FEDERAL UNIVERSITY OF PAMPA

Lucas Alexandre Fell

Extensionly - A tool for supporting the management of outreach projects and programs in the university: Front-end

Alegrete
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Term Paper presented in Software Engineering Graduation Course in the Federal University of Pampa as a partial requirement for obtaining the title of Software Engineering Bachelor

Supervisor: Prof. Ph.D. Maicon Bernardino da Silveira

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Term Paper presented and approved on .... of .....
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This work is dedicated to all software engineering empiricists who,
at some point, felt like giving up
and throwing everything up in the air,
but still made it to the end.

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"The most beautiful experience we can have is the mysterious.
It is the fundamental emotion that stands at the cradle of true art and true science."
(Albert Einstein)

RESUMO

Em 2023, o processo de curricularização de novas Ações de Extensão será implantado obrigatoriamente pelas Instituições de Ensino Superior do país. Apesar disso, em sua maioria, as Instituições não possuem um processo completamente automatizado para a gestão dos Programas e Projetos de Extensão, que continuaria sendo realizada manualmente pelo coordenador ou colaboradores de extensão. A realidade não é diferente na Unipampa, onde foi inicialmente identificada essa oportunidade de melhoria no processo. Essa é a motivação principal por trás da Extensionly. Desenvolver uma solução que contemple todos os processos envolvidos no ciclo de vida das atividades extensionistas. Para isso, o esforço conjunto de dois autores tem sido realizado, tanto na geração de artefatos de suporte à pesquisa, como no desenvolvimento da solução. Este trabalho tem como foco principal a parte do *front-end* e experiência de usuário do sistema, enquanto que o outro concentra-se no *back-end* da aplicação. Sobre os artefatos gerados, foram eles: (a) Um protocolo, formulado e executado para a realização de uma revisão sistemática na literatura cinza, de acordo com as diretrizes da Engenharia de Software, com o objetivo de encontrar ferramentas similares. Os resultados foram classificados e, a partir de sua análise, foi realizada uma extração de requisitos e necessidades iniciais da aplicação; (b) Um *survey*, cuja confecção foi realizada segundo definições e diretrizes encontradas na literatura. Esse estudo foi direcionado à comunidade acadêmica da Unipampa e teve como objetivo classificar, em escala de importância, os requisitos previamente coletados com a revisão na literatura cinza. Os resultados foram analisados e, a partir deles, pretende-se iniciar o desenvolvimento da ferramenta proposta, uma solução *web* para apoiar o processo de gestão dos programas e projetos de de extensão, cujos benefícios serão principalmente a redução de esforço necessário para a criação de uma atividade extensionista e a agilidade no engajamento dos extensionistas voluntários.

Palavras-chave: Ferramenta. Survey. Literatura Cinza. Front-end. Extensão. Universidade.

ABSTRACT

In 2023, the process of curricularization of new outreach actions will be implemented by the country's Higher Education Institution (HEI). Nevertheless, the Institutions do not have a completely automated process for the management of outreach programs and projects, which would continue to be carried out manually by the coordinator or outreach collaborators. Reality is no different in Unipampa, where this opportunity for improvement of the process was initially identified. This is the main motivation behind Extensionly. To develop a solution that contemplates all processes involved in the life cycle of outreach activities. For this, the joint effort of two authors has been made, both in the generation of research support artifacts and in developing the solution. This work has as its main focus in the front-end and system user experience, while the other focuses on the application back-end. About the artifacts generated, they were as follows: (a) A protocol, formulated and executed to perform a systematic review in grey literature, according to the software engineering guidelines, with the objective of finding similar tools. The results were classified and, from their analysis, an extraction of initial requirements and needs of the application was performed; (b) A survey, whose confection was performed according to definitions and guidelines found in the literature. This study was directed to the academic community of Unipampa and aimed to classify, in the scale of importance, the requirements previously collected with the review in grey literature. The results were analyzed and, from them, the development of the proposed tool will start: A web solution to support the management of outreach programs and projects, whose benefits will be mainly the reduction of effort needed to create an outreach activity and agility in the engagement of volunteer outreach participants.

Key-words: Tool. Survey. Grey Literature. Front-end. Outreach Activities. University.

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LIST OF ABBREVIATIONS AND ACRONYMS

API Application Programming Interface

ATE Administrative Technician in Education

CAEX Outreach Actions Control

CSI Client Side Includes

CSR Client Side Rendering

FORPROEX Forum of Pro-Rectors for Outreach of Brazilian Public Universities

FR Functional Requirement

HECI Higher Education Community Institution

HEI Higher Education Institution

HTML HyperText Markup Language

ID Identification

JS JavaScript

MoSCoW Must have, Should have, Could have and Will not have

MVP Minimum Viable Product

NGO Non-governmental organization

OA Outreach Activity

PII Personally Identifying Information

PROEXT Dean of Outreach and Culture

SAP Academic Project System

SEI Electronic Information System

SEO Search Engine Optimization

SGCE Electronic Certificate Management System

SIGAA Integrated Academic Activities Management System

SIPPEE Information System for Research, Teaching and Outreach Projects

SSI Server Side Includes

SSR Server Side Rendering

TP Term Paper

TS TypeScript

UI User Interface

Unipampa Federal University of Pampa

CONTENTS

1 INTRODUCTION

This work is part of a collaborative effort by two students from the Software Engineering course. Since the complexity and size of the problem were bigger than what the academy is used to seeing on Term Papers (TPs), the work was split among both authors. This decision was supported and previously agreed upon by their supervisor.

The effort was separated as follows: While this paper encompasses all of the front-end system requirements, such as analytics, multiple languages, component styling, design of the pages with the user interface and user experience, the counterpart focuses heavily on the back-end system requirements. Both projects are going to be separate implementations, will live in different version control repositories and both will have their own specific DevOps pipelines and deployments.

The Federal University of Pampa provides a number of options for students to engage in environments outside of the institution. An outreach activity can be defined as the following, in accordance with the 317th CONSUNI Resolution from April 29, 2021: An action that integrates the curriculum matrix and the organization of research, constituting an interdisciplinary, political, educational, cultural, scientific, and technological process (PROEXT, 2021c). Additionally, it fosters the development and use of knowledge in constant articulation with teaching and research, which transforms the interaction between Unipampa and society.

There are four (4) different modalities for outreach activities (PROEXT, 2021c): (i) Program: a series of actions with a medium to long-term time frame that are focused on a single goal; (ii) Project: it is typically associated with a Program and has a clear goal and a set duration; (iii) Course: training activity, with short duration, and; (iv) Event: an action with an artistic, cultural and scientific character, with a well-defined duration.

As an illustration, consider the JEDI Program, which enlists the help of the local community (both academic and non-academic) as well as public or private businesses to address local issues and promote capacity building and IT training (BERNARDINO, 2021).

To register a new Outreach Activity (OA), it is first necessary to identify whether it is a Specific or Linked OA - whether it is linked to an Undergraduate Curriculum Component or not. The OA insertion process is carried out at the Dean of Outreach and Culture (PROEXT) of Unipampa. Once registered, the course committee will need to appoint one or more professors as outreach supervisors (PROEXT, 2021c).

The supervisor's duties also include creating and disseminating a biannual report detailing the outreach efforts conducted during the course, validating the use of Specific OAs, and evaluating the formative character of the action carried out by the student.

The student is responsible for requesting the use and validation of the hours spent in the activity with the Academic Secretary of the course after contacting the supervisor and expressing interest in an OA (PROEXT, 2021c). Additionally, the professor is in

charge of choosing and enrolling any student who expresses interest in the OA program up until there are openings.

1.1 Motivation

It should come as no surprise that time is crucial in the academic setting. Because it is such a valuable resource, it needs to be handled with extreme caution. As there is currently no solution to handle all the requirements of generating and administering outreach programs in Unipampa, time is what propels this initiative forward.

The process of curricularization of the new OA will be mandatedly implemented by HEI in Brazil starting in 2023 as a result of Res. No317 (PROEXT, 2021c). However, the coordinator or other team members of the Outreach Programs and Projects would handle all management manually. In light of this, a number of problems with this manual method were found that might be easily resolved by adding a tool to assist the management process.

This implies that the professors and coordinators must personally complete everything, including constructing a project, submitting and getting it authorized, sending emails and making registration forms to open it for the students to join and eventually earn their participation certificate. Given the numerous emails the student receives from the institution each day, it is possible that one or more of the offers will go overlooked. The entire process is not optimized and requires a lot of time and work to complete.

Also due to the institutional program "Unipampa Cidadã" (Unipampa Citizen) - which aims to dedicate a portion of the hours currently invested in outreach activities in projects and areas of great social relevance - it is expected that the enrollment rate of new students in higher education will increase (PROEXT, 2021a), which consequently highlights even more the importance of automating manual processes at the university.

1.2 Research Aims and Objectives

According to what has been presented, this TP has the research aim of developing the front-end part of a tool in which all the current management of OAs will be carefully observed and reproduced, in order to reduce the effort of the professors and supervisors with the manual steps of the process.

In order to achieve this, the following research objectives were defined:

- Systematically review grey literature works and products in order to find similar solutions, collecting the first batch of requirements.

- Elaborate a survey, according to Kasunic (2005), in order to discover new system requirements and in order to better understand the target users' needs.

- Analyze the results and refine the elicited requirements to create tangible tasks and an implementation roadmap.
- Study current market technologies, programming languages and frameworks to build a stack which delivers a great user experience and is creates a codebase that is easily maintained.
- Create a working Minimum Viable Product (MVP) of the system which implements at first the most critical collected and refined requirements for the system to become usable by early users to provide feedback for the product's further development (BECKER, 2020).

Table 1 also describes the research aim and questions.

Table 1 – Synthesis of the Research Aim and Research Objectives.

