University Outreach Management: Assessment and Perspectives from the Case Study of the University's Academic Week

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Abstract

Context: The Brazilian National Council of Education's Resolution Nº. 7/2018 mandates the integration of outreach activities into higher education curricula, effective from 2023. This requirement has created a need for efficient solutions to manage and support outreach activities within universities. **Problem**: Managing outreach activities manually is challenging, often leading to inefficiencies and missed opportunities for student engagement. The absence of a comprehensive system for managing these activities makes it difficult for coordinators to track and validate students' participation effectively. **Solution**: This study presents the development and evaluation of a web-based IS designed to support the management of outreach programs and projects within academic institutions, particularly focusing on use during large-scale events like an Academic Week. **Theory of IS**: The research is based on Soft Systems Theory (SST), which helps address the complex social and organizational issues involved in managing university outreach activities. **Method**: A case study method was employed during our university's Academic Week, involving over 300 users. Data were collected through direct observation and a structured survey, utilizing the AttrakDiff technique to evaluate user satisfaction with usability and functionality. **Summary of Results**: The Web-based IS demonstrated effective support for managing outreach activities and received positive feedback from users. Key insights were collected, including suggestions to improve navigability, performance optimization, and user support materials. **Contributions and Impact in the IS Area**: This research contributes a tailored management Web-based IS that addresses specific needs in academic outreach, potentially enhancing the efficiency and accessibility of outreach activities. The findings provide valuable insights for further development and set the groundwork for similar applications in educational institutions.

CCS Concepts

• **Social and professional topics** → **Information systems education**; • **Applied computing** → *Enterprise applications*; • **General and reference** → Empirical studies.

Keywords

Outreach Management, Outreach Programs, Outreach Projects, Web-based Information System, Usability Evaluation, Case Study

1 Introduction

According to Resolution Nº 7/2018 of the National Council of Education (NCE) [22], the integration of outreach activities into the curriculum is a mandatory requirement starting in 2023. This means that all undergraduate courses in Higher Education Institutions (HEIs) must allocate at least 10% of the curriculum's workload to outreach activities. HEIs offer a variety of options for students to engage in environments outside and participate in outreach initiatives. As a final note, the NCE [22] says that the HEI would have at most 3 (three) years, counting by the date the document was published, to implement what was proposed. An **Outreach Activity (OA)** can be defined as an action that integrates the curriculum and research organization, constituting an interdisciplinary, political, educational, cultural, scientific, and technological space. Additionally, it fosters the development and use of knowledge in constant coordination with teaching and research, transforming the HEI's interaction with society.

There are five (5) different modalities for OAs [22]:

(i) **Program**: a set of actions with medium to long-term deadlines focused on a single objective;
(ii) **Project**: associated with a Program, with a clear objective and a defined duration;
(iii) **Course and Workshop**: a short-term formative activity;
(iv) **Event**: an action with a well-defined artistic, cultural, and scientific character and duration, and;
(v) **Service Provision**: an activity or contract performed by third parties (community, company, among others) that is characterized by intangibility, inseparability of process/ product, and does not result in the ownership of a tangible good.

In the context of our HEI, the Outreach Coordinator is responsible for preparing and disseminating a semester report detailing the outreach activities performed, validating the OAs, and evaluating the formative nature of the students' participation. The student is responsible for requesting validation of the hours spent on OAs from the academic secretariat. Additionally, it's the professor's role

to approve the enrollment of any student expressing interest in an OA with available spots. However, the program or project coordinators and team members often lack ICT resources or software to support their execution, resulting in manual management in most cases. Consequently, several issues have been identified with this manual method, which can be easily addressed by including an information system to assist in the management process of outreach programs and projects.

This implies that coordinators have to handle everything personally, including elaborating a project, submitting and authorizing it, sending emails, and creating registration forms to make the OAs available for students to participate in and eventually earn their participation certificates. Given the numerous emails students receive from the HEI every day, it is possible for one or more opportunities to go unnoticed. Overall, the process is not optimized and requires a significant amount of time and effort to be completed and controlled properly. As such a valuable resource, it needs to be handled with extreme caution. Currently, there is no solution to meet all the requirements for generating and managing outreach programs and projects, which is why time is driving this initiative.

Hence, to address these issues, this study proposes the development of a web-based IS to support the management of university outreach programs and projects. We evaluated the proposed solution during the university's Academic Week, a large-scale event involving over 300 users, including faculty, administrative staff, and students. The research is grounded in Soft Systems Theory (SST), a methodology that facilitates the analysis and resolution of complex problems in social and organizational systems. SST is particularly valuable for understanding interactions among diverse stakeholders and for designing solutions that incorporate the interests and perspectives of all parties involved [8, 26].

SST guided the design of the proposed solution by capturing the social and organizational complexities associated with managing outreach activities. It also facilitated the identification and accommodation of the distinct roles performed by users, such as participants, proponents, and coordinators, ensuring the system effectively addressed their specific needs. This theoretical framework contributes to the field of Information Systems (IS) by providing insights into how digital solutions can integrate social and technological processes in educational environments.

