Development of a postgraduate-management website in a higher-education institution to enhance user experience

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Juan Carlos Guzman-Pito
Graduated in Computer Systems Engineering
Institution: University of Guanajuato - Campus Irapuato-Salamanca
Address: 5 de mayo 18, Zona Centro, 38954 Yuriria, Gto., México
E-mail: jc.guzmanpito@ugto.mx

Geovanni Hernandez-Gomez
PhD in Optics
Institution: University of Guanajuato - Campus Irapuato-Salamanca
Address: 5 de mayo 18, Zona Centro, 38954 Yuriria, Gto., México
E-mail: geov.hernandez@ugto.mx

Eduardo Cabal-Yepez
PhD in Electrical Engineering
Institution: University of Guanajuato - Campus Irapuato-Salamanca
Address: 5 de mayo 18, Zona Centro, 38954 Yuriria, Gto., México
E-mail: educabal@ugto.mx

Luis Manuel Ledesma-Carrillo
PhD in Electrical Engineering
Institution: University of Guanajuato - Campus Irapuato-Salamanca
Address: 5 de mayo 18, Zona Centro, 38954 Yuriria, Gto., México
E-mail: lm.ledesma@ugto.mx

ABSTRACT
The University of Guanajuato keeps a website for postgraduate course administration. However, because the website was created in 2010, it currently has a number of issues that limit the user experience. Among the website's most serious drawbacks, they point out that the website is not responsive, which means that visitors cannot navigate using mobile devices. Furthermore, the administrators believe that the website's design is unattractive and are taking steps to improve its appearance. The goal of this project is to create a website for the University of Guanajuato's postgraduate management that is based on the digital quality evaluation model "e-GovQual," specifically in two dimensions: efficiency and reliability, with the goal of improving the site's usability and, as a result, its performance.

Keywords: website, user experience, higher education, usability, e-service quality.
1 INTRODUCTION

The research community recognizes the problem that educational institutions face in providing students with smooth and user-friendly digital experiences. As a result, higher-education institutions, such as the University of Guanajuato, are continuously improving its postgraduate-course management webpage, seeking to exploit the advantages from new web-design technologies. Hence, this project focuses on developing an efficient and reliable website for meeting specific requirements for postgraduate-program coordinators and students.

A well-designed website not only reflects the institution’s integrity and professionalism, but it also helps to improve the user experience (UX). To accomplish this goal, it is necessary to consider the models that evaluate the quality of digital services, such as e-GovQual (Durachman et al., 2020), e-SERVQUAL (Muhammad et al., 2016), WebQual (Loiacono et al., 2007), and others that have been well documented in the literature.

Taking the above-mentioned models into account makes it easier to create high-quality websites. In today mobile-driven world, it is critical to create flexible websites that provide a pleasant experience to the growing number of users accessing web content via mobile devices. Therefore, responsive design ensures a consistent user experience across multiple screen sizes and devices, addressing diverse user demands and preferences on websites. In this regard, higher-education institutions might increase their website usability, and overall user experience, by prioritizing high-quality webpage designs through the use of responsive creation concepts, generating a strong digital presence and fostering meaningful connections with their target audience.

2 BACKGROUND

CONHACYT (Consejo Nacional de Humanidades, Ciencias y Tecnologías) is a mexican government institution responsible for promoting and sponsoring scientific research, technological innovation, and human-resources development. It strives to expand scientific knowledge and fosters innovation-driven growth in Mexico by financing research initiatives, offering scholarships for postgraduate education, and fomenting international collaborations.

The SNP (Sistema Nacional de Posgrados) by CONHACYT aims to ensure that all students admitted to a Specialty, Master’s, or Doctorate degree, who do not have institutional support, have the same opportunities of receiving a scholarship by applying directly to the SNP-scholarship platform, looking for simplifying administrative processes under the principle of “leaving no one behind, leaving no one out.”

On the other hand, the University of Guanajuato (UG) is a renowned higher-education institution in Mexico, acknowledged for its high academic level and research capability. It offers a diverse range of
undergraduate and postgraduate degrees in natural and social sciences, humanities, engineering, and health care. Currently, the UG offers more than 100 postgraduate programs, from which, 61 are part of the CONHACYT SNP.

The DAIP (Dirección de Apoyo a la Investigación y al Posgrado) is the institutional office for supporting research and postgraduate studies at the UG. This office is in charge of the communication between the UG and CONHACYT, through the DGP (Departamento de Gestión de Posgrados), a postgraduate management department.