Topic	Description
Subject	Management of outreach programs and projects.
Study	Tool for Support in management of outreach programs and projects.
Research Question	How can a tool to support the management of outreach programs and projects of Unipampa optimize the management of proposition, registration, dissemination and accountability processes of outreach actions?
Research Hypothesis	With a tool to support the management of outreach programs and projects, it is possible to have a reduction on the effort needed to create an outreach activity and an increase in the engagement of volunteer outreach participants.
Research Aim	Develop the front-end of a tool to support the management of outreach programs and projects of Unipampa
Research Objectives	Report results and execution methods of the following processes: (i) Research: Analyze similar tools, state the processes that will be made available by the tool, conduct surveys with the organizers and participants of OAs, understand the limitations of current processes. (ii) Planning: Elicitate functional and non functional requirements, identify stakeholders, define architecture and technologies. (iii) Development: Elaborate the features defined, build the entire front-end. (iv) Deployment: Perform experiments with possible end users, collect feedback and implement appropriate improvements and corrections.

Source: Author.

1.3 Contribution

The main contribution of this study will be the implementation of an MVP, in the form of a web application, to support and automate the whole process of OAs in the university. It also aims to generate valuable artifacts about the state of outreach activities management tooling and support in Brazil, such as a grey literature review. A survey is also conducted, aiming to better understand the needs of outreach participants regarding this specific kind of tooling. Due to the complexity of this proposal, as previously mentioned, the effort was split amongst two TPs. This one focuses on the development of a

web app, with all its related challenges, but it doesn't encompasses the back-end services in detail.

As for the artifacts generated to support the research, such as the grey literature systematic review and the survey, all of them were done in conjunction by both authors and are not related specifically to a single work. The other author is Igor Dalepiane da Costa.

1.4 Organization

This document is organized according the following chapters:

- **Chapter 2: Methodology**: Describes how the study was planned, the adopted methodology and the approaches used to conduct it.
- **Chapter 3: Background**: Important information and details of concepts related to the study, e.g. outreach activities in Brazil and in the Federal University of Pampa, federal laws and similar tools.
- **Chapter 4: Grey Literature**: How the protocol was structured, results, discovered tools, preliminary requirements.
- **Chapter 5: Survey**: How it was structured, results, validation of refined requirements with the target audience.
- **Chapter 6: Extensionly**: Revolves around implementation details, created artifacts, technologies used, the software engineering process, DevOps practices and the incorporation of analytics.

2 METHODOLOGY

This chapter discusses how the study was planned, the adopted methodology and the approaches used to conduct it. The next sections will describe in more detail the procedures and techniques used on the research. Scientific research is described on Section 2.1. In Section 2.2, the research classifications according to Prodanov and Freitas (2013) are defined. After that, in Section 2.3, the research design is shown and explained. A research schedule was created and can be seen in Section 2.4. Finally, in Section 2.5, the whole chapter is briefly summarized.

2.1 Introduction

The word "Science" comes from the latin word "Scire", which means to learn and to know. For science to be done, there has to be a way to gather new information, building upon what is already known. This is where scientific research fits in. The scientific method, says Prodanov and Freitas (2013), is a way, through a set of adopted procedures, to achieve knowledge.

It is the basic instrument which turns thoughts into systems, ordering them through procedures, which guides the scientist along the way to achieve his predefined scientific goals. Prodanov and Freitas (2013) also mentions that without the scientific method, there is no science.

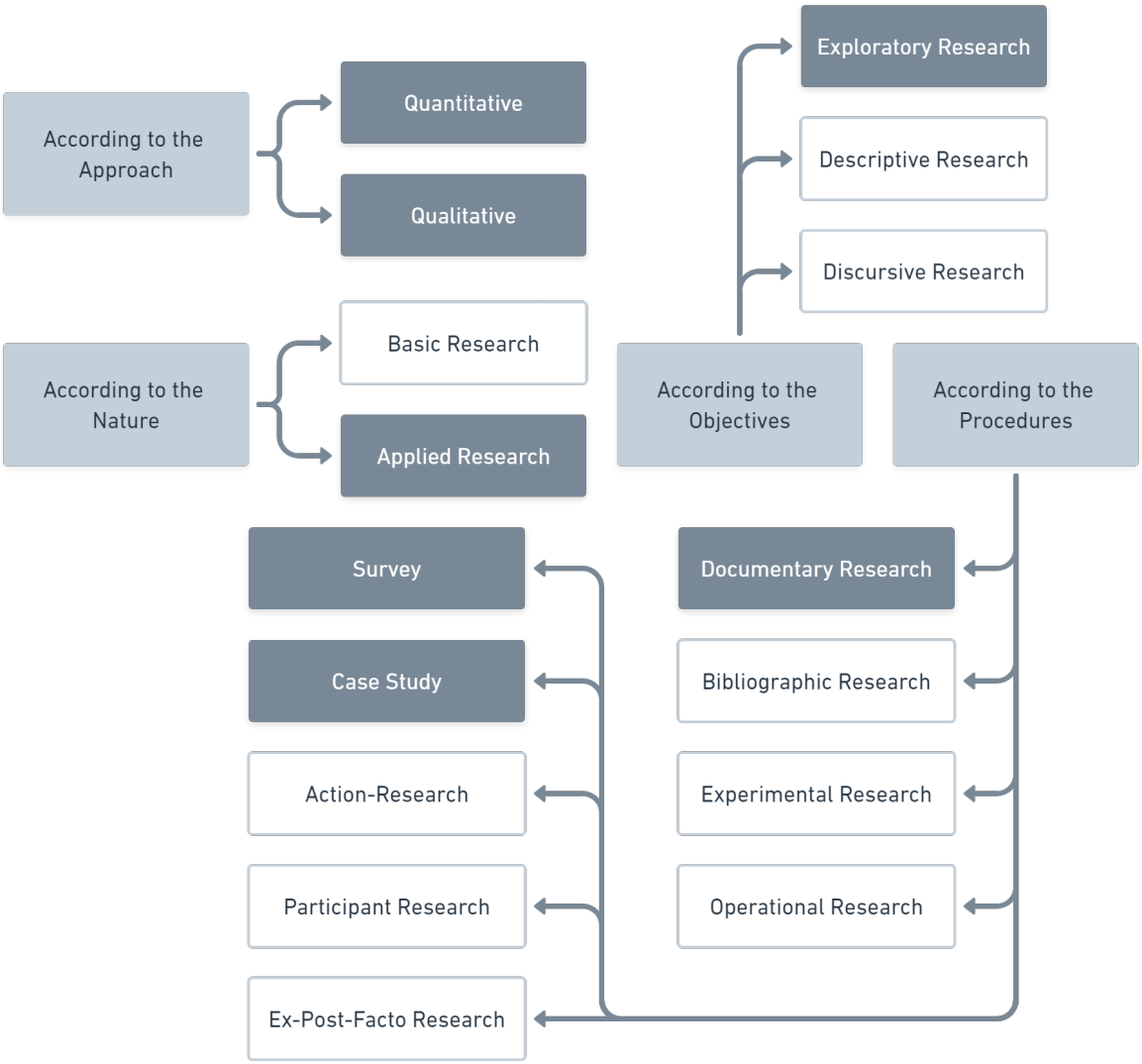
2.2 Research Classification

This research study is defined according to the classification created by Prodanov and Freitas (2013). It has multiple research types, each of which can be classified into several categories according to the nature, goals, approach and procedures of the study. Figure 1 shows how the research is categorized. The darker boxes represent categories which apply to this work. The terms in them are described in this section. The other boxes are kept for consistency with the original model.

Looking through the nature point of view, this is an **Applied Research**. It has the goal of generating knowledge to the solution of specific problems, through a practical application. It is related to local interests and often has a new process or product as a result.

From the objectives point of view, it is classified as an **Exploratory Research**, since one of its goals is to discover more information about what is being investigated, and maybe finding a new type of approach to the subject. This type of research generally takes the form of bibliographic research and **Case Studies**. The former doesn't apply to this study, though, because the final product won't be heavily inspired on white literature. Only the latter applies, because researches of this nature are more focused

Figure 1 – Research Classification



Source: Adapted from (PRODANOV; FREITAS, 2013).

on the immediate application of knowledge in a circumstantial reality, emphasizing the development of theories.

However, the product will certainly be inspired by grey literature, meaning it fits as a **Documentary Research**. It is similar to bibliographic research, but the main difference between them is the nature of their sources. While bibliographic research makes fundamental use of contributions from various authors on a given subject, documentary research is based on materials that have not yet received an analytical treatment or that can be reworked according to the research objectives.

According to the technical procedures, this research also features a **Survey**. They are much more suitable for descriptive rather than explanatory studies. They are inap-

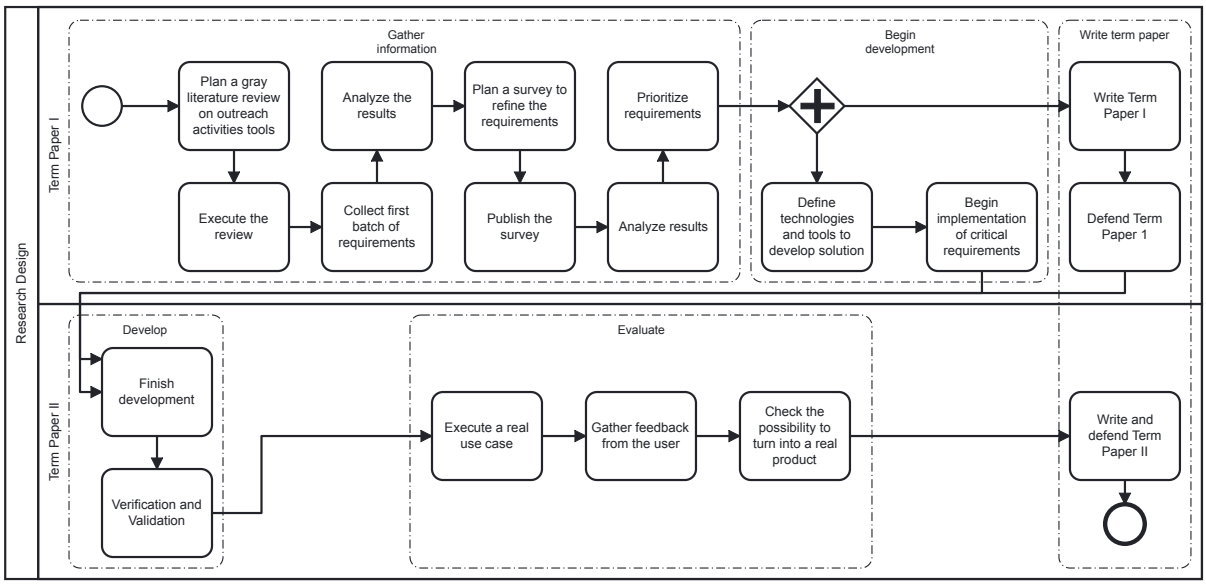
propriate for the deepening of more complex psychological and psychosocial aspects, but very effective for less delicate problems, for example, electoral preference and consumer behavior. The latter is much more aligned with this study than the former. Surveys are very useful for the study of opinions and attitudes, but little indicated in the study of problems referring to complex social structures. How this technique was applied in the scope of this work is described in detail in Chapter 5.

