

Implementing Digital Transformation in a Peruvian University: The ESTDI Model and its Impact on Customer Service

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Abstract. This study presents the ESTDI (Emerging Technology Strategy for Digital Transformation) model as a scalable framework for digital transformation in higher education. The model integrates QR technology, cloud computing, and machine learning (chatbot) to improve customer service for students and teachers. Using a descriptive correlational design, the model was implemented in the Faculty of Business Management at the Universidad Femenina del Sagrado Corazón (UNIFE) in Peru. Data were collected through questionnaires administered to 61 students and 17 teachers. The results showed improvements in student satisfaction with response time, information accuracy, and quality of service, but highlighted the need for teacher training on digital tools. The ESTDI model offers a promising approach for universities to leverage emerging technologies to enhance their operations and services, with implications for student engagement, teaching effectiveness, and organizational agility. Future research should validate the model in other contexts and explore its impact on learning outcomes and institutional performance.

Keywords: Digital competence, digital transformation, chatbot, Machine Learning, QR, ESTDI.

1. Introduction

Currently, firms are prioritizing ongoing advancement in response to negative shifts in global information technologies, which is referred to as digital transformation (Ventura et al, 2023). The University, being familiar with these changes and trends, is well-equipped to adapt to them. The emergence of social networks, mobile devices connected to networks, and multimedia tools that enhance the learning process will enable the University to better cater to its users (teachers and students), thereby optimizing academic procedures (Párraga et al., 2023; Aldana, 2022). Given the significance of examining the digital transformation in the Faculty of Business Administration at UNIFE, it is crucial to address these challenges. This research has the potential to be expanded to the broader higher education sector (Romero et al, 2023; Castañeda, 2023). ESTDI commits to enhancing educational and administrative procedures by using cutting-edge technology. Furthermore, it prioritizes the substantial enhancement of the user experience for both students and instructors. By using this framework, the faculty is positioned as a leader in educational innovation, guaranteeing improved efficiency, tailored experiences, and accessible customer service. This leads to a more competitive training program that is aligned with the requirements of the international market and the digital era. (Castañeda, 2023).

It is a comprehensive procedure that includes the use of digital technology to enhance education and learning. This transition encompasses not only the use of digital resources, but also necessitates alterations in corporate culture, teaching methodologies, and educational infrastructure. This method is crucial as it can tailor education to the specific requirements of students and equip them for a perpetually changing job market. From an academic standpoint, digital transformation facilitates access to cutting-edge resources and study materials, while also fostering enhanced cooperation and communication among students and professors. Technology can enhance knowledge sharing and create a more dynamic and participatory learning environment via the use of open educational materials and online learning platforms. Furthermore, learning analytics enables ongoing assessment and enhancement of learning processes to guarantee that learning goals are in line with the proficiencies demanded in the professional realm.

Companies face a threat from global technological trends, specifically the process of digital transformation. Mobile devices, along with networks and multimedia, enable more efficient learning processes and better serve users (teachers and students). This optimization of academic processes has been supported by various sources (Aldana, 2022; Bermudez y Pérez, 2018; Uribe, 2023). An examination of the user experience on academic and management information has shown an issue of discontentment among instructors and students caused by the lack of digital transformation tools (Pedraza, 2020; Rodríguez et al, 2023; Vega et al, 2022). Furthermore, the advancement of this study has significant significance as it will enhance the user experience of educators and learners throughout the process of digitization, serving as a pivotal component of the digital transformation encountered at institutions (Mejía, 2021; Demattei and Sánchez, 2021; Zambrano et al, 2019). After assessing the theoretical framework for analyzing Digital Transformation (DT) in universities, it is proposed to focus on Administration, specifically on the digitalization variable of the user experience. This will be done through various dimensions of continuous improvement, including University City, ICT Infrastructure, Administration, Teaching, Research and Technology Transfer, Marketing, Communication, and Governance of the digital transformation. The decision to focus on Administration and the digitalization of the user experience is based on the information shared in the Faculty of Business Administration and supported by the works of Uribe (2023), De Giusti (2023), and Cardenas et al. (2023).

The implementation of digital transformation in higher education is crucial for ensuring the continued relevance and competitiveness of educational institutions on a global scale. Digitizing curriculum and integrating digital skills into educational programs are crucial in equipping students with the necessary preparation for future difficulties. Technology facilitates the globalization of education by enabling students to engage in virtual exchange programs and work with peers from other countries, thus enriching their educational and cultural exposure. Lastly, the transition to digital platforms in higher

education is crucial for ensuring sustainable growth and fostering innovation. Institutions may cultivate creativity, encourage critical thinking, and enhance problem-solving skills by advocating for a comprehensive and student-centric approach. When used strategically and with ethical considerations, technology has the potential to revolutionize higher education by making it more accessible, equitable, and of superior quality. This program will provide future leaders and professionals with the necessary skills and knowledge to make a meaningful impact on society. The present study enhances the existing literature by introducing a novel framework, named "ESTDI," for the digital transformation of the Faculty of Business Administration at UNIFE. This framework is built upon the "Theoretical Model for the Analysis of Digital Transformation in Universities" and aims to enhance customer service for both students and teachers.

1.1. Digital Competence

Over the last several years, society has seen a significant shift, driven in part by the revolution resulting from the integration of ICTs in every aspect, actor, and sector of society. A civilization that is interconnected on a global scale, where changes are rapidly introduced, characterized by the transformation of space and time, an overwhelming amount of information, and the emergence of new kinds of collective and networked intelligence. Additionally, this society presents novel situations and obstacles, including emerging disparities and risks such as the digital divide (Armas and Alonso, 2021; Hernández et al, 2021). In response to these challenges, various administrations and institutions recognize the importance of reevaluating educational priorities for the 21st century. This involves equipping citizens with the essential strategies to effectively navigate these demands, including the acquisition of digital media skills to actively and proficiently engage in contemporary society (Domingo et al., 2020; Ledesma, 2022).

1.2. Digital Competencies Frameworks and Models

Several frameworks and models have attempted to define and standardize digital competence. These have been established by various institutions or administrations at different periods, for different target audiences, and, most importantly, depending on the methodology or viewpoint on which they are based, as previously mentioned (Padilla et al, 2019). One of the most well-known international models is that created by the Educational Testing Service (ETS), a quality and education development organization that creates assessment instruments for various levels. According to this organization, they create and conduct about 50 million tests each year, mostly in the United States, including the Test of English as a Foreign Language (TOEFL) and the Test of English for International Communication (TOEIC). ETS developed the iSkills instrument to test and certify a set of critical thinking abilities in a technical and digital setting (Cabero et al, 2021; Llanes, 2022).

Another model to highlight is the European Computer Driving License (ECDL), also known as the International Computer Driving License (ICDL), which is a standard for certifying understanding of fundamental computer and technology principles. Like the previous model, it focuses on the general population, independent of academic degree or occupation (Perdomo et al, 2020; Lizárraga et al, 2022). It is a program launched by the Council of European Professional Informatics Societies (CEPIS) to promote and develop Europeans' ICT competence, which has been suggested by the European Commission (Restrepo and Cifuentes, 2020). The capacity to study, teach, and do research using information and communication technologies (ICTs) effectively and responsibly. This encompasses abilities such as looking for, assessing, utilizing, and sharing digital information; using digital technologies to cooperate and communicate professionally, and comprehending the ethical and legal implications of using digital information. Digital competence in academia also includes the capacity to use digital resources in the teaching process, resulting in a more richer and adaptable learning environment. Students and instructors must be able to adapt to new digital tools and platforms, as well as stay current on developing technology trends that may support and improve the educational experience. As a result, digital competence is critical for educator's and student's continued professional growth, as well as for preparing

graduates for an increasingly digitized and globalized job market.

1.3. Definition of Digital Transformation

According to Lledó (2022), digital transformation reconstructs organizational dynamics to better meet the demands of current and future customers. It is an essential component of a company's business or strategic strategy (Fernández, 2020; Mejía & Mejía, 2022). Digital transformation, on the other hand, refers to the integration of digital technology across a firm, radically altering how it runs and offers value to its consumers. It also entails a culture shift that compels organizations to continuously question the existing quo, experiment, and grow comfortable with failure (Pérez et al., 2021).