For a postgraduate program to be recognized into the CONHACYT SNP, the web page of the postulant institution must guarantee showing some essential information as:

- The courses used for accrediting the postgraduate program.
- The postgraduate program duration in months.
- The frequency of new postgraduate students’ enrollment.
- The area, field, and discipline in which the program is classified.
- The faculty that supports the program.
- All information regarding the program tuition fees.

As a result, the UG Postgraduate Management Department recognizes the significance of having a functional website that efficiently manages information regarding the UG postgraduate programs, since it is essential for monitoring the program status and determining its qualification to be registered in the CONAHCYT SNP.

However, the current website utilized by the DGP suffers from notable flaws that limit its effectiveness, for instance:

- Lack of Responsiveness: The current website lacks from a responsive design, making it incompatible and unusable on mobile and tablet devices. This limitation prevents prospective students and users from accessing important information conveniently, hindering their browsing experience and limiting engagement with the postgraduate programs.
- Deprecated System Functions: Critical system functions have been compromised due to the deprecation of certain ASP (Active Server Pages) language features. As a result, the website fails to deliver key functionalities, affecting the accuracy and efficiency of program administration and hindering seamless user interactions.
- Unattractive Aesthetic Design: Users of the website have reported that the current aesthetic design is unappealing. The visual presentation and overall layout fail to create an engaging and user-friendly experience. This can negatively impact the perception of postgraduate programs and deter potential applicants from exploring further.
Manual User Registration: The process of user registration on the platform is manual and lacks from a dedicated form. This outdated method consumes excessive time and increases the likelihood of errors, affecting both, administrators and prospective students. A more streamlined and automated registration system would significantly enhance efficiency and accuracy.

Addressing these flaws on its current website is of utmost importance for the UG Postgraduate Management Department. Therefore, the department will be notably benefited by implementing a responsive web design, resolving deprecated system functions, improving the aesthetic appeal, and introducing an automated user registration process; in this way enhancing users experience, optimizing program administration, and attracting a larger pool of potential candidates for postgraduate studies.

3 LITERATURE REVIEW

3.1 RELEVANCE OF DIGITAL SERVICES IN HIGHER EDUCATION INSTITUTIONS

The significance of high-quality digital services cannot be emphasized, particularly in the context of higher-level educational institutions. According to (Ali, 2018) the quality of digital services is considered a crucial success element in higher-level educational institutions efforts to separate themselves from competitors. The quality of institutional digital services can permit students to utilize courses materials at any moment and from any place, fostering flexibility and self-paced learning. Furthermore, these services can help students and instructors interact and communicate effectively, resulting in a more dynamic and interesting learning environment. As a result, higher education institutions must invest in and emphasize high-quality digital services to attain a considerable competitive edge.

It is true that e-service quality has become a critical concern to please students, who are the primary stakeholders. According to recent research, there is a considerable positive association between perceived e-learning service quality aspects and e-learning student satisfaction (Dangaiso et al., 2022). It has also been discovered that measures of service quality have enough explanatory power and may thus be used to compute e-learner satisfaction successfully (Sumi et al., 2021). Because of the widespread use of the internet in education; monitoring e-service quality is critical (Ali, 2018).

3.2 INTERNET USAGE TO CONSUME DIGITAL GOVERNMENT SERVICES IN THE EUROPEAN UNION (EU)

As reported by (Sá et al., 2016) 46% of EU citizens make use of the Internet to seek employment, use the public library, submit tax declarations, register births, apply for a passport, or use other public government services. According to statistics (see Figure 1), 80% of citizens believe that government digital services save them time, 76% recognize their flexibility, and 62% claim that save them money. As a result, it is critical to develop and research models and concepts for measuring the quality of online e-
Government services in the context of local municipalities, in order to improve both the services and the degree of satisfaction among users.

Figure 1. Opinions of EU citizens on the use of digital services.

Source: Sá et al., 2016

3.3 THE USE OF THE INTERNET IN MÉXICO

According to the findings of the ENDUTIH (Encuesta Nacional sobre Disponibilidad y Uso de Tecnologías de la Información en los Hogares), a national survey on the availability and use of Information Technologies in Mexican homes (INEGI, ENDUTIH, 2020), the percentage of Internet users (considering the population six years of age or older) in Mexico is 72% (see Figure 2).