Through the approach point of view, the research is both **Quantitative**, meaning translating opinions and information into numbers to classify and analyze them. And also **Qualitative**, because some parts of the study can't be quantified, and must be understood subjectively. An example would be to receive written, detailed feedback from a target-user through the survey.

2.3 Research Design

In order to conduct the study correctly, a research design was created. The activities are grouped in five phases: (1) gather information; (2) begin development; (3) write term paper; (4) develop; (5) evaluate. They are all described in this section and can also be observed in Figure 2.

Figure 2 – Research Design



Source: Author.

The **gather information** group aims to create two tangible artifacts: the grey literature systematic review and the survey to better understand the scope of the goal product and most importantly collect a list of well defined requirements.

The **begin development** group is where the implementation and the term paper writing begins. This is where the technologies used throughout the development of the product are defined. The most important requirements should already be implemented as well.

Next, there is the **write term paper** group, in which both first and second term papers are going to be written and defended. It is important to notice that the first work will be written while the initial MVP implementation is on going.

Continuing to the next milestone, is the **develop** group, where it is planned to finish the product development. After that, in the **evaluate** group, is where the real use case will be ran, and the feedback from it, analyzed. If all goes well, the product might turn into a real solution, adopted by the university to be used.

2.4 Research Schedule

In order to have a clear vision of the steps required to run this study, a timeline was created describing what will be done by month until the expected ending of the research. Refer to Table 2 for the full overview of what was planned.

Table 2 – Research Schedule

Activities	2021/2	2022/1					2022/2				
	Nov - Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Plan and execute systematic review in the grey literature											
Plan and execute survey with target users											
Analyze results from previous steps and map requirements											
Plan and start tool development											
Write Term Paper I											
Defend Term Paper I											
Continue the development of the tool											
Execute a real use case on the tool											
Write Term Paper II											
Defend Term Paper II											

Source: Author.

2.5 Chapter Summary

This chapter provided an idea of how the methodology is defined for the study and how the research can be classified. In addition, the created research design was presented, showcasing the different planned processes for the future and those that have already been executed. Chapter 3 describes all the information and background necessary for the

success of this work, while also assisting the reader in better understanding the research methodology previously described.

3 BACKGROUND

In this chapter, information that complement the objective of the study are discussed, helping to understand the policies and resolutions involved. In Section 3.1 the national outreach activity policy will be presented, which is valid for all HEI in Brazil. It applies for each OA regarding its relation to the academic and external community. Soon after in Section 3.1.1 and Section 3.1.2 the vision of how both the Higher Education Community Institution (HECI) as a whole and Federal University of Pampa, respectively, adapted to receive these new rules is described. Afterwards, in Section 3.1.3 the differences between outreach programs and projects will be presented, followed by how new proposals are handled in Section 3.1.4. Then, a more detailed explanation about the "Unipampa Cidadã" project is described in Section 3.1.5. Section 3.2 showcases current available tools and solutions in the market which are related to the study goal product. Finally in Section 3.3 a general summary of the chapter is presented.

3.1 Outreach activities in Brazil

It is clear that participating in outreach activities has many benefits for the students who decide to take part in it (SELLOU; HARRISON; RIVETT, 2011). Besides promoting individual growth, the activities can also serve as a bridge connecting students and professors even more. In order to preserve them and encourage younger students to participate in them, the Forum of Pro-Rectors for Outreach of Brazilian Public Universities (FORPROEX), updated the old version of the National Outreach Policy document, published in 1999, with current situations and challenges encountered in recent years. In the new version of the document, (FORPROEX, 2012), some of its objectives are the following:

- Achieve the recognition of university outreach activities as an essential tool for the public university.
- Ensure that the outreach activity is the solution to any type of social problem faced by the country.
- Defend the funding of outreach programs and projects so that they can continue to function.
- Promote environmental and sustainable awareness in outreach projects in Brazil.
- Promote solidarity both nationally and internationally, covering the area of impact of outreach actions.

As a reference for directing and assisting Higher Education Community Institutions (HECI) to create their outreach policies, (FOREXT, 2013) also highlights the

importance of integrating outreach activities with research and teaching, along with discussions of a social nature and the effects of the results on society. The document proposes nine outreach activity types, which are as follows:

(1) Programs, Projects and Activities for the socialization of knowledge; (2) Outreach Courses; (3) Participation in Councils, Academic Events open to the external community: Congresses, Symposia, Seminars, Colloquiums, Course Weeks and related activities; (4) Promotions of Art, Culture, Sport and Leisure with the involvement of the external community; (5) Provision of Services, Consultancy and Advisory Services, Technological Extension, Mandatory Internships; (6) School Clinics; (7) Curricular Professional Practices; (8) Course subjects that include practices with external communities; (9) Research Projects, Course Completion Works, Monographs, Dissertations and Theses with methodologies and practices of social intervention with external communities.

3.1.1 Outreach Activity curricularization in Higher Education

In order to implement what was mentioned above in the HECI, the Brazilian Ministry of Education created the Resolution No. 7, of December 18, 2018, which establishes guidelines, principles, foundations and procedures for OAs in higher education. As such, it was regulated that OAs will be made available in the form of curricular components for the offered courses (SUPERIOR, 2018).

The document also determines that the outreach activities must comprise at least 10% (ten percent) of the total student curricular workload of undergraduate courses, and they must also be part of the curriculum of the courses (SUPERIOR, 2018, p. 2, art. 4). Another important discussed topic is about the self-assessment of OAs. The main reason for this is the constant improvement of the activity with teaching, research, student training, teacher qualification, the relationship with society, the participation of partners and other institutional academic dimensions.. This evaluation must include the following:

(a) How many curricular credits the activity can give; (b) How it contributes to the Institutional Development Plan and the Pedagogical Projects for the Courses; (c) The demonstration of the results achieved in relation to the participating public.

Each OA must also contain the planning of its internal activities, the strategies for self-assessment, proposal, development and conclusion. These must be duly recorded and analyzed in order to organize the activity work plans.

As a final note, the Resolution says that the higher education instutitions will have at most 3 (three) years, counting by the date the document was published, to implement what is being proposed.

3.1.2 Outreach Activity curricularization in Federal University of Pampa

In relation to Unipampa, as with other HECI, it must create a resolution aimed at standardizing outreach activities in general, presenting what they are, their target

audience and their objectives. And thus was born the CONSUNI/UNIPAMPA Resolution No. 332 of 2021, which determines the types of outreach activities, already mentioned earlier in the study, their managing bodies, executing team, possible related processes, and rules such as the minimum duration of 8 (eight) hours (PROEXT, 2021d).

As Unipampa highlights in the Resolution No. 317 of 2021, the main objectives in the insertion of outreach activities in undergraduate courses are the following (PROEXT, 2021c): (i) Help students develop their critical, civic, interdisciplinary and responsible education; (ii) Improve teaching in undergraduate courses as a whole and strengthen the inseparability between teaching, research and outreach; (iii) Strengthen Unipampa's social commitment; (iv) Stimulate constructive discussions in all sectors of Unipampa; (v) Promote actions that strengthen Unipampa's ethical principles and social commitment in all areas; (vi) Encourage the academic community to be more present in human, academic, social, cultural and economic development.

3.1.3 Outreach Programs and Projects

According to FOREXT (2013), Outreach Program and Projects are activities regulated by the institution that articulates events involving teaching and research, always involving the external community. With them students can make decisions directly about the community in which they live, contributing to their evolution and progress.

Viero (2012) describes the difference between programs and projects as follows: A project is a set of educative actions of social, cultural or technological nature, with a specific objective and determined deadline. An outreach program is a set of projects, which is preferably multidisciplinary and integrated with research and teaching activities.