Initially, we conducted a study of gray literature to map common functionalities among similar solutions found [2]. Based on the preliminary list of functionalities, we then conducted a survey with members of the academic community to validate and prioritize the mapped functionalities and identify new ones [1]. Subsequently, we carried out a usability evaluation with experts to assess the ease of use of the proposed solution [3]. At present, the solution is in the validation phase and is continuously evolving with the incorporation of new functionalities to meet all types of OAs as outlined in Resolution Nº 7/2018/NCE.

In this context, the project aims to develop a web-based IS to support the management process of OAs in outreach programs and projects through a case study of the Academic Week event at our university. For this purpose, the following objectives have been defined for this study:

(i) Present the proposed web-based IS and its functionalities;
(ii) Plan and conduct a **Case Study** [27] of our university's Academic Week event involving seven (7) courses and more than 300 users from the academic community and local society;
(iii) Discuss the results obtained from the case study;
(iv) Suggest possible improvement points for the proposed web-based IS.

The main contribution of this study is to present preliminary results from a case study of the developed web-based IS, aiming to gather evidence for improvements and further evolution of the proposed system. Therefore, this case study provided feedback on its applicability and capability to manage activities in an academic event, with the goal of enhancing usability for the academic community and identifying potential new functionalities to be incorporated into the web-based IS.

This study is organized as follows: Section 2 describes the technical issues and design decisions about the proposed web-based IS. Section 3 describes how the study was evaluated and discusses the analysis of the collected results. Section 4 discusses and compares the related work. Finally, Section 6 presents the final considerations of the study and future work.

2 The Proposal Tool

Here, we present the technical aspects of Software Engineering (SE) used in our software development process.

The our proposal tool front-end will be developed as a web application, which relates to the back-end by consuming its Application Programming Interface (API), - a collection of established guidelines that describe how programs or computers communicate with one another [19]. The project will be versioned using Git, a version control system made to manage any project, no matter how big or small, quickly and effectively [7]. A lot of communication between both authors is required for the partnership to work, since this is the only client being developed for the back-end server for now. In addition to assisting various university outreach activities, the tool's overall goal is to improve ties between the academic and outside communities by opening a line of contact through which requests can be made to the university. As a result, students will get more familiar with and connected to the community as a whole, which will greatly benefit their formation. The tool's primary application is for UNIPAMPA Campus Alegrete, but it may also be utilized by other *campi* within the university system and potentially by other Brazilian institutions in the future. The proposed tool is called ExtensiPro and is available at <https://extensipro.com/>.

2.1 Actors

The system as a whole was designed with multiple user roles, or actors, in mind.

According to [14], an actor's UML designates a function performed by a user or by any other system that communicates with the subject. In this case, it was referred to as the user. This was a necessity identified very early on, since there are many actors involved in the OA ecosystem in HEI. They are as follows:

Participant: a listener, someone (external or student) who enrolls to passively participate in the activity;
Instructor: a speaker, someone who presents or teaches something to participants;

Proponent: the one who proposes the OA, usually a professor;
Coordinator: a role that can review and approve proposed activities for one campus;
Supervisor: usually does not interact with the process, but can monitor the system as a whole, having access to OA in multiple *campi*.

2.2 Requirements Engineering

This sections aims to present in more detail how the requirements were collected and refined throughout the study. There were two (2) steps to the requirements elicitation stage. The first batch is the result of the **Gray Literature (GL)** [15]: systematic review [2][1]. Gray Literature revealed a total of 12 tools and 37 features that were found in the Google search engine. The results were used as a baseline to provide our preliminary requirements list. The second refinement of the requirements was applied after analyzing the **Survey** [21] results[2]. The survey [1] was responded by 123 subjects among students, professors and Education Administrative Technicians (EAT).

We submitted our preliminary requirements list for prioritizing and validating them. Besides, we collect new Software Requirements (SRs) and ideas to guide our software development process. In total, twenty-eight (28) Functional SRs were defined prior to the planning and execution of the survey. [9] explain that FR have the purpose to establish the behavior between inputs and outputs that characterizes a system's or component's function. These requirements were created after analyzing other tools found during the gray literature review [2], which had similar scope to the system being developed. Out of these requirements, six (6) of them were ruled out for now after discussions among authors, due to some of them being too complex for an MVP or simply out of scope.

The remaining twenty-two (22) were prioritized based on what was considered most critical for the application MVP. Software requirements present the list of SR mentioned in the Survey Study Questionnaire, which is presented in Table 1. In the analysis of the data collected, it is possible to elicit new SR since we had an open question giving the subjects of the study the freedom to indicate new possible functionalities not previously listed in the questionnaire.

As part of the development process, we track the progress of each functional requirement in our tool. To better visualize and understand the current status of these requirements, we use a three-symbol system represented in Table 1.

In the context of our tool, partial implementation refers to the scenario where the requirement has been addressed, but is not completely functional or integrated into the application. The specific case of partial implementation currently identified is as follows:

SR18. While there is some visibility of past versions for those directly involved, there is no formal relationship between versions of the same activity at present. Future improvements should include a more structured version history for each activity.