Figure 2. Internet users in Mexico.

Source: INEGI, ENDUTIH, 2020
When browsing the Internet, 38% of the Internet users mentioned in the previous paragraph utilize a computer. On the other hand, 76% of Internet users make use of a mobile device, while just 33% have made online transactions through a government digital platform (see Figure 3).

Figure 3. National Survey on Availability and Use of Information Technologies in Mexican Homes.

3.4 THE USE OF GOVERNMENT DIGITAL SERVICES IN GUANAJUATO, MEXICO

Based on the results of the ENCIG (Encuesta Nacional de Calidad e Impacto Gubernamental), a national survey of government quality and impact (INEGI, ENCIG, 2019), 29% of the population aged 18 and over (1,846,759 people) in Guanajuato have had at least one interaction with the government through electronic means, while 15% of these users have consulted government websites (at the federal, state, or municipal level), and 14% have filled up and submitted an online form to begin, continue, or complete a procedure, and 10% have paid for a service on government websites, as can be seen in Figure 4.

The low adoption rate of government platforms for online transactions can be linked to the state's municipalities' limited availability of such infrastructure. This absence of infrastructure makes it difficult for citizens to make electronic payments for services they use, hence removing the need for physical visits to the relevant offices is not an option at this moment.
3.5 FRAMEWORKS FOR EVALUATING THE QUALITY OF DIGITAL SERVICES

In the literature, there are various e-services evaluation frameworks that give organized techniques to assessing the quality and efficacy of electronic services.

3.5.1 The e-SERVQUAL model

The e-SERVQUAL is a model for measuring and evaluating the quality of electronic services supplied by companies. It aids in determining the gap between what consumers want and their actual experiences with e-services (Muhammad et al., 2016). This framework provides five dimensions to evaluate the overall quality of e-services (Monteiro et al., 2021):

- **Tangibility**: This dimension refers to the visible aspects of an e-service, including the design of the website and the ease of navigation. It evaluates how attractive and professional the online platform appears and feels.
- **Reliability**: It evaluates factors such as whether the website is always available and accessible, if products are delivered on time, and whether the information offered is credible and up to date.
- **Responsiveness**: It measures how quickly an online store reacts to client requests, complaints, or issues. It considers elements such as the speed and efficacy of customer service, the availability of assistance, and the level of attention to client needs.
• **Assurance:** This dimension ensures that customers feel safe and confident when they use an e-service. It analyzes elements such as the protection of personal information, the transparency of guidelines and agreements, and the online store's authenticity.

• **Empathy:** It determines whether the web-based shop is aware of the specific needs of its clients and provides guidance in order to meet those demands. Personalized advice, customized offers, and a customer-centric approach that makes clients feel heard and appreciated.

The e-SERVQUAL framework helps companies determine how effectively their e-services satisfy consumer expectations and discover opportunities for development by examining the five characteristics mentioned above. It seeks to improve the entire customer experience by providing high-quality e-services that are tailored to the needs and desires of the clients (Raza et al., 2020).

### 3.5.2 The e-GovQual framework

The e-GovQual framework is a method for assessing and measuring the quality of digital government services supplied to citizens (Durachman et al., 2020). Its primary goal is to evaluate the performance and efficiency of online government platforms and services. The framework considers multiple crucial parameters, such as website design, usability, confidence, responsiveness, and security. Governments can use the e-GovQual framework to better understand how effectively their online services fulfill the needs and demands of their citizens and make improvements based on the feedback received. The e-GovQual framework began with six dimensions and 47 traits, but was later reduced to four dimensions and 21 high-weighted features as the final e-GovQual dimension scale (Durachman et al., 2020), as listed below:

• **Efficiency:** It evaluates the system's ability to deliver services fast and accurately. This dimension considers elements such as response time, processing speed, and usability.

• **Trust:** It assesses elements such as security, privacy, and data integrity. Citizens must have trust in order to feel safe sharing personal information and making transactions online. A reliable e-government system protects sensitive information and provides a safe environment for users.

• **Reliability:** It evaluates the system's capacity to offer accurate and consistent information, complete transactions without mistakes, and keep services available.

• **Citizen Support:** It focuses on the amount of help and guidance provided to users when they use online government services. It includes features like customer service, and user-friendly interfaces.

