support the learning process.

One of the most critical aspects of this integration is the way in which technology can assist in overcoming some of the difficulties that are associated with online learning. These difficulties include student reluctance to actively

* Corresponding author

Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3433

Submitted : Jan 11, 2024
Accepted : Jan 15, 2024
Published : Jan 16, 2024

participate in the learning process and the problem of measuring student comprehension in real time. Students are able to have a learning experience that is more personalized, interactive, and responsive to their needs when technology is effectively integrated into the methods of instruction. In addition, these findings offer insights that make it possible for educators and developers of educational applications to work together in the process of designing systems that are not only focused on technology but also on an educational approach. In conclusion, the findings of this research not only present a challenge to the conventional paradigms that have been established regarding the function of technology in the field of education, but they also offer a framework for the development of more integrative educational approaches. These approaches involve the combination of technology and learning methods in order to produce an ideal learning environment.

DISCUSSIONS

In the process of developing Enterprise Architecture (EA) for online tutoring, this research reveals that data security is an essential component. The significance of incorporating data security as a foundation in enterprise architecture design is highlighted by these findings, which distinguish themselves from earlier research that frequently regarded data security as a secondary component. In the context of online tutoring, not only is data security a necessity, but it is also an ethical and legal obligation. This is because the personal data and sensitive information of students are managed digitally. The findings from this study highlight the importance of incorporating data security into every facet of enterprise architecture, including the technology infrastructure, applications, and services that are utilized. Utilizing robust data encryption, user authentication, network safeguards, and security protocols that are in accordance with the most recent industry standards are all included in this. Not only does the importance of data security reflect the growing number of cyber threats that educational institutions are confronted with, but it also reflects the fact that these threats require a more proactive and comprehensive security approach. The findings of this study point out that the concept of data security encompasses not only the technical aspects of data protection but also the policies and procedures that govern the access and utilization of data files. This policy needs to be understandable, forthright, and in accordance with the data protection regulations that are currently in effect. It is also necessary to provide training and awareness on data security to all users, including teaching staff and students, to lessen the likelihood of data breaches occurring because of user error. In the context of enterprise architecture, the findings of this research indicate that data security ought to be a primary consideration right from the beginning of the planning stages. In light of this, the data security architecture must be incorporated into the entirety of the technology architecture rather than merely being an addition or modification after the fact. Utilizing this strategy guarantees that every technological solution that is implemented is in accordance with stringent security standards. New insights into the significance of making data security a top priority in the development of EAs are provided by this research. There is an increase in user trust in the platform because of this, which not only strengthens the integrity of the online learning system. The protection of vital information and the fulfillment of educational institutions' responsibilities regarding the security of student and teacher data can be improved if the institutions make data security a priority.

A more inclusive and adaptable approach to the development of Enterprise Architecture for online tutoring is recommended because of the findings of this research, which results in recommendations. This recommendation emphasizes the significance of involving all relevant stakeholders in the development process. These stakeholders include education professionals, students, information technology developers, and system administrators. They provide valuable feedback that can assist in tailoring the EA to be more responsive to actual needs and challenges, which is made possible by their participation. The significance of adjusting one's practices to accommodate the most recent technological advancements is also an essential component of this recommendation. Electronic applications (EAs) need to be designed with the capability to adapt to and incorporate new technologies in order to keep up with the rapid development of technology. This makes it possible for learning platforms to continue to be practical and relevant, in line with the advancements that have been made in educational technology. In light of the pressing requirement to safeguard sensitive information in the digital environment, these recommendations place a strong emphasis on the protection of data and privacy. With the goal of preserving both trust and the integrity of the system, EAs are required to implement robust security protocols and adhere to data privacy standards.

In contrast to the more rigid and technical approaches that are frequently found in previous literature, these recommendations offer a different point of view. The development of EA is a dynamic process that requires flexibility and openness to change, and this approach acknowledges that it is both inclusive and adaptable. To take an inclusive approach, it is necessary to consider the various modes of education and the requirements of a wide range of users. It is essential for an effective EA to provide a user experience that is both rich and varied, as well as to support a variety

* Corresponding author

Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3433

Submitted : Jan 11, 2024
Accepted : Jan 15, 2024
Published : Jan 16, 2024

of learning methods. Adaptation to the most recent technological advancements is not only associated with the utilization of the most recent tools and platforms but also with the utilization of data and analytics to enhance the way learning is accomplished. EAs are required to have the ability to integrate analytical solutions to provide insightful information regarding learning performance and to assist in making decisions based on data information. By considering the technical, human, and process aspects, the recommendations that come from this research provide a framework for the development of EA that is more holistic. This approach not only improves the efficacy of learning but also strengthens the technological infrastructure, which is why EA is such an essential tool in the process of achieving educational objectives. EA possesses the capability to not only fulfill current demands but also the readiness to confront future challenges and capitalize on forthcoming opportunities because of this approach.