During this stage of development, the non-implemented SRs were given lower priority as they were deemed non-essential to the core features of the tool. The intricate nature of our application, with its multitude of business rules, made it challenging to implement every feature within the given timeframe. Consequently, we made the strategic decision to concentrate our efforts on refining and optimizing the key features that provide the greatest value to users. In future updates, we intend to address these non-implemented SRs to further enhance the tool's functionality and expand its capabilities. We then conducted a usability assessment with experts to evaluate the user-friendliness of the proposed solution [3].

Figure 1 illustrates the main functionalities of the proposed solution. These functionalities can be categorized into administrative activities, which involve the roles of Coordinator, Proponent, and Professor/Administrative Technician, responsible for managing outreach programs and projects with the following features: (i) Create Program; (ii) Create Project (Figure 2); (iii) Edit Activity; (iv) Manage Activity Requests; (v) Manage Activity Enrollments; (vi) Manage Attendance Records (Figure 6); (vii) Export Enrollment Table.

In contrast, the roles of Participant, External User, and Student act as end users, executing the following functionalities: (i) List and View Programs; (ii) List and View Projects; (iii) List and View Outreach Activities (Figure 4); (iv) Enroll in Activities (Figure 5); (v) Evaluate Activities (Figure 7); (vi) Issue Certificates; (vii) Propose Activities (Figure 3).

Table 1: List of software requirements of the proposed web-based IS.

ID	Requirement	Priority	Status
SR01	Suggest new OAs	Must	●
SR02	Allow OA registrations	Must	●
SR03	Record participant attendance	Must	●
SR04	Analyze and approve OA proposals	Should	●
SR05	OA search by text	Must	●
SR06	Register prerequisites for OA	Could	●
SR07	Edit OA registration status	Should	●
SR08	List OAs user is registered to	Must	●
SR09	Maintain OA participation history	Must	●
SR10	Help area (FAQs, manuals)	Should	●
SR11	Consult OAs with filters	Must	●
SR12	Register external users	Won't	●
SR13	Register interest in knowledge areas	Should	○
SR14	Show proponent details	Could	●
SR15	OA favorites list	Could	○
SR16	Declare interest in an OA (when registrations are not open)	Must	○
SR17	Share OA information	Could	●
SR18	History of past OA versions	Should	◐
SR19	Professor annotations in the OA's details	Could	●
SR20	OA feedback by the enrolled user	Could	●
SR21	Detailed OAs schedule	Must	●
SR22	Pre-fill OA final report	Could	○

Legend: (S)tatus: ○: Not Developed | ◐: Partially Developed | ●: Fully Developed

[1]Gray Literature: https://doi.org/10.5281/zenodo.8098553
[2]Survey: https://doi.org/10.5281/zenodo.7931976

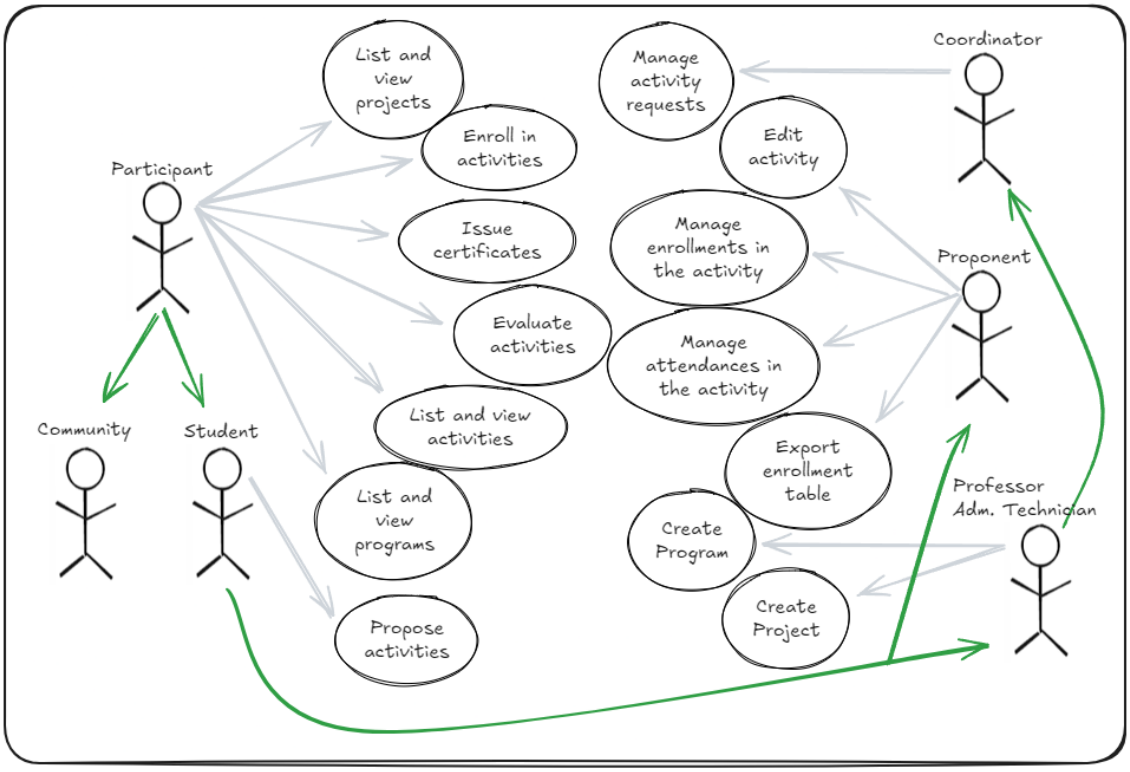

Figure 1: Use Case Diagram (UCD) of the proposed tool.