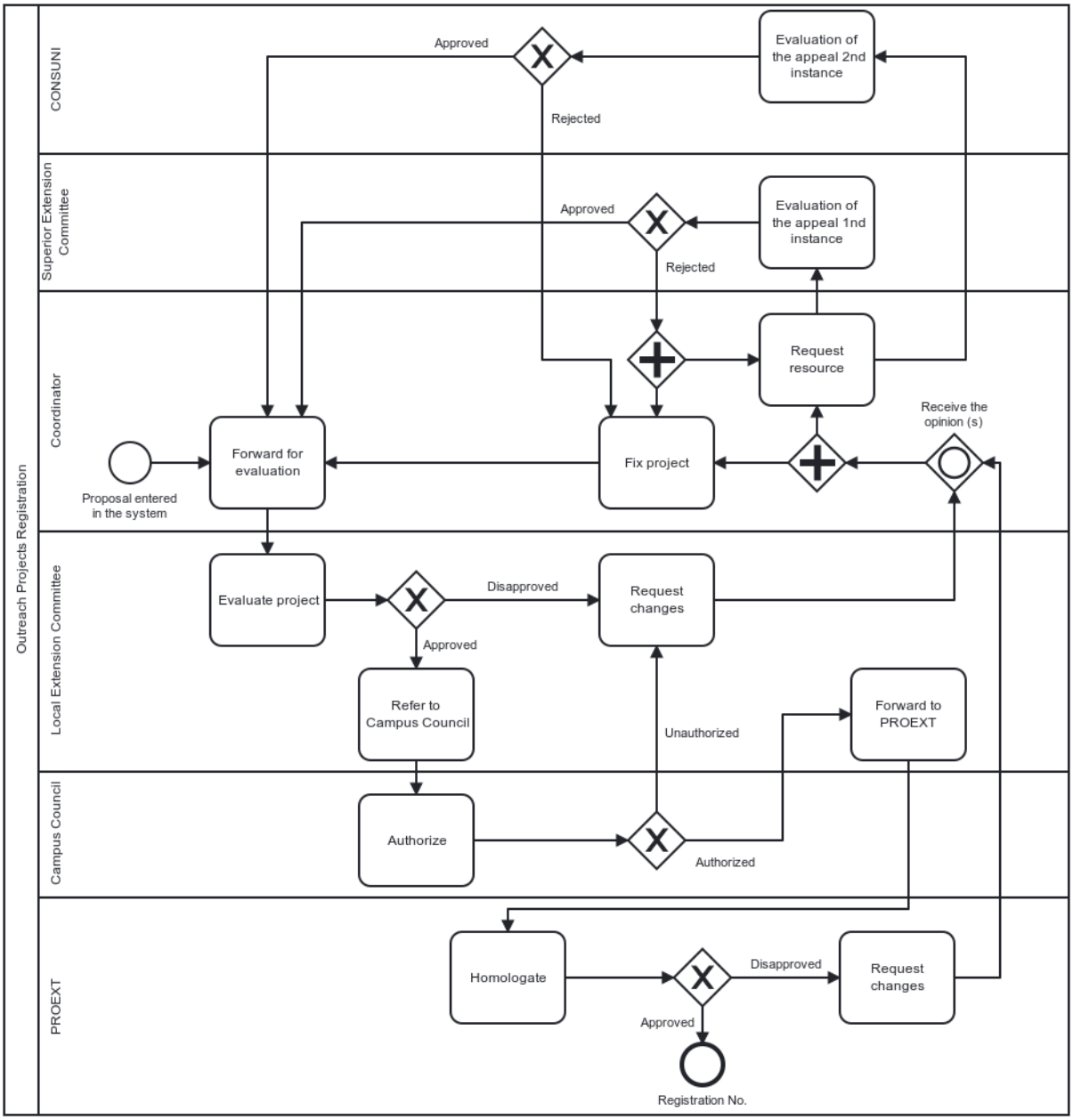
A good example of an outreach program is JEDI (2022), which, as mentioned earlier in Chapter 1, aims to solve local problems using technology and involvement with the community. In the first cycle of the program four outreach projects were proposed, each with its own objectives, methodologies and activities: (i) Padawan Academy; (ii) Jedi Apprentice; (iii) Jedi Problem-Solving; (iv) Jedi Mind.

3.1.4 Workflow for Outreach Activity Proposals

As briefly mentioned in Section 3.1.2, PROEXT (2021d) defines a few requirements which must be met before creating new outreach projects or programs. The Federal University of Pampa created a few workflow visualizations in order to better understand how the process works.

In Figure 3, the registration flow of a new outreach project is presented. It is possible to see that the proposal goes through several steps of corrections and evaluations, being sent to several actors throughout the whole process. Finally, the Dean of Outreach and Culture is the responsible entity to request final changes or approve the project, granting a new registration number.

Figure 3 – Outreach Projects Registration



Source: Adapted from (PROEXT, 2022).

In addition, Figure 4 presents the steps related to the approval and generation of certificates. Firstly, the proponent of the activity must have the presence list and spreadsheet with information for the generation of certificates. Afterwards, a final report is created and inserted into the Information System for Research, Teaching and Outreach Projects (SIPPEE) system. This report is then evaluated and approved, returning to PROEXT, who, with the information spreadsheet, sends this data to the Electronic Certificate Management System (SGCE) system, finally receiving the certificates and sending

them to participants' emails.

3.1.5 UNIPAMPA Cidadã

The Federal University of Pampa, through Normative Instruction No. 18 (PROEXT, 2021a), making use of Resolution No. 317, (PROEXT, 2021c), establishes the outreach project called "Unipampa Cidadã" (Unipampa Citizen). It must be offered by all courses, consisting of citizenship and solidarity activities and with the objective of forming graduates aware of their social responsibility, stimulating and increasing integration with the local community.

After the implementation of the project in the institution's courses, the subject offered for the project must be at least 60 and at most 120 hours, and is required to be taken by all students. The community actions must be carried out in public institutions, Non-governmental organizations and organizations or organized civil society associations. The course outreach supervisor is the one in charge of making the evaluation, planning, monitoring and validation of the project, as well as defining the beginning of the activities.

The project also describes in Normative Instruction No. 18 a form that must be filled when activities are finished. This way, the student will be able to reflect on the impact of the project under his vision, pointing out what he learned during the project's execution. The supervisor can make observations on the student and indicate if he has been approved or not.

3.2 Similar Tools

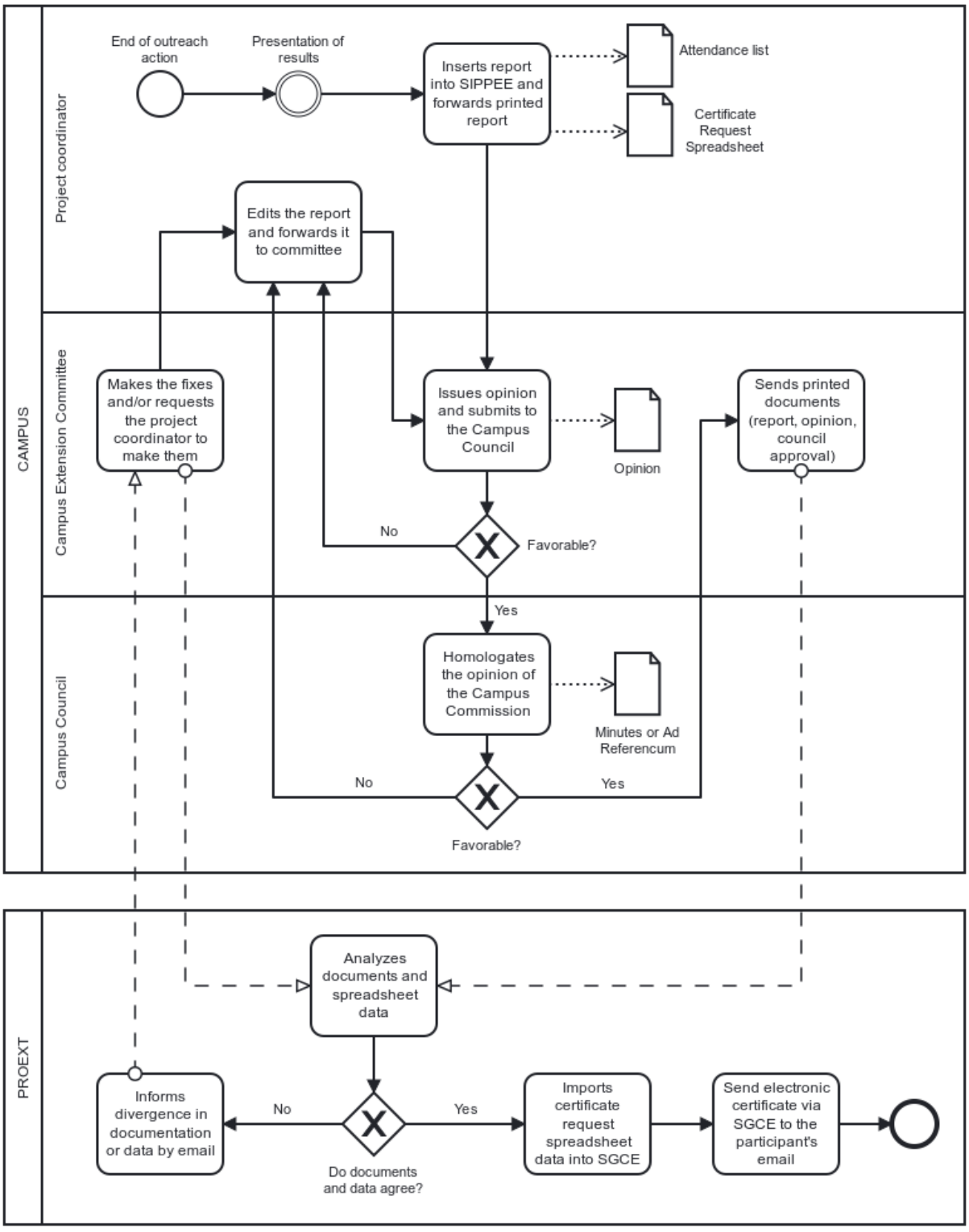
As Chapter 4 will later present in more detail the systematic review performed in the grey literature, a research has been done to collect tools related to outreach activities which are available currently in the market. With the results it was possible to list features, details and common points among the tools.

A lot of interesting and different results were found and analyzed, generating artifacts and describing all the cool and unique features each of them had. During the review, the tool that returned the most results and was always present in the search results, was Integrated Academic Activities Management System (SIGAA). However, its scope reaches way beyond just managing outreach activities. It contains features for most processes present in an institution. Another that presented interesting results was Outreach Actions Control (CAEX), which had several unique features. Overall, it was possible to retrieve ideas of great importance and find inspiration to build a new related product.

3.3 Chapter Summary

This chapter presented guidelines of several resolutions and normatives related to outreach, both in the country as a whole, and in the Federal University of Pampa. It was also discussed about the similarities and differences between the outreach programs and projects, presenting the most relevant processes involved in their lifecycle. As a recent example of an outreach program, "Unipampa Cidadã" (Unipampa Citizen) had part of its objectives and guidelines presented. Finally, it was also discussed a little about the systematic review in the grey literature and the similar tools found. The next chapter aims to discuss more about criteria, methodology, results, research questions, and other relevant information related to the grey literature systematic review.

Figure 4 – Issuance of Certificates



Source: Adapted from (PROEXT, 2022).

4 GREY LITERATURE SYSTEMATIC REVIEW

Since the final outcome of this research is a software product, a systematic review of the grey literature - to map and evaluate existing tools and solutions that already solve the problem of managing outreach activities in the context of HEI - would be of great value before starting the development of the solution itself. The review was conducted by two authors. As previously mentioned, there are two term papers, written individually, but the artifacts created to support the study were made in conjunction.

This chapter reports the systematic review carried out in the grey literature. In addition, information relevant to the development of the goal product, obtained through the research, will also be presented. The protocol defined to conduct the review will be discussed, citing points such as research questions, inclusion and exclusion criteria, extracted data and search strings, in addition to detailed analysis and comparisons of the selected tools.