The procedure is complex and requires a comprehensive restructuring of the organization's operations and strategy. This phenomenon extends beyond the use of new technology; it represents a comprehensive transformation of the firm. Digitization impacts every aspect of the firm, including supply chain management, customer contact, business information, and product and service innovation. The core of this transition is in the need to predict and fulfill the evolving demands of consumers, who, in the era of digitalization, want quicker, more tailored, and more available solutions. From a strategic standpoint, digital transformation needs dedicated leadership and a comprehensive strategy. To thrive in the constantly evolving digital environment, corporate executives must cultivate a culture of adaptability and ongoing education. This entails reassessing existing business models and integrating cutting-edge technology. Digitization has the potential to bring forth disruptive innovation, which may lead to substantial competitive advantages and the exploration of new markets. However, it also requires a readiness to embrace failure and undertake risks as integral components of the process of acquiring knowledge and developing oneself.

Digital transformation encompasses the automation of processes and the optimization of resources, resulting in enhanced operational efficiency and cost reduction. Utilizing big data platforms and sophisticated analytics, together with integrating information systems, allows for better informed and data-driven decision-making. Furthermore, digitalization enhances internal cooperation and communication, as well as enables distant work, which is particularly crucial in the present environment characterized by the worldwide pandemic. Lastly, digital transformation has ethical and corporate social responsibility ramifications. Organizations must prioritize cybersecurity and safeguard personal data, while also considering the environmental impact of digital technology. To guarantee that the advantages of digitalization are available to all sectors of society, firms must tackle additional obstacles, such as digital inclusion and technological disparities. Put simply, digital transformation is a sweeping and all-encompassing shift that impacts every aspect of an organization, extending beyond mere technological advancements.

1.4. Digital Transformation in Universities

Alonso & Chacón (2018) argue that digital transformation is not just dependent on digital technologies and should not be confined to discussions solely about technology. The driving force behind digital transformation is strategy, not technology. An organization's strategy is derived from its mission, which represents its purpose, and its vision, which represents its desired future state. Hence, while discussing the digital transformation of universities, it is essential to begin with their core purpose and depend on a distinct and ambitious vision that positions us in the envisioned future (Cueva, 2020; Ramírez, 2021). Therefore, while considering the university as a whole entity, we may examine the digitalization of learning and the digitalization of research as distinct processes, which are the primary objectives of the university. To meet the obligations of teaching and research, it is necessary to depend on the organization's resources, processes, information, and people. Therefore, we will also examine the digital transformation of university management. The latter, referring to IT, is often the primary area of interest, as it has been increasingly integrated into management practices and is the most advanced. When discussing digitization, our thoughts are typically limited to electronic administration. However, while discussing the genuine transformation of universities, it is essential to consider the change of their fundamental

activities: education (dissemination of information) and research (creation of knowledge). Given that transition always involves alteration, we will examine this aspect from two viewpoints: quantitative and qualitative (Ramírez, 2020; Sampedro et al, 2021).

However, from a quantitative standpoint, change has consistently been present. Universities have transformed, adjusting their techniques to accommodate changes in the surrounding conditions. The modifications occurred smoothly and progressively, resulting in a gradual and ongoing development. What recent event or development has occurred that has sparked widespread discussion regarding transformation? Universities, along with all other organizations, are now experiencing a significant level of confusion and detachment from both technological and social realities due to the enormity of change. There are just two alternatives. One way to bridge this current divide and adapt to the new social reality is by transforming oneself. There are two options: to stay still or to take a reckless step into this unfamiliar territory and maybe vanish. However, the qualitative viewpoint of change. When integrating new technology, namely digital technologies, four distinct stages may be seen. During the first phase, we begin to experiment with the concept, examining the potential that this novel technology may provide. Given the intriguing nature of the technology, it is used to carry out traditional duties in the same manner as before, as is the case in our analysis, while also automating other jobs. It becomes evident that these emerging technologies provide fresh opportunities for us to engage in activities, prompting us to adopt familiar practices but with a novel approach, so facilitating our progress. However, the true benefit arises when we can engage in novel activities using innovative approaches, resulting in a transformative effect on us (Díaz and Berrocoso, 2020). Consequently, we may conclude that the digital revolution in universities should enable us to engage in novel activities using innovative methods, including two key elements: novel methods and novel activities. Thus long, the emphasis has been placed on innovative methods, resulting in the digitization of institutions. However, the true metamorphosis will occur by engaging in novel activities (while maintaining focus on their goal). The Theoretical Model for the Analysis of Digital Transformation in Universities, devised by Quezada (2023) in the study of the Digital Transformation of Higher Education Institutions, will play a pivotal role. An Abstract Conceptual Structure.

Table 1. Summary of levels and variables of analysis

Levels of analysis		Variables	
1	University City	1.1	Mobility on the university campus
		1.2	Sustainability of the university campus
2	ICT Infrastructure	2.1	Automation of university management processes
		2.2	Communications infrastructure
3	Administration	3.1	Automation of university management processes
		3.2	Digitalization of the user experience
		3.3	Impact on relations with the environment
4	Teaching	4.1	Face-to-face teaching
		4.2	On-line teaching
		4.3	Teaching innovation
5	Research and transfer	5.1	Digital media for research
		5.2	Digital networks for research transfer
6	Marketing	6.1	Incorporation of new students
		6.2	Relationship with alumni
		6.3	Raising additional funds
7	Communication	7.1	External communication
		7.2	Internal communication
8	Governance of digital transformation	8.1	Responsibility for digital transformation

Velasco et al. (2017), for each level of analysis, we identify variables that determine the level of learning. The result is a theoretical model in which we divide digital transformation research into eight

levels of analysis or measurement and identify eighteen variables to examine to understand the impact of digital transformation on these types of organizations.

1.5. Machine Learning

It is a field within artificial intelligence that serves as an intermediary between data and information methodically. ML systems may be taught using automated voice recognition systems, like iPhone Siri, to translate acoustic input into a sequence of data by vocalizing a semantic structure represented as word strings. The primary objective of Machine Learning is to make predictions about unknown future events or scenarios without explicit programming. Arthur Samuel defined Machine Learning as the field that enables computers to learn autonomously in 1959. Tom M. Mitchell further elaborated on this definition, stating that a computer program is considered to learn when its performance on a specific task improves with experience. This definition emphasizes the key components of a learning algorithm, which operate under the same principles regardless of their order. It is important to highlight that the concept of artificial intelligence, along with its various aspects, is closely tied to the renowned Alan Turing Test (Rojas, 2020). This test sets a criterion for labeling artificial intelligence (whether in the form of software, hardware, or both) as "intelligent." According to this criterion, a machine's responses should be indistinguishable from those of a human being, as determined by a person's inability to differentiate between the two (Alfaro & Ospina, 2021).

1.6. Cloud Computing

Alouffi et al. (2021) state that the word "cloud" is used as a metaphorical means of referring to the Internet, and it has been in use for some years. Cloud computing encompasses network-based services, including email, storage, and application use, that can often be accessed via a web browser. When using these services, the data used and saved, together with the majority of the necessary applications, are processed and performed by an Internet-based server (Bello et al, 2021).

The inception of cloud computing was initiated by prominent Internet service businesses like Google and Amazon, which constructed their infrastructure. Subsequently, an architectural framework was established: a structure consisting of horizontally dispersed assets, implemented as highly expandable virtual IT services and governed as consolidated and consistently adjusted resources (Schleier et al, 2021). However, networks are primarily utilized for technical processing applications with a relatively loose connection. They consist of a system composed of subsystems that have a certain degree of autonomy in their actions while maintaining a continuous interrelation between them. This arrangement forms a "virtual supercomputer" that is capable of performing large tasks. On the other hand, cloud computing is specifically designed for Internet services. While the implementation may be recent, the concept itself is not new and has been a topic of discussion in the field for several years under various names such as "utility computing," "on-demand computing," "elastic computing," or "grid computing" (not to be confused with the aforementioned network processing) (Xu et al., 2019).