2.3 Design Decisions

The decisions made regarding the development of the goal product are discussed here.

DD1. **Programming Language**: We chose TypeScript (TS) for its extensive tool and technology ecosystem. It enhances JavaScript, a dynamic language, by introducing type enforcement, which increases robustness and predictability [5];

DD2. **Software Architecture**: We evolved the tool's architecture to meet changing technological requirements. Originally built with NextJS and React, it has now transitioned to Svelte and SvelteKit. This approach improves dependency management, code sharing, and testing [6]. While React offers reusability and simplification, it relies on Client Side Rendering (CSR), which can have limitations such as security risks and longer page load times [11, 24]. In contrast, Svelte compiles components into efficient imperative code, resulting in faster load times and a simplified development process [16]. The adoption of SvelteKit also enables Server Side Rendering (SSR), enhancing performance and supporting users without JavaScript [20]. We migrated to Svelte and SvelteKit due to their simpler syntax, development efficiency, and alignment with our objectives. To facilitate communication between front-end and back-end servers, we utilized Type-safe Remote Procedure Calls (TRPC), enhancing type safety and system reliability [18].

DD3. **Multiple Languages**: The application will support multiple languages, starting with Portuguese and English. While the immediate focus is on serving the local Portuguese-speaking community, considering this aspect from the beginning will save time in the future if the software expands globally [23].

3 Case Study

This section serves as a structured guide for conducting the critical case study during the 2023 Academic Week at our university. The focus is on utilizing the proposed tool, a platform under development designed to optimize and improve the management of academic OAs. This protocol outlines the methods for data collection and obtaining meaningful feedback from two distinct groups: Participants and Proponents.

The scientific method adopted is the case study approach [27], incorporating data collection methods such as a combination of direct observation and feedback gathered through a **Survey** [21]. The questionnaire will be distributed at the end of the event to ensure that user experiences and opinions are fresh and relevant. According to [21], a questionnaire is a data collection and analysis approach where participants respond to pre-developed questions or statements. The protocol defined for this study was adapted from the guidelines proposed by the author and is illustrated in Figure 8.