The chapter is organized as follows: Section 4.1 introduces terms and concepts used during the study. In Section 4.2, the protocol defined by the authors will be presented. How the research was conducted, together with the data collected to answer the research questions will be described in Section 4.3 and Section 4.4 discusses threats to the validity of the study. Finally, Section 4.5 completes the systematic review.

4.1 Background

Grey literature is defined by the following quote from Garousi, Felderer, and Mäntylä (2019, p. 2):

> <grey literature> is produced at all levels of government, academia, business, and industry in print and electronic formats, but is not controlled by commercial publishers, or that is, where publication is not the main activity of the producing body.

The term “black box” refers to the quality of software where the internal mechanisms of the system are not known; its use only focuses on outputs generated in response to selected inputs and execution conditions Nidhra and Dondeti (2012). This term was used in the context of the Google search engine, where it is not known exactly what happens internally, only that sometimes the results vary minimally, even though the search string remains the same.

4.2 Planning

The authors decided that it would be more interesting and add more value to the study if a systematic review was carried out in the grey literature instead of in the white literature, due to the little content of formal works published on the outreach activities management topic.

4.2.1 Reasons for Carrying out the Review

The main reasons to include a grey literature in review in the study by the authors were the following: (i) More search results for tools instead of formal articles; (ii) Running the search strings on white literature returned very few results; (iii) Several tools and solutions do not have published articles; (iv) By searching for tools, the authors hope to find functionality ideas and inspiration for the development of the goal product itself.

In Table 3 are the questions used in the decision to carry out the review of the grey literature and their answers. In addition, the objectives defined for carrying out the review were:

(i) Find free tools that partially support academic management; (ii) Find features in existing tools; (iii) Validate ideas for features and data that will be used in the solution.

Table 3 – Questions for Inclusion of Grey Literature

Question	Answer
Is the subject "complex" and insoluble considering only the formal literature?	No
Is there a lack of volume or quality of evidence, or lack of consensus on outcome measurement in the formal literature?	Yes
Is contextual information important to the subject under study?	Yes
Is the objective to validate or corroborate scientific results with practical experiences?	No
Is the aim to challenge assumptions or falsify results of practice using academic research or vice versa?	No
Would a synthesis of insights and evidence from the industrial and academic-community be useful to one or even both communities?	Yes
Is there a large volume of professional sources that indicate high professional interest in a topic?	Yes

Source: Adapted from Garousi, Felderer, and Mäntylä (2019).

4.2.2 Research Questions

In Table 4 are presented the research questions defined by the authors to be answered with the systematic review.

Table 4 – Research Questions

ID	Question
RQ 1.	What tools currently exist that perform academic management?
RQ 1.1.	Which ones have related functionality or support outreach activities?
RQ 1.2.	What are the features offered by these tools?
RQ 1.3.	What are the most common features between this type of tool?
RQ 1.4.	What data do the tools use in relation to activities, participant registration and user registration?

Source: Author.

4.2.3 Search Strings

The search strings were created after adapting the methodology used in (GODIN et al., 2015). First, search terms were created, using keywords such as **extensão** (outreach), **programa** (program), **projeto** (project), **gerenciamento** (management) and **atividade** (activity).

Furthermore, due to the scope being limited to outreach activities in Brazilian universities, the site filter provided by the search engine used "site:.edu.br" was initially used, meaning that only sites whose domain included the specified ending would be shown. However, it was later realized that it was better to remove the filter as some private universities do not have .edu in their domain.

Ultimately, the authors came up with ten search strings in total, with seven of them using the combination of the terms "**extensão** (**programa** | **projeto**)", which were defined as the most relevant terms. With each string, a limit was set to use only the first ten pages returned by the search engine, resulting in one hundred records per string and, consequently, one thousand records in total.

The keyword "SIGAA" was removed after the first search because it is a tool used by many public universities Graças Vieira and Machado (2013), which cluttered the results with essentially the same record, potentially hiding other solutions. The defined strings are presented in Table 5.

Table 5 – Search Strings

No.	Search String
1	sistema gestão acadêmicas (atividades | projetos) site:.edu.br
2	(sistema | ferramenta) gestão acadêmicas (atividades | projetos) extensão site:.edu.br -SIGAA
3	(ferramenta | aplicação) extensão (programa | projeto) (gestão | gerenciamento) -SIGAA
4	(app | aplicativo) extensão (programa | projeto) (administração | gerência) -SIGAA
5	ferramenta extensão (programa | projeto) (gestão | gerência) -SIGAA
6	(ferramenta | aplicação | app | aplicativo) extensão (programa | projeto) gestão -SIGAA
7	software extensão (programa | projeto) (gerência | gestão | controle) -SIGAA
8	(software | ferramenta | aplicação) extensão atividade -SIGAA
9	sistema extensão (projeto | programa | atividade) gestão -SIGAA
10	acadêmica extensão (projeto | programa | atividade) -SIGAA

Source: Author.

The search for the strings itself was performed on the Google search engine.

4.2.4 Inclusion Criteria

The elaboration of the inclusion criteria took place in two stages. Due to the large number of institutional sites that were just catalogs of outreach activities, in the first stage the authors applied a filter to differentiate tools from catalogs. To be included, the result should include at least three of the following criteria: (a) User login; (b) Registration of activities; (c) Activity listing; (d) Possibility of signing up for outreach activities.

After filtering the results with the criteria established above, step 2 was applied. In it, the criteria defined for inclusion were more rigorous. They are presented in Table 6:

Table 6 – Inclusion Criteria

ID	Inclusion Criteria
IC 1.	The tool or website supports the management of outreach activities.
IC 2.	The tool or website has a stable version.
IC 3.	If it is a tool, it must have documentation.

Source: Author.

4.2.5 Exclusion Criteria

In addition to applying the inclusion criteria, exclusion criteria were also defined, in which any result that fit only one of them was automatically excluded from the review. Initially, the authors defined a total of 6 criteria, however, after alignments with the advisor, it was realized that two of them were unnecessary. The rest, which were applied to the results, are displayed in Table 7.

Table 7 – Exclusion Criteria

ID	Exclusion Criteria
EC 1.	If it is a tool, it does not have a source code download or an online page.
EC 2.	The tool or the website has not received updates for more than 10 years.
EC 3.	The tool or website is for the exclusive use of the organization, that is, closed to the external public.
EC 4.	The tool or website is paid and does not provide a trial version or all outreach activities are paid.

Source: Author.

4.2.6 Quality Criteria

To assess the quality of the tools that passed the inclusion and exclusion criteria, five quality criteria were defined that are focused on characteristics considered important within a tool and how it stands out from the others. To quantify the scores for each criterion, the scale used in the article by Iung et al. (2020) was adapted, being: (i) **Y**es: 1.0; (ii) **P**artially: 0.5; (iii) **N**o: 0. The defined criteria are presented in Table 8.

4.2.7 Data Extraction Strategy

In order to answer the defined research questions (Table 4), after the final list of tools is selected, a manual data extraction is carried out. Initially, we seek all the functionalities related to OA that the tool provides, generating a matrix with the data. There, all the different functionalities found between the results are listed. More about the matrix is presented later on in Section 4.3.2.1.

Table 8 – Quality Criteria

ID	Quality Criteria	Score		
		Yes (1)	**Partial (0.5)**	**No (0)**
QC 1.	Does the tool use a relevant amount of data related to outreach activities?	The tool uses >=20	10 - 19	10 pieces of information
QC 2.	Does the tool have unique features among the selected tools?	The tool has 1	1	No unique features
QC 3.	Does the tool have a relevant amount of features among those collected?	The tool has >=14	9-13	8 features in common with other tools
QC 4.	Does the tool have specialized support?	Yes	Partially	No
QC 5.	Has the tool been maintained frequently?	The last update was in 2022	2021-2019	2018 and before

Source: Author.

Afterwards, the first four most relevant features in common with all the analyzed tools were highlighted and a new manual extraction was performed. Now with the purpose to find all the features these solutions had. With this data refined and tabulated, it becomes much easier to solve similar problems that will eventually arise when developing the goal product.

4.3 Reporting

The search and record mapping was carried out between 17/02/2022 and 20/02/2022, with the objective of starting and ending in close dates, thus reducing one of the threats to validity.

4.3.1 Research

The total workload was split equally between both authors. This way, each analyzed five of the ten pages by string, totaling fifty results by search string and five hundred in total, by author. Initially, 169 results were collected, as shown in Table 9.

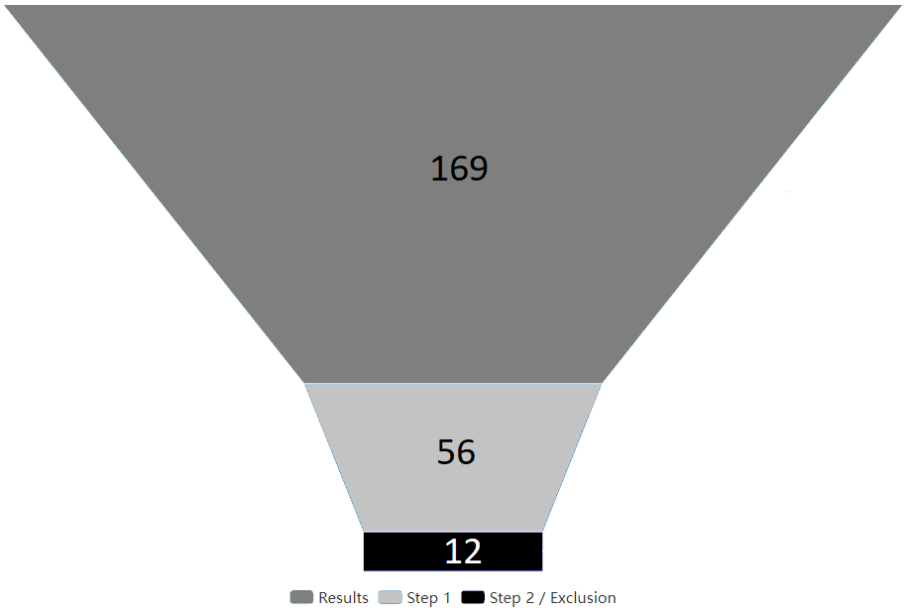
After applying the first step of the inclusion criteria, 56 results were left. Subsequently, the verification with the second stage of the inclusion and exclusion criteria was carried out, which further reduced the results, with 19 tools failing **IC 1.**, 8 did not pass **IC 2.** and 24 tools were denied for not passing **IC 3.**. As for the exclusion criteria, only one tool was removed by **EC 1.** and also only one by **EC 2.**, however on **EC 3.**, 14 tools did not pass and the same amount occurred for **EC 4.** Thus, there were only 12 tools and websites left to be evaluated, as shown in Figure 5.