A QR code is a type of information storage system that uses a two-dimensional bar code encoded in a matrix of dots. It can also be presented in its original form, which is characterized by three squares in the corners. These squares help the scanner detect the optimal position for reading the code. Invented by the Japanese firm Denso-Wave in 1994, the code has three squares positioned in the corners, enabling the decryptor to see the code's viewpoint. The objective of this was to ensure that the code could withstand being read quickly and effortlessly (Rodríguez et al, 2019; Spinelli and Dreizzen, 2021).

2. Conceptual Framework

2.1. Background of the digitization of the user experience in the UNIFE academic system

Between 2015 and 2019, "Chamilo" served as a virtual classroom platform facilitating asynchronous communication between teachers and students. The research project conducted in 2018, titled "Model

of Factors that Explain the Limiting Factors in the Use of UNIFE Virtual Classrooms by the Teachers of the Faculty of Business Management," concluded that the female university of the Sacred Heart, following the theory of Herrada and Villar (2021), is at level 1. This means that UNIFE is primarily a face-to-face university that only incorporates digital elements into its educational process.

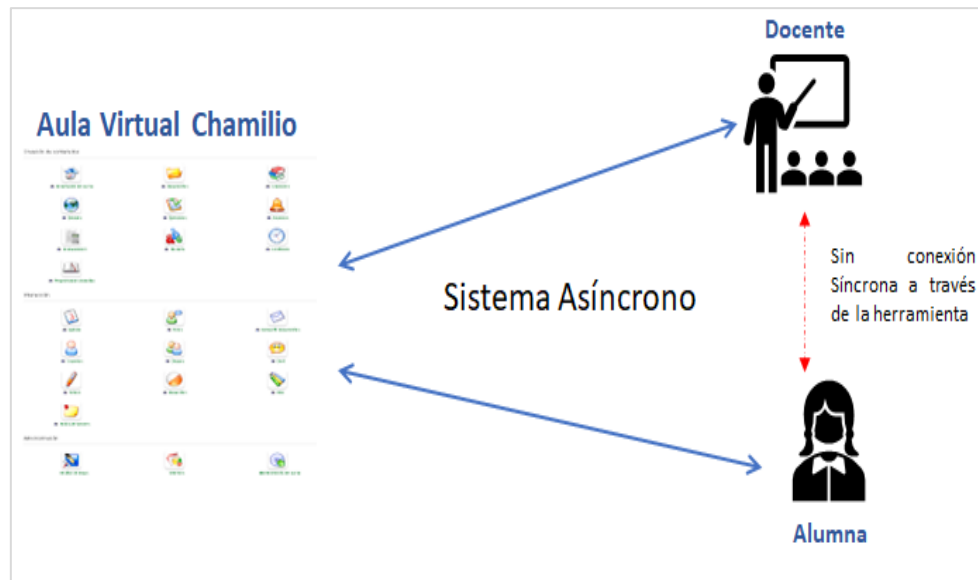


Fig. 1: Chamilo Virtual Classroom System

Based on the information provided, it can be inferred that the research aims to create a model of Digital Transformation for UNIFE. This model will enable the university to enhance its academic value by implementing a synchronous system that facilitates seamless communication between teachers and students through the use of new technological tools. The expected outcome of this implementation is an improvement in the academic system. The responsibility is with them to develop the ESTDI model, which is a scalable framework for digital transformation.

The Scalable Digital Transformation Model (ESTDI). The scalable digital transformation approach aims to use new technological solutions to enhance and streamline the organization's value-adding operations. This concept is applicable in many organizations.

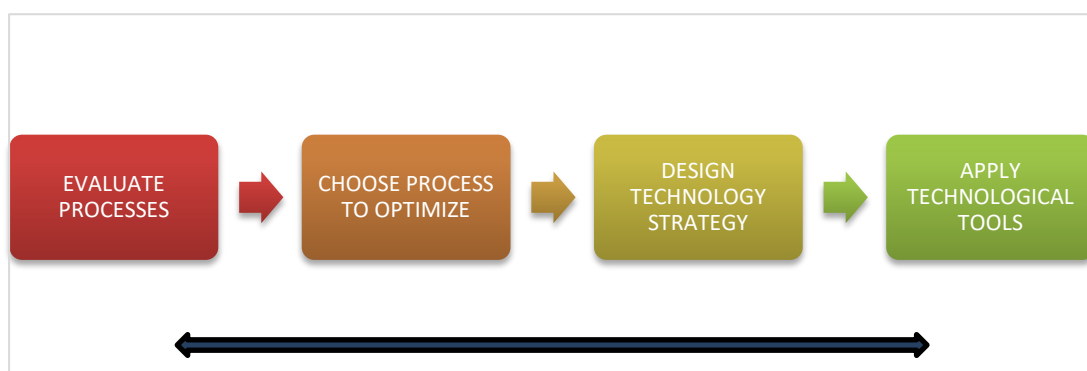


Fig. 2: ESTDI model diagram

The study used a created model to improve the academic system of the Faculty of Business Management at UNIFE. Each of the aforementioned steps has been completed to determine the technical tools that will be used for this goal. The tools to be applied are as follows:

Utilization of QR Technology with Cloud Computing. Since 2015, UNIFE has obtained the Mi-

Microsoft 365 Cloud, which includes various technologies for facilitating real-time communication between professors and students. This will enable the initiation of the Digital Transformation process at UNIFE. This technology enables the creation of a database for accessing information via QR codes. The QR Code application is a component of the application that generates QR codes dynamically on SharePoint sites. Conversely, our objective in incorporating these technology tools is:

- Scan QR codes and extract the encoded information, which in this instance is the URL leading to a document stored on SharePoint Online.
- Integrate the functionality to authenticate users, including both instructors and students, within the security framework of Office 365.
- Display the primary attributes or metadata of these papers, provided that the document is present and the user is logged in correctly.
- Having the capability to access the document directly from the application.

For this construction, we shall use the following technologies internally. Xamarin. Forms offer a comprehensive cross-platform user interface toolkit for .NET developers. The capability to build completely native Android, iOS, and Universal Windows Platform apps using C# in Visual Studio. Azure Active Directory (Azure AD) is a cloud-native service provided by Microsoft that offers identity and access management capabilities. Azure AD facilitates the authentication and authorization process for your workers, enabling them to securely log in and have access to external resources, including Microsoft Office 365.

Azure Portal and several other Software-as-a-Service (SaaS) applications (Hilario et al, 2024). Furthermore, this includes internal resources such as the corporate network, intranet apps, and any cloud applications that have been built by your firm. Microsoft Office 365 is a subscription-based solution that includes the Microsoft Office suite (Word, Excel, PowerPoint, Publisher, Access, OneNote, and Outlook). To enhance integration, a mobile application will be developed to access information such as documents, videos, and plans. This mobile application will display the requested information and allow users to open documents and rescan them within the app. The instructor will use the Web Interface, accessed via their Microsoft 365 account, to produce a QR code containing the information that will be shared with the students of their course at UNIFE.

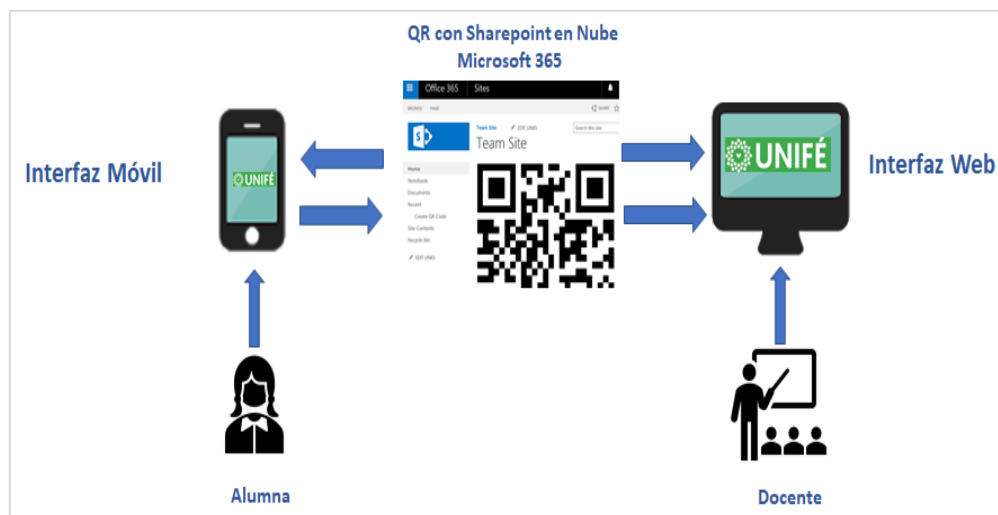


Fig. 3: Design of the use of QR and Cloud in UNIFE.