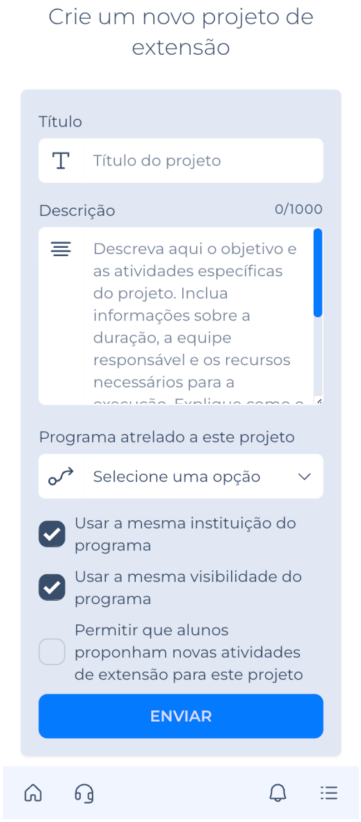

Figure 2: Create Project

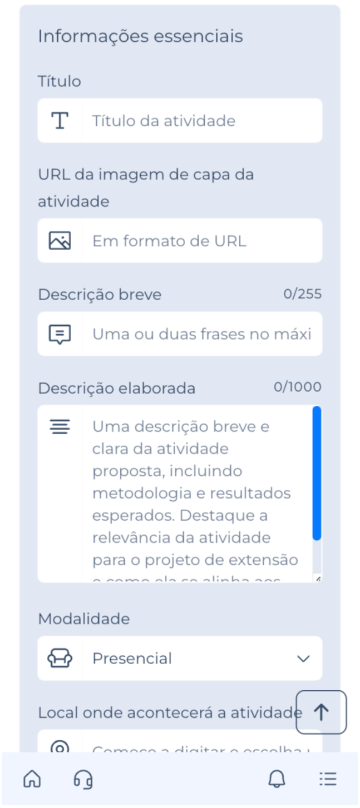

Figure 3: Propose Outreach Activities

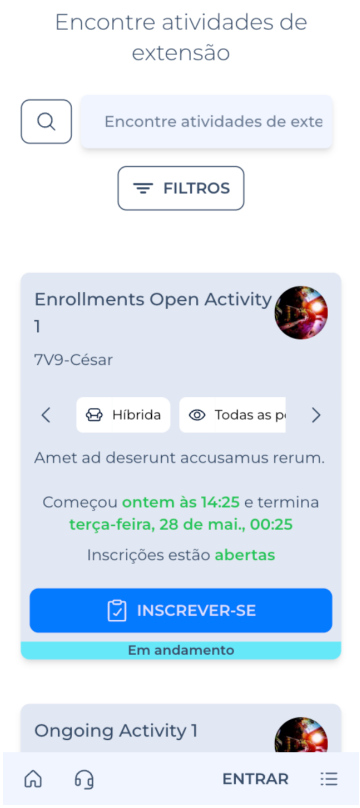

Figure 4: List and View Outreach Activities

3.1 Research Objectives

The case study has the following main objectives: (i) Assess the usability and efficiency of the proposed tool in a real-world testing environment during the Academic Week, involving over 300 active users; (ii) Collect qualitative and quantitative data from users (Participants and Proponents) through a structured questionnaire; (iii) Identify key areas for substantial improvements and necessary adjustments, focusing on usability refinements prior to the full release. Hence, Table 2 formalizes the research method through the following Research Question (RQ):

Table 2: Research Question.

RQ. How does a web-based tool for managing university outreach activities impact the usability and efficiency of academic event management?

3.2 Target Audience

The current client is the Federal University of Pampa (UNIPAMPA), a Brazilian public higher education institution, specifically serving the Computing and Engineering undergraduate programs at the Alegrete campus. The tool supports the management of outreach activities, particularly for large academic events. Although designed for this institution, its scalable architecture enables adaptation to similar contexts, making it a versatile solution for other academic environments.

In this study, participants will be categorized as follows: **Participants**: Individuals involved in the academic week who explore and use the proposed tool for various activities. Within the tool, Participants are users who can register for activities, propose new ones, and generate participation certificates if they meet the attendance requirements for the activity. Once a Participant proposes an activity, they transition to the role of a Proponent.

Proponents: Users who propose, coordinate, or manage activities through the platform. They have a deeper, more technical involvement with the platform's functionalities, serving as full managers of their proposed activities. After the activity proposal is approved by the coordinator of the associated project, the proponent gains the ability to manage registrations and attendance lists for their activities.

3.3 Sampling Plan

Data collection was predominantly carried out through a questionnaire, ensuring a uniform approach. The questionnaire was designed to capture feedback on the user experience, interface, navigability, perceived usefulness, and any problematic areas in the proposed tool:

Figure 5: Enroll in Outreach Activities

Figure 6: Manage Attendance Records

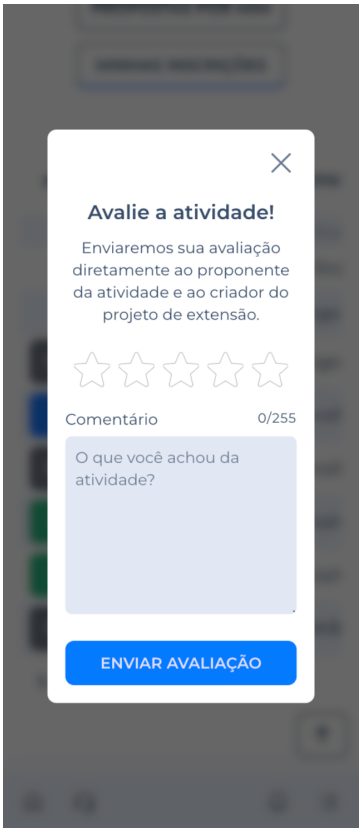

Figure 7: Evaluate Outreach Activities

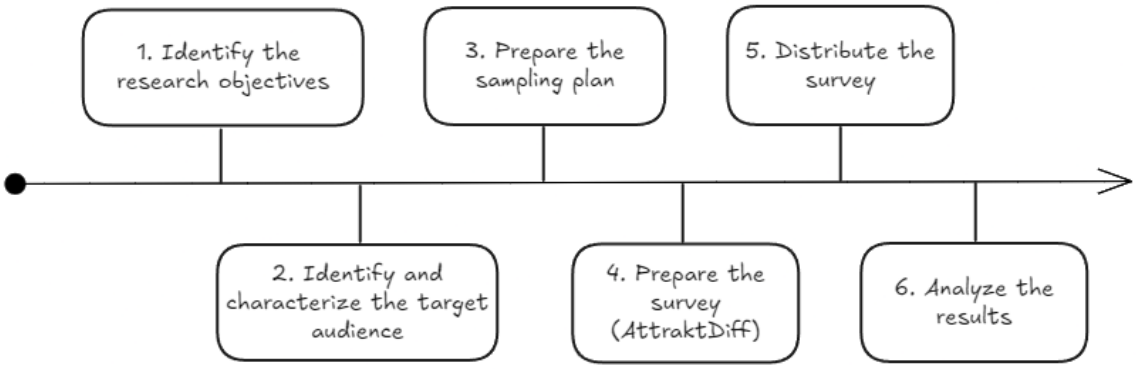

Figure 8: Research Process (Adapted from [21])

(i) **For Participants**: Focuses on ease of use, overall experience, and satisfaction with the proposed tool;
(ii) **For Proposers**: Addresses more technical issues, exploring the tool's effectiveness in managing activities, problems or bugs encountered, and suggestions for improvements.