Table 9 – Search Results

No.	Search String	Evaluated Results	Potential New Tools	Total
1	sistema gestão acadêmicas (atividades | projetos) site:.edu.br	100 out of ∼1.250.000	4	4
2	(sistema | ferramenta) gestão acadêmicas (atividades | projetos) extensão site:.edu.br -SIGAA	100 out of ∼182.000	11	15
3	(ferramenta | aplicação) extensão (programa | projeto) (gestão | gerenciamento) -SIGAA	100 out of ∼15.600.000	9	24
4	(app | aplicativo) extensão (programa | projeto) (administração | gerência) -SIGAA	100 out of ∼7.140.000	13	37
5	ferramenta extensão (programa | projeto) (gestão | gerência) -SIGAA	100 out of ∼11.000.000	27	64
6	(ferramenta | aplicação | app | aplicativo) extensão (programa | projeto) gestão -SIGAA	100 out of ∼22.500.000	15	79
7	software extensão (programa | projeto) (gerência | gestão | controle) -SIGAA	100 out of ∼8.300.000	24	103
8	(software | ferramenta | aplicação) extensão atividade -SIGAA	100 out of ∼30.900.000	10	113
9	sistema extensão (projeto | programa | atividade) gestão -SIGAA	100 out of ∼26.400.000	30	143
10	acadêmica extensão (projeto | programa | atividade) -SIGAA	100 out of ∼17.000.000	26	169

Source: Author.

Figure 5 – Results x Criteria



Source: Author.

4.3.2 Data Extraction

In this section, it will be presented how the two data extractions from the found tools were performed, one for the feature matrix and another to retrieve more information on the most important features in common between the tools.

4.3.2.1 Feature Matrix

After the research was carried out, in order to apply the quality criteria, it was necessary to create a matrix of functionalities among the filtered results. In this way, the authors were able to understand which features are present most frequently among the evaluated tools. A total of 37 features were found, some repeating themselves more than others. The matrix can be seen in Figure 6.

The most common features among all the evaluated tools and websites were highlighted in lighter grey, so that they could be used as criteria in the next phase of data extraction.

4.3.2.2 More Information from Important Features

In the second data extraction, the objective was to identify which information was used in the (i) Listing of outreach activities; (ii) Detailed page of an activity; (iii) Enrollment of a participant into an activity; (iv) Registration of users external to the institution.

Because each tool has its own attribute naming and its own format, it was difficult to standardize the analysis, so the original names were kept. Tools that did not have the selected features have been highlighted in grey instead of leaving the cells in blank, to avoid confusion. The extracted results are written in an informal way precisely because it was almost impossible to try to follow a pattern for all the tools. The extracted data can be seen in Figure 7.

4.3.3 Tool Classification

Once all the data had been extracted and tabulated, it was possible to classify the tools using the previously defined quality criteria. 0 (zero) is the minimum and 5 (five) is the maximum score for a tool. The final results obtained are displayed in Table 10.

With this classification, it is easy to see that the CAEX tool and SIGAA achieved the highest grades, and this was really the expected result. First because SIGAA is one of the most used academic management tools by institutions in the country and CAEX is the tool that presented the most unique features. Thus, being two tools with great potential and that contributed a lot in the acquisition of information to build the goal product.

Figure 6 – Feature Matrix

		Tools											
		Cachalote	**CAEX**	**Einstein**	**ENS**	**Santa Marcelina**	**SGE**	**SIEX**	**SIG**	**SIGAA**	**Suap**	**UNINASSAU**	**UNINTER**
Features	System login	X	X	X	X	X	X		X	X	X	X	X
	Outreach activity listing	X	X	X	X	X	X	X	X	X	X	X	X
	Issuance of certificates	X	X						X	X		X	X
	Certificate validation	X	X				X		X	X	X		
	Application for activity evaluator	X									X		
	Event details page	X	X	X	X	X	X	X	X	X	X	X	X
	Event enrollment	X	X	X	X	X	X		X	X	X	X	X
	Detailed schedule	X					X		X	X	X		X
	Event query with filter		X	X	X		X	X	X	X		X	X
	Calendar view		X								X		
	External user registration	X	X	X	X	X	X		X	X		X	X
	Registration of interest in areas of knowledge		X	X									
	Discussion forums by event		X										
	Attendance recording - MGMT		X										
	Proposals for new events - MGMT		X										
	Task evaluation environment - MGMT	X	X										
	Transform proposals into events - MGMT		X										
	Manage submissions - MGMT		X										
	Enable certificates - MGMT		X										
	Fill in the final report - MGMT		X										
	Responsible teacher details		X	X	X					X			X
	List of events by teacher			X						X			
	Favorite events			X									
	Text event search	X		X		X	X	X	X	X			X
	Application of interest (when applications are not open)				X								
	Registration of event prerequisites				X								
	Enrollment form without login				X						X		
	Related events				X	X		X	X				
	Print enrollment status						X						
	Edit enrollment		X				X		X	X			
	Print event information							X					
	History of past versions of the event							X				X	
	Teacher's notes									X			
	Logged user event listing		X	X			X		X	X		X	X
	Logged user event history		X				X		X	X		X	X
	Help area (frequently asked questions, manuals)	X		X			X		X		X		X
	Testimonials from past participants				X								
	Sum of features	**12**	**22**	**13**	**12**	**7**	**14**	**7**	**15**	**16**	**10**	**10**	**13**

Source: Author.

4.3.4 Answering the Research Questions

Table 4 contains the research questions and was presented earlier in the study. However, each question is also described below, for the sake of convenience.

- **RQ 1.** What tools currently exist that perform academic management?

  This is a question that in general also covers some tools that were removed in the application of inclusion and exclusion criteria. In this case 36 tools were found that supported academic management of some nature, but those that pass the criteria established, are listed in the tool matrix in Figure 6, totaling 12 tools.

- **RQ 1.1.** Which ones have related functionality or support outreach activities?

Figure 7 – Additional Information Extraction

		Features			
		Listing of outreach activities	**Detailed page of an activity**	**Enrollment of a participant into an activity**	**Registration of users external to the institution**
Tools	**Cachalote**	Image and title, duration, location, "Learn More" button.	Activity image, description, duration, location, contact phone, contact email, enrollment period and detailed schedule.	Description of the participant's disability, if any.	Name, username, email and password.
	CAEX	Title, duration, enrollment period and "Learn More" button.	Presentation of the activity, general objective, justification, beneficiary, "I want to register" button .	**Step 1**: Choose the activity; **Step 2**: Education, course, institution, scholarship holder?, funder, occupation, place of work; **Step 3**: Select which sub-activities you want to participate in; **Step 4**: Review completed information, confirm.	CPF, name, category, date of birth, sex, place of birth, nationality, marital status, password.
	Einstein	Image, category, title, "Learn More" button.	About, objectives and qualifications, student profile, program and methodology, faculty, FAQs, target audience, period, investment.	Select class, payment information.	Email
	ENS	Image, title, start date, "Learn More" button.	About, content, modality, validity, duration in hours, contact information, prerequisites, investment, faculty, testimonials from participants, related courses.	**Step 1**: Entry form, CPF, name, email, telephone; **Step 2**: Course, location, modality; **Step 3**: Personal data, CPF, name, email, telephone, gender, education level, address; **Step 4**: Review of information; **Step 5**: Payment if necessary; **Step 6**: Conclusion.	User-related data used in event registration
	Santa Marcelina	Image, title, brief description.	Link to application form, presentation, target audience, faculty, contact, related activities.	Desired activity, full name, email, date of birth, RG, CPF, telephone number, address, do you have a link with the institution?, how did you find out about the activity?	User-related data used in event registration
	SGE	Image, title, enrollment period, short description, "Learn More" button.	About, validity, certification, modality, transmission platform, target audience, faculty, schedule.	Select which event activities you want to participate in.	Name, nationality, CPF, gender, type of participant, telephone, institution, email, password.
	SIEX	Registration number, type (project, program...), title, unit, department, coordinator, status, functionality to print.	**Description**: Activity data, characterization (year it started, unit, linked program, extension line, knowledge area, keywords, thematic area). **Full description**: Presentation and justification, general objectives, specific objectives, methodology, evaluation method, website, internal or external target audience, characterization of the target audience. **Plans**: Activity plans, monitoring and guidance plan, evaluation process. **Specific information**: Physical infrastructure, link with teaching?, link with research?, estimated public. **Additional information**: Faculty (Position of participation, name, telephone, email, unit, department, period of work). **Partner institutions**: CNPJ, name, characterization, type. **Scope**: Name, state, county, zip code, details. **Linked activities**: Type, registration number, title, status. **Results achieved**: Specific results, general results. **Productions**: Type, title, date of publication/delivery of the product, identification/reference. **History**: Name of the activity along with the date it was performed, Print PDF Review Information.		
	SIG	Title, type, details, schedule, enrollment.	**Activity data**: Type, title, description, free?, total workload, total vacancies, scope, thematic area, knowledge area, classification, promoting unit, coordinator. **Period**: Start date/time, End date/time. **Contacts**: Phone, email, website, registration period.	Just subscribe button after being logged in.	**Access data**: Email. **Personal data**: Name, gender, date of birth, marital status, nationality. **Documents**: CPF, passport, RG, address. **Professional data**: Academic degree, training, institution that obtained the highest degree, institution where you work. **Contacts**: Phone, cell phone.
	SIGAA	Year, title, type, department.	Title, year, no. of scholarships awarded, no. number of students involved, estimated audience, period, main area, CNPq area, proposing unit, units involved, type, cities where it will be held, spaces where it will be held, source of funding, workload, number of vacancies, person responsible for the action, email of the person responsible , url, summary, schedule, internal target audience, external target audience, team members (name, role, category (faculty, student)), photo list, enroll button.	**Activity data**: Title, coordinator, remaining vacancies, proposing unit, instructions, general information. **Completed by the participant**: Link (institution), file if necessary (file description).	Personal data: CPF, RG, name, date of birth, address, contact (phone, cell phone), authentication (email, password).
	Suap	Title, description, enrollment period	Title, presentation, workload, location, start of registration, end of registration, start, end.	Name, email, telephone, CPF, profile (student, external audience).	
	UNINASSAU	Title, category (lecture, personal development...).	Start date, end date, category, image, summary, location. **Activities**: Title, number of vacancies, deadline for registration, period, location, menu, schedule, bibliography.	Vacancies, workload, investment, discount, final value, completion period, user clicks "Finish".	CPF, name, email, address, cell phone, password.
	UNINTER	Image, title, price, add to cart button.	Date, description, realization, target audience, curriculum structure, certification criteria, faculty, sub-activities, how it works.	Add to cart and checkout.	Name, CPF, RG, date of birth, gender, email, cell phone, telephone, address.