Within the realm of mathematics, QR codes exhibit more specialization by distinguishing between the arrangement of subjects and applied tasks. This not only enhances students' efficiency by offering them efficient and structured access but also demonstrates an instructional strategy that emphasizes

independent learning and ongoing self-evaluation. By incorporating QR codes into SharePoint, the efficiency of distributing educational content is enhanced, while simultaneously fostering a more engaging and individualized learning experience. This digital tool is crucial in contemporary education since the accessibility and adaptation of material are vital for academic achievement.

Within the realm of mathematics, QR codes exhibit a heightened level of specialization, serving to distinguish between the arrangement of subjects and practical assignments. This not only enhances students' efficiency by giving them immediate and structured access but also demonstrates a pedagogical style that emphasizes independent learning and ongoing self-evaluation. By incorporating QR codes into SharePoint, the efficiency of distributing educational content is enhanced, while simultaneously fostering a more engaging and individualized learning experience. This digital tool is crucial in contemporary education since the capacity to acquire and modify knowledge is vital for academic achievement.



Fig. 2: Course and Software Engineering

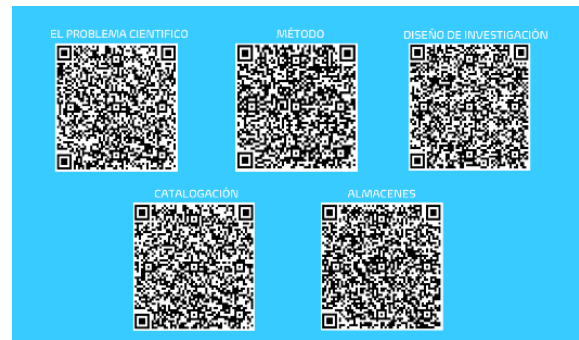


Fig. 1: Thesis Seminar Course



Fig. 4: Mathematics Course



Fig. 3: Mathematics Course

The suggestion to integrate a Machine Learning system into the academic framework of UNIFE signifies a notable progression in the mechanization of student services. The use of a supervised learning model inside a Chatbot is becoming more popular as a technical resolution for the repetitive inquiries that students make outside of regular administration hours. This virtual assistant is seamlessly integrated into both the online platform and mobile apps, ensuring smooth and direct contact. It provides instant responses to predetermined queries about the Enrollment Process and the Administrative Process.

The chatbot, using Natural Language Processing (NLP) techniques, will have the capability to understand user inquiries and provide relevant and current information. The database that supports the virtual assistant will store comprehensive information on academic processes, enabling the system to provide precise responses to student inquiries. By incorporating this technology into the university's

digital infrastructure, not only are frequent questions managed more efficiently, but it also demonstrates a dedication to educational innovation and the ongoing enhancement of student service. The figure shown depicts the sequence of user-system interaction, emphasizing the user-friendly accessibility and effectiveness of the consultation procedure. The use of this Machine Learning technology at UNIFE serves as a prominent illustration of how artificial intelligence may be utilized to enhance the educational and administrative experience, guaranteeing efficient communication and unparalleled availability of academic materials.

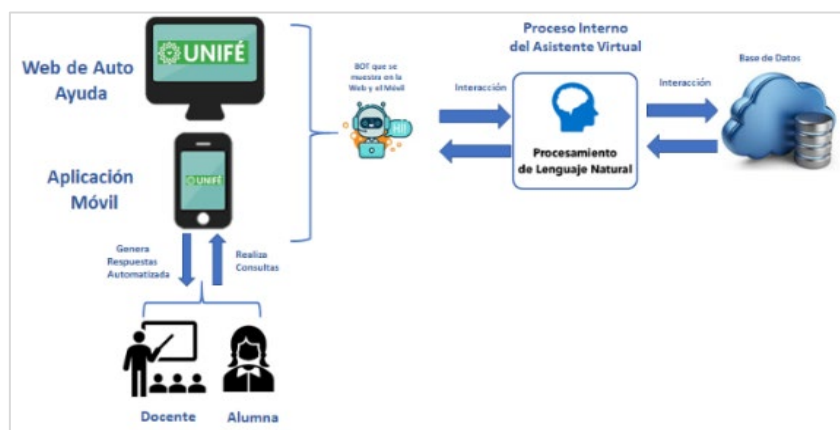


Fig. 8: UNIFE Chatbot Process

The life cycle of the UNIFE Chatbot is described as a dynamic and ongoing process, which operates on the premise of supervised learning. The process starts with a thorough analysis phase, during which the requirements and expectations of the end-users are identified and described. At this stage, business and technology management collaborate closely to define the goals and extent of the project. The subsequent phase entails the establishment of comprehensive specifications, which will function as a strategic plan for the construction of the Chatbot. The criteria for the Chatbot should be unambiguous, quantifiable, and attainable, and should include the particular features necessary to fulfill customer inquiries.

The building of dialogues is a crucial stage that requires a rigorous approach to crafting interactions that are both natural and effective while maintaining consistency. In this phase, the Chatbot's conversation scripts are created to provide accurate and contextually relevant replies while interacting with people. Ensuring an intuitive and accessible interface is crucial for user experience (CX) design. This design should prioritize usability and deliver a favorable user experience, irrespective of the user's degree of technological proficiency. Developing and training a chatbot entails implementing artificial intelligence algorithms and training the model using a dataset that accurately represents the desired behavior. This phase is essential for the Chatbot's capacity to assimilate from previous conversations and enhance its performance gradually. The testing step is crucial for guaranteeing the quality and operation of the Chatbot before it is deployed. During this phase, thorough testing is conducted to detect and rectify faults, as well as to verify that the Chatbot fulfills the set criteria.

Ultimately, the deployment signifies the initiation of the Chatbot's functionality in an actual setting. Nevertheless, the lifetime does not terminate at this point. Continuous monitoring and user feedback are essential for making ongoing adjustments and enhancements to ensure that the Chatbot remains current and effective in its role as a virtual assistant. The UNIFE Chatbot lifecycle is an iterative process that goes beyond the initial deployment, with a focus on continuous improvement and adaptation to the evolving needs of users and the academic environment.



Fig. 5: UNIFE ChatBot Life Cycle

The primary objective of the UNIFE Chatbot's development is to provide a uniform and effective user interface across online and mobile platforms. The snapshot of the UNIFE Self-Help Portal displays a well-crafted user interface that ensures an excellent user experience, regardless of the device being used. The Chatbot design has straightforward and appealing visual components, including a representative emblem that represents the fusion of human contact with technical efficiency. This design not only improves the accessibility and visibility of the Chatbot but also strengthens the visual identity of UNIFE. The Chatbot is equipped with advanced machine learning and natural language processing algorithms, which allow it to effectively comprehend and answer user requests. The Chatbot is powered by a comprehensive and often updated database, guaranteeing the provision of precise and pertinent responses. UNIFE's incorporation of the Chatbot into the online portal and mobile app demonstrates their commitment to technical innovation and their determination to always improve the student experience. The deliberate positioning of the Chatbot inside the UI guarantees that users can readily get support whenever necessary, showcasing the significance of accessibility and efficiency in student service.