3.4 Questionnaire Development

The questionnaire was developed using the AttrakDiff technique [17], a recognized tool for assessing the attractiveness of products and services. The technique is designed to measure both pragmatic qualities (usability) and hedonic qualities (related to aesthetic satisfaction and user identification). Applying the AttrakDiff technique in the context of the proposed tool will allow for the evaluation of users' emotional reactions to the tool, as well as capturing their

perceptions of the platform's usefulness and effectiveness. The AttrakDiff technique focuses on evaluating the user experience by measuring pragmatic and hedonic aspects of interaction with the tool. Differently from the Technology Acceptance Model (TAM) [10] and the Unified Theory of Acceptance and Use of Technology (UTAUT) [25], which assess technology acceptance based on factors such as perceived usefulness and ease of use. AttrakDiff is best suited for measuring subjective perceptions of usability and design, while TAM and UTAUT are used to predict technology adoption. To assess attractiveness, we employed a semantic differential measurement instrument consisting of 28 seven-point scale items, each defined by opposing adjective pairs (*e.g.*, confusing – clear, unusual – ordinary, good – bad). These adjective pairs are arranged along a graded intensity scale, allowing for nuanced responses. The responses are then aggregated into distinct scale values, representing key dimensions of user experience: Pragmatic Quality (PQ), Hedonic Quality (HQ) and Attractiveness (ATT).

The questionnaire begins with a consent form clarifying the research objectives, the use of collected data, and ensuring the confidentiality and anonymity of the participants. After the consent agreement, the questionnaire proceeds with a series of demographic and tool usage questions, including:

(i) Association with the university;
(ii) Age range of the respondent;
(iii) Previous experience with OAs before using the platform;
(iv) Undergraduate course or academic program of the respondent;
(v) User role in the proposed tool, with multiple-choice options: (a) Proposer of OAs; (b) Participant in OAs.

Each item in the questionnaire presents a pair of contradictory concepts, such as "Pleasant" and "Unpleasant". Participants must position their opinion on a seven-point scale between these adjectives. This approach provides an intuitive measure of users' emotional reactions to the tool, capturing both their pragmatic and hedonic responses regarding usability and the product's aesthetics.

Finally, the questionnaire ends with an open section for additional comments, where users can provide free feedback on the tool, report bugs or issues encountered, and suggest improvements or desired features.

3.5 Distribution the Questionnaire

The questionnaire was distributed digitally using the email addresses provided by users during registration on the proposed tool. An email with a blind copy was sent to all registered users, containing a brief explanatory text about the importance of feedback for the continuous improvement of the tool, followed by the link to the questionnaire hosted on *Google Forms*.

The questionnaire was available for a two-week period, allowing users to participate according to their availability. The blind copy approach in the email ensured users' privacy, preventing email addresses from being shared among recipients. After the two-week period, the questionnaire was closed for responses, with a total of 39 respondents. Although this number does not represent the entire user base, it provides a significant sample for preliminary data analysis and for identifying trends and areas of improvement in the proposed tool.

3.6 Analysis of the Results

The data collected through the questionnaire were subjected to detailed statistical analysis to identify trends, patterns, and user perceptions regarding the proposed tool. From the AttrakDiff questionnaire responses, we calculated the average scores for each attribute. These averages provide an overview of users' perceptions of the tool, indicating areas of success and aspects that require improvement.

The qualitative analysis of the data suggests that the proposed tool is seen as innovative and practical by its users, although some consider it still complex and challenging, indicating opportunities for simplification and improving the user experience. It is recommended to continue the development focusing on simplifying the interface and improving the support documentation to facilitate tool usage. A detailed evaluation of each AttrakDiff attribute, along with user comments, will provide more precise guidance for future iterations of the tool's design and development.

Based on the analysis of the questionnaire results, several constructive suggestions were gathered from the participants. While the quantitative data offers an overview of user perceptions, it is the qualitative comments that provide direct insights for improvements. Here, we highlight three prominent suggestions extracted from the respondents' feedback and discuss the importance of each for enhancing the proposed tool:

(i) **Improvement in Navigability**: Some users expressed difficulties navigating the current interface, suggesting the need for a more intuitive design and clearer menus. This suggestion is crucial for increasing usability, especially for new users who may not be familiar with the tool's workflow;
(ii) **Performance Optimization**: Several comments noted the occurrence of slowness during platform use. Optimizing performance, by improving page load speed and interface responsiveness, is essential for keeping users engaged and ensuring the efficiency of academic OAs;
(iii) **Enhancement of User Support**: The lack of detailed support material for problem resolution was a common concern among participants. Expanding and updating the support documentation, including step-by-step tutorials and FAQs, can empower users to use the proposed tool more efficiently and independently.

These improvements are essential for the ongoing development and success of the proposed tool. Implementing these suggestions will not only increase user satisfaction but also strengthen the tool's position as a reliable solution for managing university OAs.