Source: Author.

As it was already shown in Figure 6, which describes the relations between tools and features, the following tools were discovered: (1) Cachalote; (2) CAEX; (3) Einstein; (4) ENS; (5) Santa Marcelina; (6) SGE; (7) SIEX; (8) SIG; (9) SIGAA; (10) SUAP; (11) UNINASSAU and (12) UNINTER.

- **RQ 1.2.** What are the features offered by these tools?

  All the features found were listed in the features matrix, present in Figure 6, with a total of 37 features.

Table 10 – Quality Criteria Evaluation

		Quality Criteria										
		QC 1.		QC 2.		QC 3.		QC 4.		QC 5.		Final
		Ans.	Score	Ans.	Score	Ans.	Score	Ans.	Score	Ans.	Score	Results
Tools	**Cachalote**	9	0,0	No	0,0	12	0,5	Partially	0,5	2021	0,5	1,5
	CAEX	4	0,0	7	1,0	22	1,0	Yes	1,0	2022	1,0	4,0
	Einstein	12	0,5	1	0,5	13	0,5	Partially	0,5	2022	1,0	3,0
	ENS	11	0,5	3	1,0	12	0,5	Partially	0,5	2022	1,0	3,5
	Santa Marcelina	6	0,0	No	0,0	7	0,0	Partially	0,5	2022	1,0	1,5
	SGE	8	0,0	1	0,5	14	1,0	Yes	1,0	2016	0,0	2,5
	SIEX	53	1,0	1	0,5	7	0,0	Yes	1,0	2022	1,0	3,5
	SIG	18	0,5	No	0,0	15	1,0	Partially	0,5	2022	1,0	3,0
	SIGAA	28	1,0	1	0,5	16	1,0	Yes	1,0	2022	1,0	4,5
	Suap	8	0,0	No	0,0	10	0,5	Yes	1,0	2022	1,0	2,5
	UNINASSAU	14	0,5	No	0,0	10	0,5	Partially	0,5	2022	1,0	2,5
	UNINTER	9	0,0	No	0,0	13	0,5	Partially	0,5	2022	1,0	2,0

Source: Author.

- **RQ 1.3.** What are the most common features between this type of tool?

  The most common functionalities in this type of tool are: (i) A login system; (ii) Lististing of Outreach Activities; (iii) OA details page; (iv) OA enrollment and (v) Registration of external users. There is another feature that appears frequently but not as much as the others: the search for events by text, with 8 of the tools found implementing this functionality.

- **RQ 1.4.** What data do the tools use in relation to activities, participant registration and user registration?

  By analyzing the second data extraction presented in Section 4.3.2.2, the most common fields for OAs are: (a) Title; (b) Duration; (c) Enrollment period; (d) Contact information; (e) Description; (f) Target audience; (g) Faculty and (h) Schedule.

  Regarding enrollment, the most common fields found are: (a) Participant's personal data; (b) Institutional affiliation; (c) Participant type and (d) Information about the participant's disability, if any.

  When it comes to user registration, basically personal data, authentication data and address are the most used by these tools, others also ask for information about the institution, type of participant and professional data.

4.4 Validity

During the stages of the systematic review mapping, some threats to validity were identified. Most of them the authors were able to minimize, but others remain unresolved. They are as follows:

- During the research stage, the authors noticed that the search results varied minimally, between one or two different records when comparing the results they both

obtained. It was an easy threat to mitigate, but it couldn't be completely ruled out. The strategy used was to log out of the account logged into the browser and perform the search in anonymous mode. This ended up reducing the number of divergences, but there were still cases of different results.

- Lack of validation of functionalities with the developers of the tools found. Unfortunately, the authors were unsuccessful in contacting any universities regarding the management solution being used.

- Related to conducting the research, in order to minimize the divergence of results, the authors tried to conduct the search in the shortest possible time, starting and completing it in just three days. If the delay was longer, there would be an increasing opportunity to bring threats to the study, as the search engine is considered a "black box", making it difficult to predict the exact results that will come with each search string.

4.5 Considerations

Through this systematic review of the grey literature, it was possible to find tools similar to what the goal product of the whole study should be. Before conducting the review, there was no idea of the current state of the area and of which solutions are most widely used by Brazilian HEI.

A lot of valuable information about tools being used today was collected. The scope of Outreach Activities management and processes was now much clearer. This knowledge will make a difference when implementing the goal product, which aims to be an all around solution for OA administration.

Also, all research questions that were previously defined in the review protocol could be answered.

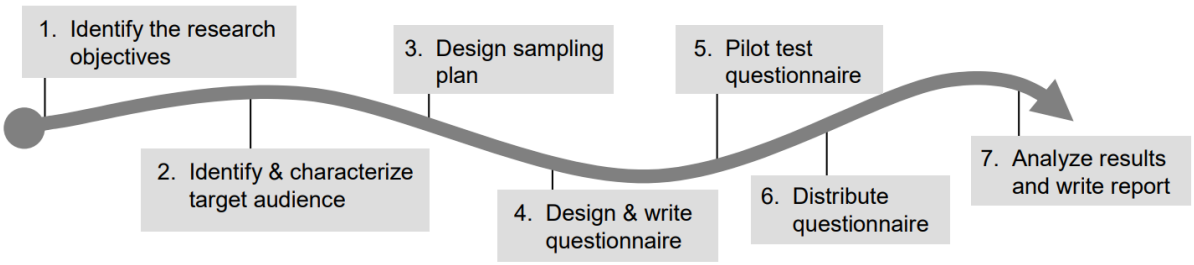
5 SURVEY

In this chapter, more detailed information is presented about the survey that was conducted. Similar to the previous chapter, which talks about the grey literature systematic review, the survey was also a joined effort work between two authors. The tasks on which each was responsible will be described later. Section 5.1, presents details about the protocol created, author of reference and division of tasks among the researchers. Afterwards, in Section 5.2, threats to the validity of the study are reported. Finally, Section 5.3, presents all results achieved during execution.

5.1 Survey Protocol

According to Kasunic (2005), a survey is an approach to data collection and analysis in which participants answer questions or statements that were developed in advance. The protocol chosen for the elaboration of this study was also inspired by the guidelines proposed by the author and is illustrated in Figure 8.

Figure 8 – Seven Steps of the Research Process



Source: (KASUNIC, 2005).

As will be described in more detail later, the objective is to understand the needs of students and teachers in relation to projects and outreach activities. The choice of a survey as a data collection approach is due to the fact that according to Kasunic (2005), the characteristics of such a research allows us to generalize about the beliefs and opinions of many people studying only a subset of them. Which is the perfect fit for this study.

Given that this research was performed by two students, the effort was divided equally, so that quality and performance were improved. Table 11 describes the division of activities created by the authors and also already includes those defined by Kasunic (2005).

Table 11 – Tasks Separation

Activity	Responsibility
Define and document research objectives	Lucas F.
Define and document research questions	Lucas F.
Define and document how research results will be used	Lucas F.
Define the appropriate target audience for the research	Igor C.
Determine the appropriate media to apply the research in	Igor C.
Recruit members of the target audience to participate in pilot test	Igor C.
Breakdown research questions into questionnaire topics	Lucas F.
Organize and sequence questions	Lucas F.
Review the questionnaire based on the pilot test	Igor C. and Lucas F.
Perform the pilot test	Igor C. and Lucas F.
Evaluate comments	Igor C. and Lucas F.
Perform final corrections before the distribution of the questionnaire	Lucas F.
Questionnaire ready for distribution	
Distribute questionnaires	Lucas F.
Monitor answers	Igor C. and Lucas F.
Send reminders	Igor C.
Questionnaire response deadline	
Perform analysis	Igor C. and Lucas F.
Write draft report	Igor C.
Revise draft	Igor C. and Lucas F.
Perform the final corrections	Igor C. and Lucas F.

5.1.1 Identify the Research Objectives

The point of having well defined research objectives, as Kasunic (2005) presents, is to increase the odds of executing a successful questionnaire. Through the results generated by the grey literature systematic review, mentioned earlier in Chapter 4, it was possible to elaborate questions so that the participant informs, in his view, the importance of a certain requirement. This survey aims to order by priority and refine the elicited requirements, using the individual opinion the target audience.

In addition to being asked the participants' opinion, they were also allowed to provide long written feedbacks and suggestions or improvements to each of the presented requirements. Since one of the objectives of the survey was to refine existing requirements, enabling the users to describe their thoughts in more detail allowed the authors to identify underlying issues that would otherwise go unnoticed.