The e-GovQual framework seeks to evaluate and improve the quality of e-government services, hence improving the overall citizen experience, by considering the four essential factors described above: efficiency, trust, reliability, and citizen support.
3.5.3 The WebQual instrument

The WebQual tool aims to collect customer feedback of website quality across twelve dimensions (Loiacono et al., 2007), which are given below:

- **Informational Fit-to-Task**: Determines how well the information supplied on the website satisfies the specific needs of users in order for them to complete their tasks efficiently.
- **Tailored Information**: Highlights the website's ability to adapt information depending on specific user choices.
- **Trust**: Assess what users think of the website's information, security, and privacy policies.
- **Response Time**: Evaluates how quickly a website provides feedback or completes transactions.
- **Ease of Understanding**: Evaluates the clarity and simplicity of the website's information, making it simple for users to understand and explore.
- **Intuitive Operations**: Analyzes the usability and simplicity of the website's interface and functionality in order to reduce the learning curve for users.
- **Visual Appeal**: Emphasizes the website's aesthetic design and visual beauty in order to increase user engagement and satisfaction.
- **Innovativeness**: Measures the level to which the website includes fresh or innovative elements that improve the user experience.
- **Emotional Appeal**: Looks at the website's ability to generate positive feelings or develop an emotional connection with users.
- **Consistent Image**: Tests the coherence and consistency between the website's content and design aspects with the organizational image.
- **On-line Completeness**: Evaluates the amount of detail and sufficiency of the website's information and services.
- **Relative Advantage**: Emphasizes the website's perceived superiority over other options available to users.

The WebQual instrument's dimensions provide a complete framework for analyzing and rating the quality of websites from the point of view of users. This instrument can be used by researchers and organizations to evaluate and enhance the user experience and satisfaction in their websites.
3.5.4 The state portal benchmark model

The evaluation of digital services offered by government websites has been used to benchmark digital government progress and its influence on society (Puron-Cid et al., 2022). Following a review of some of the main approaches to evaluating government websites, including purely technical approaches as well as some of the more holistic evaluation systems known to be used in the United States and the European Union, the authors performed a Principal Components Analysis (PCA) on data obtained from a ranking of Mexican state government websites, with the purpose of testing the dimensions of the evolutionary model proposed in the ranking.

Based on the work of (Puron-Cid et al., 2022), the authors suggest a model with five components for determining the quality of Mexican government websites, as shown in the table below (see Table 1).

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>It examines the information made available to citizens through the website (such as event news or announcements, statistical information about government agencies, and so on).</td>
</tr>
<tr>
<td>Interaction</td>
<td>It comprises apps that enable citizen-government contact, such as forms for asking questions and sending requests, forums, or automated applications like virtual public workers.</td>
</tr>
<tr>
<td>Transaction</td>
<td>The provision of services with well-defined cycles and processes, which include the payment of fees (for example, the ability to pay taxes such as property taxes, tourism taxes, and so on).</td>
</tr>
<tr>
<td>Integration</td>
<td>It refers to a website's ability to present itself as a single point of contact for citizens, regardless of which agency or agencies are in charge of delivering certain services or information. At this point, communication occurs not just between the government and citizens, but also between government agencies.</td>
</tr>
<tr>
<td>Participation</td>
<td>This dimension permits citizens to submit feedback, communicate with the authorities, and connect with other citizens. For example, blogs, forums, online surveys, electronic voting, and the use of online social media networks.</td>
</tr>
</tbody>
</table>

Source: Puron-Cid et al., 2022

The results confirm most of the original dimensions of the assessed instrument but allow for a reduction in the number of questions and more solid estimations. Furthermore, the new reduced instrument was verified using data from 2016 and 2017.

4 METHODOLOGY

The methodology of this project is centered on the creation of a website to suit the requirements of the UG's Postgraduate Management Department, with a particular emphasis on improving the User Experience (UX) for program course coordinators. We intend to use responsive design to ensure that the website provides a positive viewing experience across many devices, allowing coordinators smooth access and interaction.

The process includes stages such as requirements gathering, identifying issues with the present website, assessment of the current website's mobile performance, use the agile SCRUM technique to website development, and performance testing to determine if the new website has been improved.
This approach seeks to produce a user-centric website that assists program coordinators with administrative duties, improving efficiency and effectiveness in postgraduate program management.