UNIFE's Chatbot exemplifies the use of technology to enhance communication and information accessibility in the academic setting, serving as a vital resource for both students and teachers. The development of UNIFE incorporates a comprehensive strategy that considers both technological functionality and user experience, guaranteeing that UNIFE maintains a leading position in digital education. Here, we present the progress of UNIFE's Chatbot and its appearance on both online and mobile platforms:



Fig. 6: UNIFE Self-Help Portal

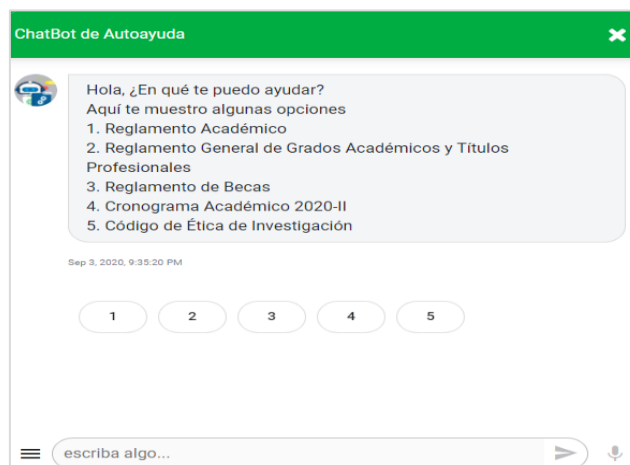


Fig. 7: UNIFE's self-help response chatbot

The technical integration design for digital transformation at UNIFE is presented as a comprehensive concept that aims to achieve the seamless convergence of many developing technologies. This paradigm prioritizes the development of a cohesive digital network that enhances effectiveness, availability, and ingenuity. The key infrastructure for all digital processes is Cloud Computing with Office 365. This cloud platform offers a robust framework for collaboration and data storage, along with the ability to remotely access instructional and administrative resources. Integrating Machine Learning into this cloud environment is essential for incorporating analytical intelligence and predictive capabilities into the system. UNIFE can automate processes and predict demands, as well as customize the educational experience using data patterns. QR codes and web/mobile interfaces serve as direct interfaces with users, enabling instant access to digital content. These interfaces are specifically intended to be user-friendly and accessible, guaranteeing that both students and staff can effortlessly connect with the system, without encountering any technical obstacles.

The figure shown depicts the interconnection of several technologies to create a unified framework. (a) Office 365 serves as the central component of the system, facilitating and linking all digital activities. (b) Machine Learning effortlessly integrates with Office 365, offering data analysis and forecasts that enhance decision-making and customization of services. (c) QR codes establish an immediate and smooth connection between the physical environment and digital services. (d) Web/mobile interfaces serve as the means through which users access the system's information and services. This comprehensive strategy not only enhances operational effectiveness but also enhances the user experience, bringing UNIFE in line with current digital education standards. The combination of these technologies generates a dynamic environment that is crucial for promoting innovation and maintaining the institution's leadership in digital educational transformation.

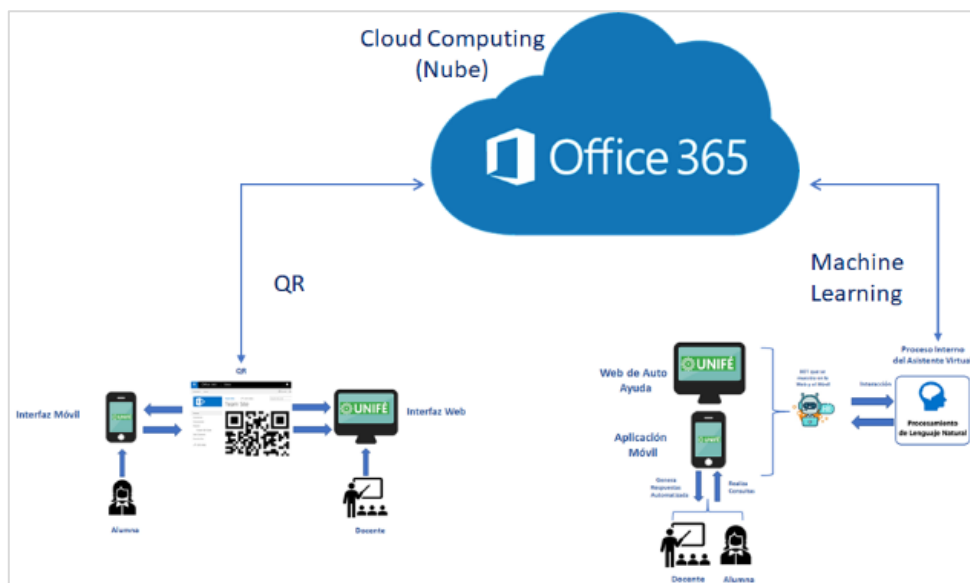


Fig. 8: Technology integration at UNIFE

The outdated and disconnected technology infrastructure of UNIFE's School of Business Administration has led to the development of the ESTDI model. This new approach serves as a comprehensive answer to the sluggishness of the current system, which is evident in its slow reaction to academic and administrative needs. The absence of a unified digital system and the continued use of outdated IT infrastructure have resulted in a fragmented set of procedures and a management approach that does not meet modern efficiency requirements. The ESTDI model, characterized by its sophisticated systemic structure, has the potential to create an efficient workflow by using automation technologies and in-depth data analytics. These instruments are created to break down current obstacles and stimulate a natural and flexible operation. The inadequate customization of the existing system, leading to a uniform and impersonalized educational experience, underscores the urgent need for an adaptable platform like ESTDI. This platform aims to fulfill individual requirements and is dedicated to providing customized academic and administrative assistance, using the revolutionary potential of new technologies like Big Data and Artificial Intelligence.

The adoption of ESTDI at UNIFE's School of Business Administration is more than just a technical enhancement. It is a deliberate and strategic change that aims to be at the forefront of digital innovation in the education sector. This effort aims to completely transform internal operations and significantly elevate the level of customer service, establishing the institution as a leader in digital educational innovation.

3. Methodology

The research conducted here is practical, with a specific emphasis on implementing a digital transformation paradigm at the Faculty of Business Administration at UNIFE. This strategy is implemented using two technical advancements: a Chatbot and a QR code prototype (Benites et al, 2021), both specifically developed to enhance the communication between instructors and students. The significance of this study is in its pragmatic utility, aiming for concrete outcomes and immediate enhancements in the educational encounter (Cvetkovic et al, 2021). The chosen methodological design is descriptive, correlational, and cross-sectional. The methodology of this study is descriptive, providing a detailed overview of how digital technologies are now being used to enhance academic services (Ochoa & Yunkor, 2019). Furthermore, this study is correlational since it examines the connection between the use of digital technology and the level of customer service, specifically within the university community.

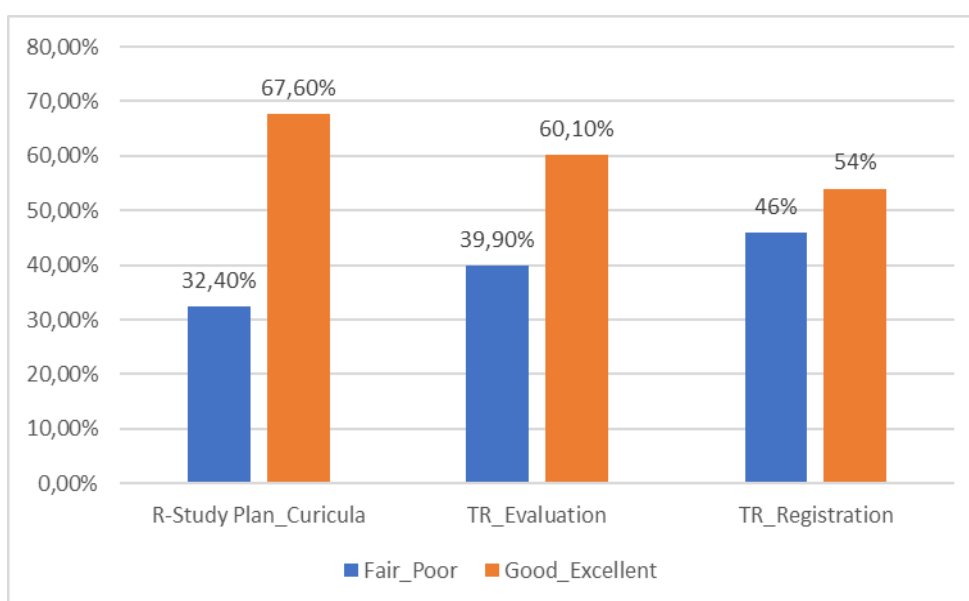
The study's cross-sectional design allows for the collection of data at a given moment, which adequately fulfills the stated goals, eliminating the need for longitudinal follow-up (Ochoa & Yunkor, 2019).