CONCLUSION

A comprehensive examination of the evolution of Enterprise Architecture in the context of online tutoring is presented in this study. The objective of this study, which was to identify and develop an architecture capable of enhancing lengthy-term strategies and technological infrastructure in the online tutoring industry, has been accomplished. To support an effective and efficient online learning system, it is critical to integrate technology, application, information, and data architecture components synergistically, according to this study. The success of online tutoring platforms is contingent upon the presence of a dependable, scalable, and secure technological infrastructure, according to research. The integration of an intuitive and interactive learning platform with a learning management system facilitates an enhanced learning experience. The importance of data privacy and security highlights the necessity for rigorous security measures to protect user data. Additionally, the significance of a versatile and adjustable framework that can accommodate emerging technologies and learning methodologies is underscored in this conclusion. Furthermore, this study proposes that to guarantee that the system created satisfies the requirements of users, the integration of EA into online tutoring should proactively solicit feedback from all relevant parties, including instructors, learners, and staff. Further investigation into the utilization of cutting-edge technologies, such as artificial intelligence, to enhance the individualization and efficacy of online learning is also made possible by this research. This study offers significant contributions by shedding light on the development and implementation of EA within the realm of online tutoring, with the goal of enhancing the caliber and efficacy of education. Preceding the future advancement of online education systems, these discoveries are expected to contribute to the achievement of broader educational goals.

REFERENCES

Afarini, N., & Hindarto, D. (2023). *The Proposed Implementation of Enterprise Architecture in E-Government Development and Services*. *3*(December), 219–229.

Alwi, M. N., Hindarto, D., & Marina, A. (2023). *Efficiency and Effectiveness : Enterprise Architecture Strategies for Healthcare Service*. *3*(December), 386–397.

Azaliah, N., Bakar, A., Harihodin, S., & Kama, N. (2016). *Assessment of Enterprise Architecture Implementation Capability and Priority in Public Sector Agency*. *100*, 198–206. https://doi.org/10.1016/j.procs.2016.09.141

Hindarto, D. (2023a). Application Of Customer Service Enterprise Architecture In The Transportation Industry. *Journal of Computer Networks , Architecture and High Performance Computing*, *5*(2), 682–692.

Hindarto, D. (2023b). *Blockchain-Based Academic Identity and Transcript Management in University Enterprise Architecture*. *8*(4), 2547–2559.

Hindarto, D., & Indrajit, R. E. (2023). *Digital Transformation in University : Enterprise Architecture and Blockchain Technology*. *8*(4), 2501–2512.

Iqbal, N., Ur, S., Elrehail, H., Fahed, T., Masaeid, A., Adaileh, R., & Alzoubi, H. M. (2023). *Analyzing effect of fear and uncertainty avoidance on use behavior of learning management system : Post COVID-19 era*. *3*(October).

Judijanto, L., & Hindarto, D. (2023). *Edge of Enterprise Architecture in Addressing Cyber Security Threats and Business Risks*. *3*(December), 386–396.

Karim, A., Demian, P., Anumba, C. J., & Baldwin, A. N. (2017). *International Journal of Information Management An enterprise architecture framework for electronic requirements information management*. *37*(March 2016), 455–472.

Kumar, P., Kumar, S., & Nandi, S. (2019). *A tutorial survey on vehicular communication state of the art , and future research directions*. *18*.

Manivannan, R. (2024). *Sustainable Computing : Informatics and Systems Research on IoT-based hybrid electrical*

* Corresponding author

Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3433

Submitted : Jan 11, 2024
Accepted : Jan 15, 2024
Published : Jan 16, 2024

vehicles energy management systems using machine learning-based algorithm. *41*(November 2023).

Olsen, D. H., & Trelsgård, K. (2016). *Enterprise Architecture adoption challenges : An exploratory case study of the Norwegian higher education sector* . *100*(1877), 804–811. https://doi.org/10.1016/j.procs.2016.09.228

Ruhi, U. (2016). *An experiential learning pedagogical framework for enterprise systems education in business schools*. *14*, 198–211.

Rui, L., Xirong, G., & Fang, M. (2012). *The Research of Petroleum Enterprise Information System Architecture Based on the G/S Model*. https://doi.org/10.1016/j.phpro.2012.02.319

Shariati, M., Bahmani, F., & Shams, F. (2011). *Procedia Computer Science Enterprise information security , a review of architectures and frameworks from interoperability perspective*. *3*, 537–543. https://doi.org/10.1016/j.procs.2010.12.089

Strakos, J. K., Douglas, M. A., Mccormick, B., & Wright, M. (2023). *The International Journal of Management Education A learning management system-based approach to assess learning outcomes in operations management courses*. *21*(December 2022).

Trad, A., & Kalpić, D. (2014). The Selection and Training Framework (STF) for Managers in Business Innovation Transformation Projects - Business Enterprise Architecture Integration. *Procedia Technology*, *16*, 755–767. https://doi.org/10.1016/j.protcy.2014.10.025

Wang, T. (2009). *Rethinking teaching with information and communication technologies (ICTs) in architectural education*. *25*, 1132–1140. https://doi.org/10.1016/j.tate.2009.04.007

Wedha, B. Y., & Hindarto, D. (2023). *Maximizing ERP Benefits with Enterprise Architecture : A Holistic Approach*. *5*(2), 703–713.

* Corresponding author