Approximately 64,10% of respondents rated the tool as innovative and 69,23% practical, reinforcing its relevance for outreach management. From another perspective, 10,26% of the participants found the tool complex, while 53,85% challenging, suggesting usability improvements.

The pragmatic quality scale results indicate a moderately positive evaluation, with a median (MDN) of 4 and an interquartile range (IQR) of 4. Participants perceived the hypothesis as practical, clearly structured, and simple, though somewhat predictable. The average score of 4.03 suggests a generally favorable assessment, with responses ranging from 1 to 7. Similarly, the hedonic quality scale results show a median (MDN) of 4 and an IQR of 4, indicating

that participants found the hypothesis elegant and of high quality. The average score of 4.08 reinforces this positive perception, with responses spanning the full scale from 1 to 7. Regarding attractiveness, the hypothesis was also evaluated positively, with a median (MDN) of 4 and an IQR of 4. The average score of 3.71 suggests a slightly lower, but still generally favorable, perception of the design. A boxplot representation (Figure 9) visually illustrates the dispersion of responses, quickly highlighting outliers and distribution trends within the dataset.

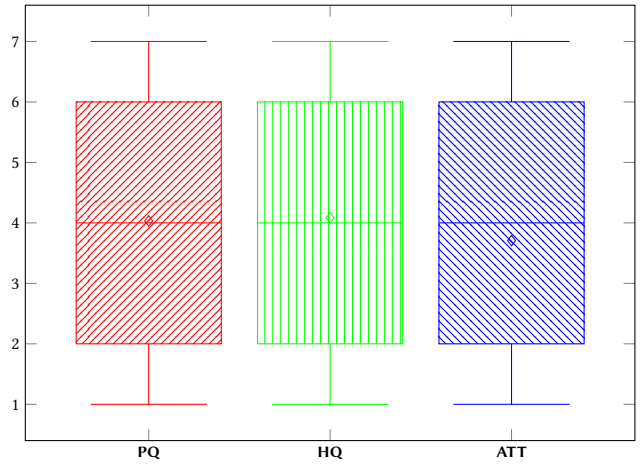

Figure 9: Boxplots with median and interquartile range of key dimensions of user experience

Finally, in Table 3 we sum up the answer to our research question.

Table 3: Summary of Response to Research Question.

Research Question: *How does a web-based tool for managing university outreach activities impact the usability and efficiency of academic event management?* **Response**: The evaluation of the proposed web-based tool during the Academic Week demonstrated a significant improvement in the usability and efficiency of managing outreach activities. With over 300 users, including students, faculty, and staff, the tool streamlined processes such as event registration, attendance tracking, and certificate generation. The AttrakDiff-based usability assessment highlighted that users found the tool intuitive and practical, although some suggested improvements in navigation and performance. Participants particularly appreciated the centralized access to outreach opportunities, which minimized communication gaps and reduced administrative burdens. Overall, the results indicate that the tool effectively supports academic event management by simplifying workflows and enhancing user engagement, with opportunities for iterative improvements to address minor usability concerns.

4 Related Work

Through our research, we've found the following two similar works in the literature. The study of Elany Farias *et al.* [12] aims to provide insights into student performance and their participation in projects to enhance the evaluation of subjects covered in the classroom. By emphasizing the importance of outreach programs, this study sheds light on the practical application of programming and prototype development, thereby bridging the gap between theoretical knowledge and real-world implementation.

By combining theoretical insights with technological advancements, this study provides a valuable perspective on utilizing online social networks to enhance educational practices [4]. It also introduces Contagious, a tool that offers guidelines for constructing online social networks oriented towards the diffusion of innovations.

Additionally, we previously conducted a systematic review of grey literature on outreach activity management tools [13]. The initial findings identified key functionalities and common challenges in the current landscape, serving as a foundation for the ongoing development of our solution. In total, 36 academic management tools were identified, of which 12 specifically supported outreach activities or related functionalities: Cachalote, CAEX, Einstein, ENS, Santa Marcelina, SGE, SIEX, SIG, SIGAA, SUAP, UNINASSAU, and UNINTER.

These studies relate to this work by also highlighting the importance of extending educational practices beyond the classroom setting and exploring innovative approaches. They also describe practical implementations and address real-world needs by talking about the development of tools and methodologies that align with evolving educational practices.

5 Key Contributions of the Study

The study presents several significant contributions, both for university outreach and for the IS field. The main contributions and their relationships with IS are highlighted below:

Technological Solution for Outreach Management: The web-based tool provides a practical solution for managing university outreach activities, addressing challenges like event registration, attendance tracking, and certificate generation. It demonstrates how IS can automate processes, reduce workloads, and integrate stakeholders on a unified platform;

Application of Soft Systems Theory (SST): SST enabled the tool to address social and organizational complexities by tailoring functionalities to diverse user roles (participants, proponents, coordinators). This highlights the relevance of SST in IS for resolving sociotechnical challenges and designing user-centered systems;

Prioritized Functionality Integration: Using gray literature and user surveys, critical requirements like registration management were prioritized. This underscores the importance of Requirements Engineering in aligning system development with user expectations and enhancing adoption;

Usability and User Experience Evaluation: Usability testing with the AttrakDiff technique provided insights into the tool's ease of use and aesthetics. This aligns with IS research

on Human-Computer Interaction (HCI), emphasizing functional and user-friendly system design;

Scalability and Flexibility: Modern web technologies (*e.g.*, SvelteKit, TypeScript) ensured scalability and adaptability, enabling future feature expansion and broader applicability across academic contexts. This reflects best practices in IS for creating sustainable, evolving systems;

Feedback for Continuous Improvement: Iterative development based on user feedback identified areas for enhancement, such as navigation and performance optimization. This approach aligns with IS practices of iterative design, ensuring long-term effectiveness and user satisfaction.