The study of the variables employs a quantitative technique, enabling the gathering of numerical data and its subsequent classification based on the variable of interest: the enhancement of customer service (Jimenez, 2020). The use of a quantitative method is crucial for providing an accurate depiction of the prevailing attributes and assessing the influence of the installed digital technologies (Jimenez, 2020). The study primarily focuses on the correlation between digital transformation and service improvement. It aims to provide a comprehensive understanding of how the integration of technological solutions can enhance the quality of care and academic management (Jimenez, 2020). Therefore, it is important to examine the methodological background in detail. This entails a comprehensive examination of the precise ways in which the Chatbot and the QR code digital tools help to enhance academic and administrative operations. An analysis should be conducted to evaluate the interaction between these technologies and end users, specifically focusing on usability, accessibility, and efficiency. Furthermore, it is crucial to take into account the institutional framework in which these technologies are deployed, including the current infrastructure, the organizational culture, and the stakeholders' readiness to embrace change.

Lastly, it should discuss how the management and execution of digital transformation, facilitated by these technologies, helps accomplish the faculty's strategic goals. This encompasses an analysis of the difficulties and possibilities that emerge throughout the process of converting information into a digital format, along with the tactics used to surmount the barriers and optimize the advantages of the digital revolution at the university level.

4. Results

This part presents the results and insights derived from the study, offering a comprehensive and unbiased perspective on the gathered data. The data shown here are the outcome of the thorough analysis conducted to answer the concerns asked in the research. By meticulously analyzing the data and using appropriate procedures, substantial findings have been derived that enhance the current understanding of the subject of research. This study provides a thorough examination of the links, patterns, and trends discovered, which leads to a more profound comprehension of the events studied and their consequences.

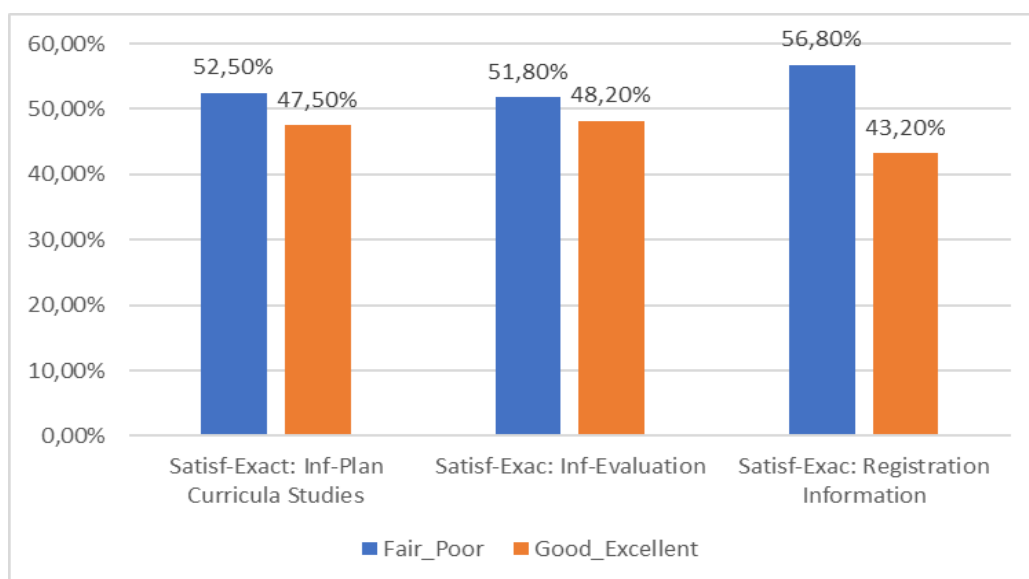


Graph 1. Student Customer Service Indicators: Response Time

Graph 1 presents a quantitative summary of the feedback received from students at the School of Business Administration. It illustrates their perspectives on three key aspects: the curriculum, the assessment methods, and the enrolling procedure. The range of replies indicates a varied assessment of these elements, prompting a more profound contemplation of the pedagogical and administrative dynamics of the institution. The divergence of viewpoints about the curriculum, with 32.4% seeing it as mediocre or unsatisfactory compared to 67.6% perceiving it as commendable or outstanding, highlights the diverse nature of the educational experience, which warrants further examination. This discrepancy may stem from a range of variables, including the pertinence and currency of the information as well as the instructional approach.

The assessment demonstrates a more equitable allocation, with 39.9% of the feedback falling within the fair or bad category, and 60.1% falling within the good or exceptional category. The presence of this equilibrium might be seen as an indication that the assessment techniques, although not immune to critique, enjoy a certain level of acceptability that implies a strong foundation for future enhancements. However, the enrollment process shows an almost equal division in student perspective, with 54% expressing good replies and 46% expressing negative reactions. This outcome emphasizes the need to evaluate and enhancing administrative protocols to get higher levels of student contentment.

Hence, it is important to examine the interplay between these factors and their impact on the whole student experience. Furthermore, it is important to consider the wider scope of digital transformation in higher education. This involves evaluating how tools like Chatbots and QR codes can act as catalysts to enhance these processes. For instance, Figure 1 offers empirical evidence to support a more thorough investigation into identifying opportunities for improvement and implementing strategic interventions that enhance the quality and effectiveness of education provided by the School of Business Administration. This comprehensive and specialized analysis serves as a foundation for knowledgeable administration and decision-making based on empirical data, which ultimately benefits the whole educational community.



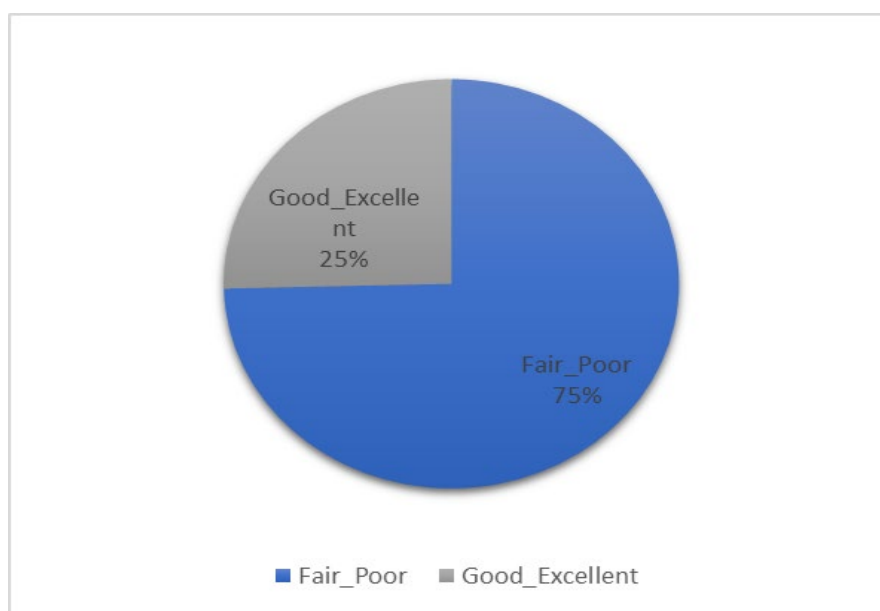
Graph 2. Student customer service indicators: Satisfaction with accuracy of information

Graph 2 presents a crucial viewpoint on student contentment about the precision of the information given by the educational institution. It focuses on three primary areas: enrollment, assessment, and curriculum. The study of this data should go beyond simple graphical displays and instead focus on a thorough examination that takes into account the implications and root reasons for the reported discontent. Regarding enrollment, 56.5% of students have an unfavorable perception, evaluating the veracity of information as either poor or fair. The data is concerning and indicates the presence of information gaps or shortcomings in the communication procedures that may be impacting students' decision-making and academic preparation.

The assessment indicates a similar pattern, with 51.8% of replies indicating discontent. This may indicate a deficiency in the clarity of the assessment criteria, discrepancies in the feedback provided, or a potential misalignment between the educational goals and the evaluation techniques used. Concerning the curriculum, 52.5% of the replies also indicate a poor evaluation. This outcome suggests that students perceive shortcomings in the pertinence, currency, or practicality of the curriculum, which might directly affect their professional readiness and acquisition of skills.