4.1 REQUIREMENTS GATHERING

This project's requirements were collected through virtual meetings utilizing Microsoft Teams, allowing for efficient and collaborative contact with stakeholders. Program course coordinators as well as the employees of the Postgraduate Management Department actively participated in discussions during these online meetings, sharing their ideas, issues, and desired website functionalities.

We also used the User Stories technique, which is effective for eliciting and documenting user demands. User Stories are a tool for highlighting needs or features of a software program from the end user's point of view. They are brief, straightforward, and clear explanations of single features or tasks that users wish to complete (Pilone, 2008). User stories tend to be articulated in a short sentence (Patton, 2014), for example: "As a [persona], I [want to], [so that]."

We obtained an in-depth understanding of the coordinators' needs and expectations by using this technique, guaranteeing that their ideas remained at the forefront of the website's development. The user stories considered relevant for the creation of the new website are listed in the table below (see Table 2):

<table>
<thead>
<tr>
<th>User Story ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>US-01</td>
<td>As a postgraduate course coordinator, I want the website to be responsive across several devices (including PCs, laptops, tablets, and smartphones) so that I can easily access and manage course-related information on the go and from any location.</td>
</tr>
<tr>
<td>US-02</td>
<td>As an administrator, I want to have a visually appealing and modern design for the website, so that it reflects the professionalism and high-quality standards of our postgraduate programs.</td>
</tr>
<tr>
<td>US-03</td>
<td>As a postgraduate course coordinator, I want to be able to publish and update course information such as the course syllabus, enrollment dates, and contact information, so that students have easy access to them and keep informed on graduate course content.</td>
</tr>
<tr>
<td>US-04</td>
<td>As a postgraduate course coordinator, I want to have access to a well-organized and user-friendly dashboard, so that I can easily view the content of my graduate program and quickly manage that information.</td>
</tr>
</tbody>
</table>

Source: From the author.

4.2 CHOOSING THE DIMENSIONS OF THE E-GOVQUAL MODEL ON WHICH TO BUILD THE WEBSITE

To address the project's research question:

RQ-01: What are the most convenient dimensions for developing the new digital platform for postgraduate course management at the University of Guanajuato and ensuring its quality?

It was agreed to pick two of the five dimensions suggested by the e-GovQual model (Durachman et al., 2020) to base the development on:
• **Efficiency dimension:** A website that is easy to use, visually attractive, and provides a smooth user experience increases user’s satisfaction.

• **Reliability dimension:** It is critical for the Postgraduate Management Department that users have access to credible information so that they are able to make informed choices.

4.3 CURRENT WEBSITE MOBILE PERFORMANCE

Based on ENDUTHI numbers, 76% of Internet users in Mexico use a mobile device to access the internet (INEGI, ENDUTHI, 2020). However, not many websites, such as the postgraduate website of the University of Guanajuato, are mobile-friendly. As mobile usage grows, it is critical for websites to provide useful mobile experiences. The Google Developers Tool "PageSpeed Insights" provides vital insights into a website's performance, emphasizing areas that require adaptation to improve mobile user experience. The following illustration (see Figure 5) depicts the outcome of an examination of the current website for UG postgraduate management.

![Figure 5. General performance report of the UG's postgraduate website on its mobile device version](https://pagespeed.web.dev)

This tool evaluates the website's loading speed, responsiveness, and general performance using industry best practices and criteria. Additionally, PageSpeed Insights gives actionable advice and solutions to address performance issues, allowing developers to make informed optimizations that have a direct influence on the mobile user experience.

4.4 AGILE SCRUM APPROACH

The agile SCRUM methodology was chosen because it fosters an iterative and incremental approach to development, allowing flexibility and adaptability to changing requirements throughout the process (Schwaber & Sutherland, 2020). This is especially useful for website development since it allows
for continual feedback and the incorporation of new features or changes based on user preferences. This collaborative approach guarantees that all team members are on the same page, resulting in greater quality output and fewer miscommunication or misunderstanding. SCRUM also insists on regular product increments or releases, providing stakeholders with early access to working website components, and providing constructive feedback.

The table below (see Table 3) contains a description of the activities in Product Backlog that was considered for each Sprint of website development.