6 Final Remarks

This study presented a critical analysis of the tool developed for managing OAs during the Academic Week at our university. With the implementation of Resolution Nº 7 of 2018 by the NCE, which mandates the integration of OAs into undergraduate curricula, the need for effective solutions to manage these activities has become increasingly evident. The proposed tool demonstrated strong performance in organizing and facilitating interactions between participants and proponents, receiving positive feedback that underscores its relevance and potential use in the academic community.

The preliminary results obtained during the event not only validated the tool's functionality but also provided valuable insights for future improvements. Data collection through surveys and direct feedback allowed for the identification of areas requiring adjustments and new functionalities to enhance the platform's usability and effectiveness.

For future work, we propose continuing the development of the tool, focusing on implementing the received suggestions and conducting new case studies in different academic contexts. Additionally, the research could be expanded to include a comparative analysis with other existing solutions, aiming to identify best practices and innovations that could be integrated into the system. Collaboration with other Higher Education Institutions (HEIs) may further enrich the validation and improvement process, contributing to the creation of a support network for university OAs.

In summary, the integration of OAs into academic curricula represents a significant step toward developing professionals who are more socially conscious and engaged. The developed tool is an important advancement in this process, and its continuous evolution has the potential to further amplify the impact of OAs within HEIs.

6.1 Limitations

The study, while comprehensive, does have certain limitations that should be acknowledged. Firstly, the technological limitations associated with the tools and programming languages used may have influenced the development process and the final product. The use of TypeScript, Svelte, and SvelteKit, while beneficial in many ways, may have also presented challenges in terms of compatibility and learning curves.

Secondly, the manpower and resource constraints must be considered. Being a project led by only two students who are concurrently engaged in other employment, the scope and scale of the research were naturally restricted. This limitation might have impacted the depth of the study, the range of functionalities that could be explored, and the extent to which the tool could be developed and tested.

Thirdly, the feedback and insights relied heavily on the subjective experiences and technical expertise of the participants. While valuable, these perspectives may not fully capture the diversity of a broader user base. The limited sample size and the specific context of the participants could have influenced the findings, resulting in a narrower assessment of the tool's applicability and performance across different settings.

Besides, the main threats to validity include selection bias (participants were primarily from the same institution), sample size limitations, and subjectivity in responses. To mitigate these risks, we ensured that data collection was anonymous, used a validated methodology (AttrakDiff), and planned future studies in other contexts.

Additionally, we recognize that a single outreach activity is insufficient to fully address the research question and agree that additional studies would enhance the validity of the results. While the case study provides meaningful insights, expanding the analysis to various types of outreach activities is essential for a more comprehensive evaluation.

6.2 Future Works

Looking ahead, several areas have been identified for future development and refinement of the tool. The feedback and insights obtained will be instrumental in shaping the tool's evolution. Key objectives include:

- **Usability and User Experience Improvements**: Based on the suggestions received, efforts will be focused on enhancing the overall usability and user experience. This includes addressing interface aesthetics, navigational flow, and the intuitiveness of features;
- **Engagement with User Groups**: Continued engagement with both expert and user groups is planned to ensure the tool remains aligned with the needs and expectations of its users. This approach will enable the iterative improvement of the tool, taking into account evolving requirements and feedback;
- **Expansion of Functionality**: Exploring the expansion of the tool's functionality to accommodate a wider range of activities and user interactions. This may involve integrating more advanced features or diversifying the types of outreach activities that can be managed through the tool;
- **Broadening the User Base**: Efforts will be made to reach a broader user base to gather more diverse feedback. This would help in understanding how the tool performs in varied settings and under different use cases;
- **Addressing Technological Limitations**: Exploring solutions to overcome any technological limitations faced. This may include adopting complementary technologies or making architectural adjustments to enhance compatibility and performance;
- **Resource Allocation**: Seeking ways to better allocate resources, including manpower, to overcome current limitations. This might involve seeking collaborations, grants, or

institutional support to expand the scope and impact of the project.

By addressing these areas, the aim is to continually improve and adapt the tool, ensuring it meets the evolving needs of its users and remains a valuable asset in the field of education and outreach.

Data Availability

We are committed to promoting transparency and reproducibility in research. In line with this commitment, we have made all the data supporting the findings of our study openly available on Zenodo at https://doi.org/10.5281/zenodo.13328799.

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