To engage in high-level academic interpretation, one must not only identify areas of concern but also develop an analytical framework that will allow the educational institution to effectively approach and resolve these difficulties. To discover the underlying reasons for student unhappiness, a comprehensive assessment of information and communication systems, as well as administrative and pedagogical procedures, has to be carried out. Furthermore, it is important to take into account the significance of digital transformation in this particular situation. Chatbots and QR codes can greatly enhance the precision and availability of information. Nevertheless, the execution of their application must be deliberate and focused on the demands of users, guaranteeing that the distinct requirements of learners are met and their entire educational experience is improved.

Graph 2 highlights the need for a comprehensive evaluation and ongoing enhancement of the information and educational services provided, urging immediate action. A comprehensive and specialized analysis of these findings may support the formulation of approaches focused on achieving high academic standards and enhancing student contentment.

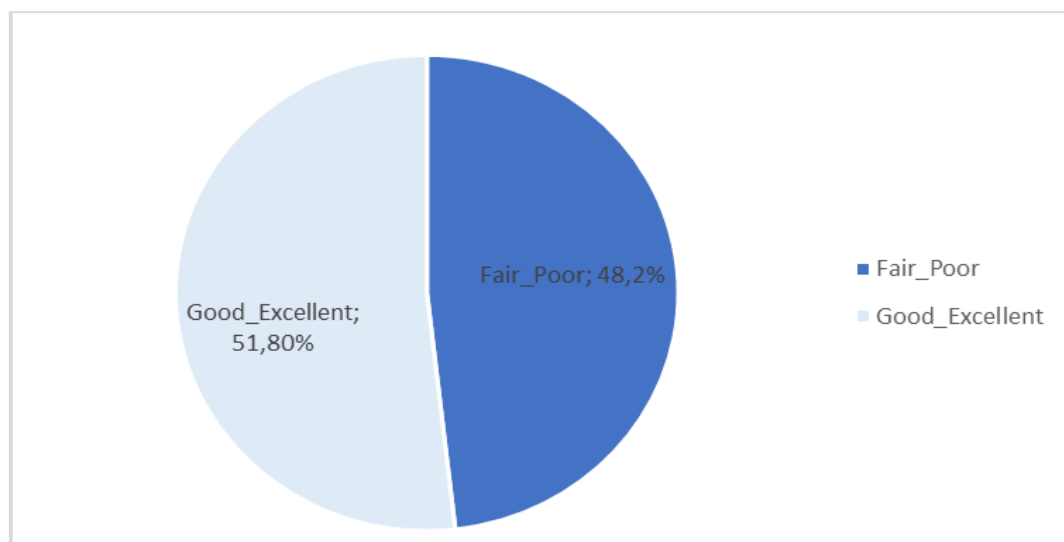


Graph 3. Student Customer Service Indicators: Quality of Information

Graph 3, labeled "Indicators of Student Customer Service: Quality of Information", provides a thorough assessment of how students perceive the quality of information they get. A staggering 74.7% of students regard its quality as subpar or mediocre, indicating a substantial problem that requires prompt and rigorous treatment from the educational institution. From a scholarly standpoint, this outcome indicates a potential discrepancy between student expectations and the actual material presented. It also highlights the need for a comprehensive evaluation of the university's communication and knowledge management procedures. The disparity in the perception of information quality may have significant ramifications on students' educational experience, impacting their academic achievement and their general contentment with the school.

It is crucial that the study of this data goes beyond identifying a problem and digs into the examination of the root reasons. Is this impression a result of insufficiently updated content? Are there any issues or difficulties in the process of transmitting information? Alternatively, may it be attributed to an insufficient technical framework that hinders prompt and precise retrieval of the required information? The significant level of discontent also prompts inquiries on the efficacy of newly deployed digital technologies, such as the Chatbot and QR code system. Although these technologies have the potential to enhance the accessibility and precision of information, it is crucial to conduct a thorough evaluation of their actual impact to verify that they are effectively achieving their intended purpose and satisfying the requirements of end users.

To summarize, Graph 3 plays a crucial role in guiding strategic decision-making for enhancing the quality of information via continual improvement. An in-depth and specialized analysis of these findings is crucial to formulate a strategic strategy to tackle the identified shortcomings and enhance the educational experience of students. The institution must fully embrace a digital transformation that encompasses the integration of new technology, while also guaranteeing that information remains relevant, easily available, and trustworthy for all members of the university community.



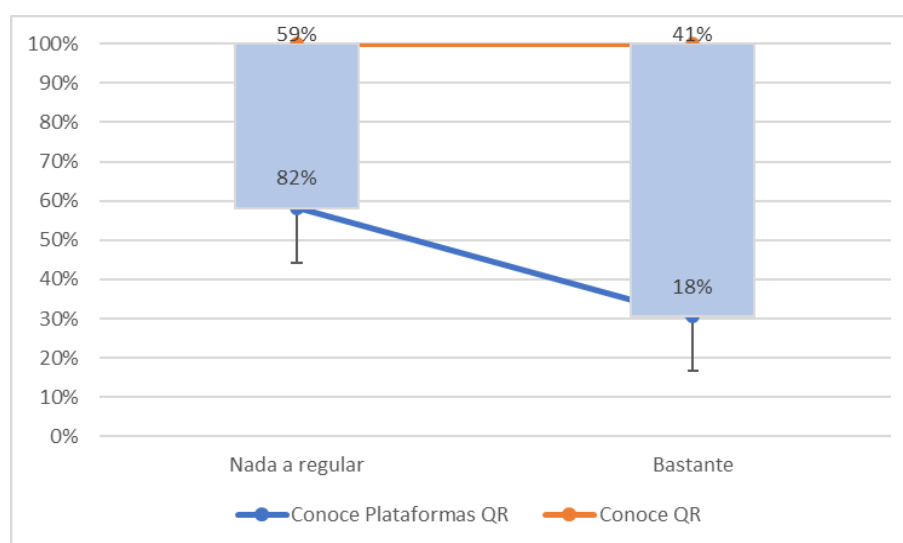
Graph 4. Student Customer Service Indicators: Knowledge and Usability of QR Codes

Graphic 4 offers a comprehensive understanding of students' proficiency in using QR codes, a crucial element in the process of digitizing education. A significant proportion of students, around 51.8%, have evaluated their knowledge and proficiency in using QR codes as good or outstanding. This indicates a rather effective integration of this technology. Nevertheless, a substantial 48.2% of individuals

consider their competency in digital literacy to be mediocre or inadequate, indicating a clear need for improvement in this area. From a scholarly standpoint, these findings indicate that while there is a strong foundation of skilled users, there is still enough opportunity to enhance the educational experience by further incorporating digital technologies. Introducing a Chatbot and increasing the use of QR codes might be strategic measures to enhance the quality of information and overall happiness of students.

The analysis of this data must prioritize the examination of how these technologies might revolutionize students' engagement with academic services. The level of usability and familiarity with QR codes might serve as an indication of students' readiness to embrace digital solutions that enhance information access and communication. Hence, it is imperative to invest in education and training in these technologies to guarantee that all students can effectively capitalize on the possibilities presented by digitalization. Graphic 4 highlights the significance of inclusive digital education and the need for policies that encourage universal technical proficiency. An in-depth and precise analysis of these findings may act as a spark for a wider educational effort to equip pupils for an ever more digitalized environment.