<table>
<thead>
<tr>
<th>Sprint Number</th>
<th>Product Backlog</th>
</tr>
</thead>
</table>
| Sprint 1. Initial Planning | • Gather requirements by conducting stakeholder virtual interviews.  
• Create user stories based on the criteria we’ve gathered.  
• Create a database model based on the system’s requirements.  
• Create wireframes or prototypes to conceptualize the user interface. |
| Sprint 2. User Registration | • Create the user registration form.  
• Add user registration functionality.  
• Create rules for validating user registration fields.  
• Make a database structure to hold user registration information. |
| Sprint 3. User Authentication | • Implement user authentication functionality (login/logout)  
• Design and develop user authentication screens/pages.  
• Implement password encryption and security measures.  
• Create authentication to protect pages from unauthorized access. |
| Sprint 4. Responsive Design | • Conduct research on best practices in responsive design.  
• Use media queries to ensure website responsiveness across various devices.  
• Design and develop an admin dashboard sidebar for easy navigation.  
• Test website responsiveness on different screen sizes and resolutions. |
| Sprint 5. Connection to DB (CRUD) | • Create a database connection module (MySQL)  
• Implement Create, Read, Update, and Delete (CRUD) functionality for relevant data entities.  
• Write database queries and statements for CRUD operations.  
• Implement error handling and data validation mechanisms for database operations. |

Source: From the author.

5 RESULTS

As a result, it is possible to state that the current website administrator's workload was lightened by including the user registration form (see Figure 6) on the website, because the user registration process was tedious and error-prone, as they had to collect the information of the users via email and then run the necessary SQL code scripts (directly in the database), without any kind of validation.
Regarding the user authentication form (Figure 7), the PHP language's PDO (PHP Data Objects) interface was used to connect to the database and run parameterized queries, avoiding issues like SQL injection. CSS styles have also been applied to improve the form's aesthetic appeal and make it responsive for use on mobile devices.

On the other hand, styles were primarily used to improve the design of the side navigation menu included on the main page of the current postgraduate website, as part of one of the user stories, creating an attractive design with the use of cards for each of the menu options (see Figure 8), while adhering to the colors embodied in the university's institutional image guide.
Finally, the same card strategy was utilized to provide information on postgraduate programs, with the goal of summarizing contact information (Figure 9). At this point, media queries were required to adjust the design to the use of mobile devices. The current website (left) displays partial information when viewed from a cell phone, but the new website displays postgraduate information correctly and conveniently.

6 CONCLUSIONS

To summarize, the usage of user stories as a requirements collecting technique has proven to be beneficial in learning about the needs and expectations of stakeholders for the creation of the UG's
Postgraduate Management Department's new website. This technique offered a more meaningful understanding of user viewpoints, making it easier to develop a website based on their preferences.

Furthermore, the selection of the e-GovQual framework's efficiency and reliability dimensions guided the development process, ensuring that the website meets the needs of the employees of the UG postgraduate management department, specifically in terms of design and information handling.

Using media queries to ensure responsive website design is a critical step in satisfying the needs of the growing number of visitors who access and browse websites via mobile devices. This method ensures that the new website provides a consistent and user-friendly experience across various devices and screen sizes, enhancing accessibility and user happiness.

Moreover, the adoption of the agile approach of SCRUM facilitates the early discovery of problems, allowing solutions to be implemented on time, boosting the satisfaction of all parties involved. Scrum events such as daily meetings, sprint planning, and retrospectives benefit team cooperation, productivity, and continual improvement. Scrum allows website development teams to become more efficient, produce high-quality outputs, and adapt to changing requirements, resulting in a successful and timely website launch.

Finally, concentrating on the improvement of overall website performance is critical since it not only enhances user satisfaction but also contributes to the reputation and success of higher-level educational institutions. Considering the recommendations from the performance evaluation of the current postgraduate website, the new website of the UG Postgraduate Management Department aims to provide a smooth user experience, efficient access to information, and reliable services, while encouraging positive interactions with its users.

**FUTURE WORK**

It is planned to deploy the new website on hosting offered by the University of Guanajuato in order to run a performance test and compare the results with those achieved on the current website. Furthermore, on both websites, the idea of employing a questionnaire to evaluate the User Experience is raised in order to truly quantify where it is and if there was a significant change after implementing essential elements of responsive design.

Finally, after reviewing the Google developer tool recommendations, the intention is to optimize the images on the website in order to convert them to the new generation format: WebP. The technologies required to minify and compress JavaScript and CSS files, on the other hand, will be examined in order to reduce the loading times of the new UG postgraduate management website.
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