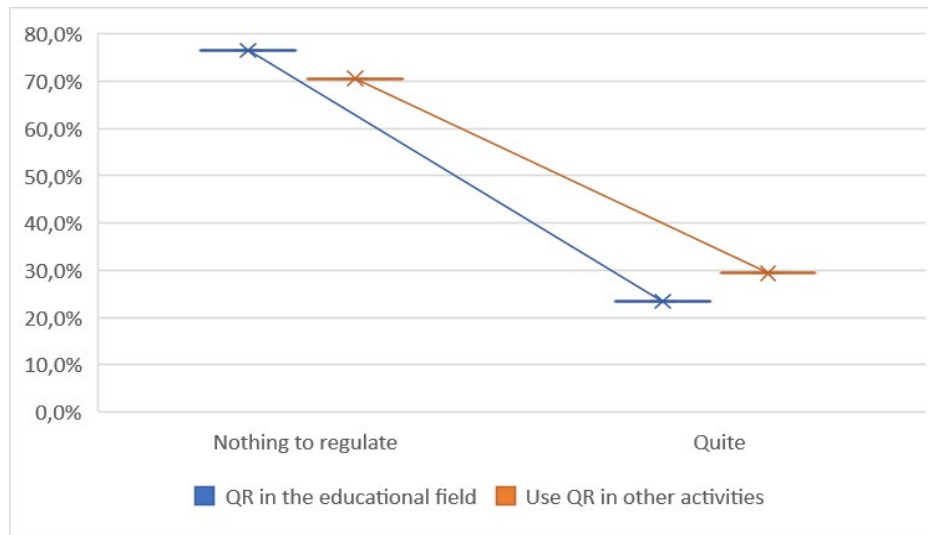
Results Related to Teachers. A detailed analysis was carried out during the implementation of this framework, the results of which are presented here. This part also investigates the direct and indirect consequences that this framework had on teacher experience and satisfaction. The results provided here offer a comprehensive explanation of how the inclusion of digital components impacted the effectiveness of communication, the quality of service provided to educators, and the efficiency of communication. In addition, the findings also highlight areas for improvement and opportunities to further strengthen the relationship between faculty and their academic body.



Graph 5. QR code awareness: Knowledge of QR and QR code generation platforms.

The research in Graph 5 shows a clear lack of competency on the part of instructors when it comes to creating, comprehending, and using QR codes, as well as managing digital platforms meant for this purpose. Just 41% of the respondents showed a significant understanding of using QR codes, which was categorized as "quite a lot". Given the growing significance of these codes in contemporary pedagogy and the interplay between educational technology, this figure is concerning. However, becoming acquainted with QR code generation systems is considerably more challenging. Merely 18% of educators state that they know a "fair amount" about this subject; this means that 82% of them have little to no comprehension. These findings emphasize how vital it is to provide continuing training initiatives that address knowledge gaps and promote the use of these digital tools in the classroom.

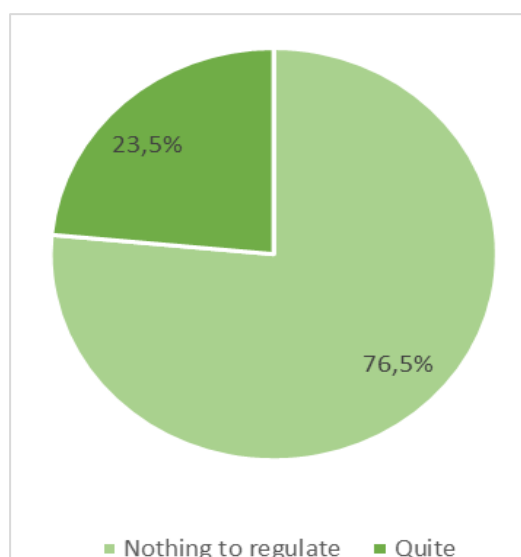
When combined, these results show that instructors' digital literacy regarding QR codes is very lacking. This might make it more difficult to use cutting-edge teaching methods and optimize the learning process in contemporary educational environments. To get over these restrictions and realize the full potential of digital tools in education, spending money on technology and training is required.



Graph 6. Usability of the QR Code in education and other activities

An overview of how teaching staff members utilize and comprehend QR codes in both general activities and within a particular educational setting is shown in Figure 6. It reveals that just 29.4% of educators regularly utilize QR codes in their lessons, compared to 70.6% who do so sometimes. This use pattern points to a cursory embrace of the technology rather than a thorough incorporation into instructional practice. Moreover, much less is known about how QR codes may be used in teaching. Merely 23.5% of those surveyed said they are acquainted with its usage in this industry, however, 76.5% don't know about its possible use. These findings show that there is a great deal of room for educators to grow in their digital competency, which is necessary for innovation and ongoing process improvement in teaching and learning.

The analysis of these findings ought to prompt a critical examination of teacher preparation programs and emphasize the importance of establishing a culture of technology adoption that goes beyond a cursory familiarity with new tools to encourage their thoughtful and strategic use in the classroom. By doing this, QR codes' educational value may be increased and they become catalysts for engaging and dynamic learning environments.



Graph 7. Would you recommend the use of QR to other colleagues?

A clear picture of educators' inclination to support QR code use in their professional networks may be seen in Graph 7. Only a meek 35% are likely to suggest this technology, which may be seen as a cautious recommendation, maybe indicating an understanding of its usefulness despite some misgivings or a lack of thorough knowledge of its possibilities. However, a sizable majority of 65% decline to make such suggestions, indicating a prevailing level of skepticism or a belief that QR codes are not sufficiently valuable for professional or educational reasons. This resistance might be caused by several things, such as a lack of technology expertise, a poor comprehension of the educational uses of QR codes, or perhaps an underestimation of their ability to provide more engaging and effective learning environments. The disparity in answers highlights the need for more research to identify the root reasons for this resistance and how these attitudes may be changed to encourage a wider and more successful use of QR codes in the classroom.

In conclusion, Graph 7 illustrates a gap in educators' readiness to embrace new technologies while also emphasizing a chance to raise teachers' technological proficiency and digital literacy, both of which are critical for the advancement of modern pedagogy and the enhancement of the learning process.

5. Conclusions

The ESTDI model represents a promising framework for digital transformation in higher education, integrating emerging technologies such as QR codes, cloud computing, and chatbots to enhance customer service and organizational agility. The application of the model to the Faculty of Business Management at UNIFE demonstrated improvements in student satisfaction with response time, information accuracy, and service quality, highlighting the potential benefits of digital transformation for student engagement and experience. However, the study also revealed challenges in the adoption and use of digital tools by teachers, underscoring the need for targeted training and support to ensure the success and sustainability of digital transformation initiatives. The findings suggest that the effective implementation of the ESTDI model requires not only technological readiness but also cultural and pedagogical change, involving the active participation and buy-in of faculty and staff. The limitations of the study, including the small sample size, single institution context, and reliance on self-report measures, should be addressed in future research to validate and extend the generalizability of the ESTDI model. Longitudinal and comparative studies could examine the impact of the model on learning outcomes, organizational performance, and stakeholder satisfaction over time and across different institutional settings.

Despite these limitations, the study makes a valuable contribution to the growing literature on digital transformation in higher education, offering a conceptual framework and empirical evidence for the use of emerging technologies to drive innovation and improvement in university operations and services. The ESTDI model provides a roadmap for universities to strategically align their digital transformation efforts with their mission and goals, and to continuously adapt and evolve in response to the changing needs and expectations of students, faculty, and society. In conclusion, the ESTDI model represents a timely and relevant approach to digital transformation in higher education, with implications for theory, practice, and policy. Universities should consider adapting and implementing the model to their specific contexts and needs, while also investing in the necessary infrastructure, resources, and competencies to support the effective use of digital technologies. Researchers should continue to refine and test the model, exploring its boundary conditions, mechanisms of action, and long-term outcomes, to advance knowledge on digital transformation and its impact on higher education quality, equity, and sustainability.

6. Recommendations

A comprehensive professional development program is suggested to enhance the digital competence of instructors at the School of Business Administration. This program will consist of a series of specialized seminars and training sessions. The training will concentrate on achieving proficient use of QR tools and mastering the sophisticated administration of Chatbots. The objective is to provide teaching staff with the practical skills and technical knowledge necessary to incorporate these technologies into the administration of educational resources and the enhancement of their teaching approaches. Furthermore, it is advised to adopt the pilot version of the scalable digital transformation model (ESTDI) inside the faculty. This model seeks to illustrate how the deliberate integration of digital technology might enhance the efficiency of the academic teaching-learning process. By using QR codes and Chatbots, the goal is to enhance the caliber and availability of information, while also promoting a smoother and tailored engagement with the student population.

Implementing this adaptable framework would not only make it easier to shift to more creative instructional methods but will also provide a model for the digital revolution in academia. The adoption of ESTDI is anticipated to act as a catalyst for ongoing enhancement and exceptionalism in education, equipping students to successfully navigate and prosper in an increasingly linked and technologically sophisticated society. Finally, it is recommended that this manuscript be accepted with minor revisions. Addressing the areas of improvement highlighted above, particularly in terms of broadening the literature review and improving the methodological details of the proposed model, will strengthen the article's contribution to the fields of educational technology and higher education management.

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