5.1.2 Identify and Characterize the Target Audience

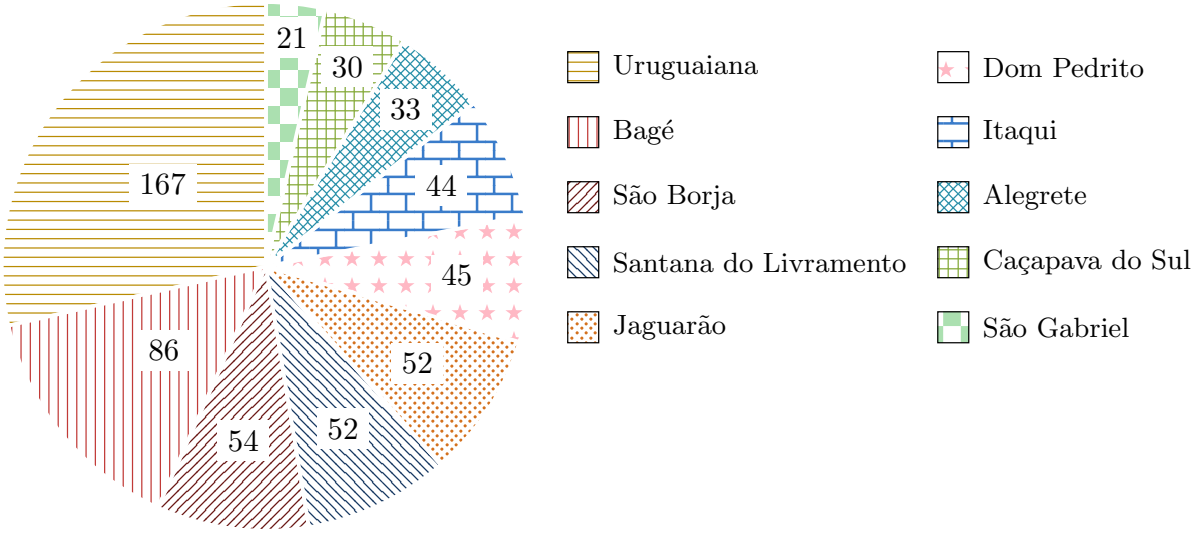
In this stage, an analysis is made to identify possible target groups and to properly select the one that best fits with the research. The population is also defined, and is composed by the academic community as a whole. To represent the population sample, the outreach program and project coordinators, teachers and students, with a preference for participants who have experience with outreach activities, were chosen.

5.1.3 Design the Sampling Plan

According to Kasunic (2005), the purpose of this phase is to determine the following topics: (i) How individuals will be selected to participate in the survey; (ii) The required size of the sample.

In order to select individuals to participate in the research, emails were sent to the Academic Secretariat of the Unipampa campuses, targeted to students and lists of outreach programs and projects coordinators. As expected, Uruguaiana and Bagé campuses, which executed the most outreach activities in 2021 (PROEXT, 2021b), as seen in Figure 9, were the ones who provided the most respondents to the questionnaire.

Figure 9 – Number of Projects Contemplated in the Internal Public Notices



Source: Adapted from PROEXT (2021b)

Besides all quantitative answers, each respondent had the opportunity to discuss in more depth about the presented questions, allowing for a qualitative feedback, which increased significantly the effort required to make the analysis. In total, the questionnaire had 123 responses.

Sample separation is an essential point for the best efficiency of the survey. The approach chosen was the number 22, defined by Molléri, Petersen, and E. (2020), where the sample should be divided according to its characteristics and similarities. To implement it, the respondents of the questionnaire who declared themselves as Administrative Technician in Education (ATE) or teachers were directed to one area of the questionnaire, and students to another, both areas with questions related to the responding profile.

5.1.4 Design and Write the Questionnaire

According to Kasunic (2005, p. 34), questions that do not have well defined goals are more likely to have questions that only consume time from the respondent, he emphasizes this with the following question: "How can you reach insightful conclusions if you do not know what you were looking for or planning to observe?"

In this survey the goal is well defined, focused on prioritization of requirements and suggestions by possible end users as described in Section 5.1.1. Similarly, the characteristics of the sample are important to write the questions in a way that everyone understands and not just the researchers. Linåker et al. (2015) highlights that the results obtained with the survey are directly related to the quality of the questionnaire used.

For Linåker et al. (2015) there are two types of questionnaires: (i) self-administrated and (ii) interviewer-administrated questionnaires. This one fits the first type, because it is a web-based questionnaire. The researches don't have to monitor the respondents. This model allows for more respondents, but on the other hand tends to have a higher dropout rate, emphasizing the importance of good structuring.

Google Forms was the chosen tool to create the questionnaire, since it contributes with a simple and uncluttered interface, while also being a part of the Google Suite service, which is adopted by Unipampa to support various processes, such as institutional emails, for example. It is also widely used, being familiar to much of the respondents. The form structure can be seen in Appendix A. The next sections will briefly describe each part of the questionnaire.

5.1.4.1 The Welcome Section

Following instructions from Kasunic (2005), the first page of the questionnaire contains important information for the participant, such as:

(i) Research objective; (ii) Estimated duration of the questionnaire; (iii) Researchers' contact email addresses; (iv) Researchers involved; (v) Voluntary, anonymous and confidential character of the research; (vi) Institution and organization involved.

5.1.4.2 Profile Questions

The questions about the participant's personal information are important in the early stages of the questionnaire, as it motivates participants to continue answering the survey without asking complex questions early on (REA; PARKER, 2005). In addition to a good classification of participants, it also allows the analysis of these to be done in a more controlled and organized way, as mentioned by Martins (2021).

The profile questions asked are listed below: (1) Is enrolled in Unipampa; (2) Sex; (3) Age group; (4) Academic education; (5) Already participated in an OA; (6) Which

roles the participant had in the OA; (7) His role in the academic community; (8) His campus and city; (9) The course the participant is taking.

5.1.4.3 Requirements Prioritization Questions

In questions related to the research objective, some directions described by Forza (2002) were used, they are as follows: (1) Define the way questions are asked to collect the information on a specific concept; (2) For each question decide the scale on which the answers are placed; (3) Identify the appropriate respondent(s) to each question; (4) Put together the questions in questionnaires that facilitate and motivate the respondent(s) to respond.

Item 1 suggests that the questions are written so that the entire responding sample can understand and formulate an answer. Since the questions of this questionnaire refer to software requirements, the user stories model has been used, which makes it very explicit who is the actor, what is desired with the requirement and the reason behind it. A user story can be defined as a casual, everyday summary of a software system's characteristics (DIMITRIJEVIĆ; JOVANOVIĆ; DEVEDŽIĆ, 2015). It was also determined that the questions would be classified as closed questions, where the possible answers are predetermined, as described by Forza (2002). However, at the end of each page, an open-ended question was also described, allowing the respondent to write freely whichever thoughts he had.

Item 2 is about the scale used in the questions. At first the Likert scale (JOSHI et al., 2015) would be used, but after better analysis, it was decided to use the an adapted Must have, Should have, Could have and Will not have (MoSCoW) scale, which is widely used in requirements prioritization (WATERS, 2009).

Afterwards, Item 3 says that the questionnaire should direct the participants to the questions they have more property to answer, bringing more constructive and relevant answers. This division was made using the profile questions commented in Section 5.1.4.2, where the participant is automatically directed to the section corresponding with his profile.

Finally, Item 4 suggests that all questions that have a common subject should be organized near each other to facilitate cross checks between each other. To implement this, the requirements were grouped by the actors' roles, and they are: (1) OA proponent; (2) OA instructor; (3) OA participant; (4) Outreach programs and projects coordinator.

The questions were also assigned Identification (ID) tags for each profile, in order to create better visualizations for the collected data later on. The logic behind the naming is simple. It starts with a letter which relates to the profile that that question is directed to, and a number, which is a simple count. They are as follows:

- **A(1-14)**: "A" stands for "Aluno", the student or participant.

- **C(1-2)**: “C” stands for Coordinator.
- **I(1)**: “I” is for Instructor.
- **P(1-8)**: “P” stands for Proponent.

Students were directed to the A(1-14) questions, while professors and ATEs were directed to the remaining 3 categories, since they have a higher chance to perform any of these roles. The questions themselves will be described in more detail later on, in Section 6.2, when the system requirements are presented.

5.1.4.4 Feature Suggestions

For the last page of the questionnaire, a field was made available in which respondents may suggest to researchers any improvement, functionality, correction, anything they thought would be valuable for the goal product. With these answers it is possible to do a qualitative analysis and achieve new ideas for the development and completeness of the final tool.

5.1.5 Pilot Questionnaire

As Kasunic (2005) describes, a pilot test is a simulation of the real questionnaire carried out with a small number of members from the target audience. For this, the authors arbitrarily invited 7 (seven) people, out of which 4 (four) were students, 2 (two) were professors and 1 (one) was an ATE. The reason behind choosing this specific number of respondents is due to the following: (i) All defined profiles for the respondents were chosen and (ii) the ratio of 4/2/1 is aligned with the expected numbers of submitted questionnaires per profile.

Unfortunately, the person chosen for the third profile, ATE, wasn’t able to answer. However, even though there are 3 (three) profiles, the questionnaire itself only has 2 (two) tracks of questions, one for students and the other for professors/ATEs. Because of that, the consequences of this happening weren’t too impactful.

As for the pilot results, a lot of great feedback was received, along with some compliments on the organization of the questionnaire. There were issues with the person identification section, where the age was changed from a number to a range of numbers, such as between 19-29 years old.

5.1.6 Distribute the Questionnaire

The questionnaire was distributed to all people who make up the sample of this research. For this, first was collected all emails of coordinators with active outreach projects or programs, from several campuses of Unipampa. They were the first to respond the questionnaire.

After two (2) days, emails were sent to all campus academic secretariats, requesting that it be passed on to all the students from all courses. In total, the survey was open to answers for eighteen (18) days.

5.1.7 Analyze the Results and Write a Report

The quantitative results related to the prioritization of requirements were collected and organized in graphs to better understand and visualize the data, while the qualitatives were subjectively analyzed and incorporated into the refined requirements list. Thus it will be possible to have an orderly list of requirements that were considered most important to end users, as well as well described user stories.

5.2 Threats to Validity

Validity is a critical variable in the success of a survey. Without the proper precautions, the whole study can fall apart if not carefully planned and executed. Kasunic (2005) says that by following a well defined procedure and adapting it to fit the research subject, threats to the validity of the research can be avoided or minimized. The author cites two important types of validity in survey research: (1) Construct validity and (2) External validity.

The first item is about being certain of what is to be measured or collected. "Are these questions providing enough information to answer my research objective?" And the second validity is more about being able to generalize the obtained results to other people, places or times.

5.2.1 Construct Validity

As soon as the first participants started submitting their responses, it was already possible to gather valuable information and insights from the results. That being said, the following items were identified as possible threats:

1. While the questions were simple and designed to be understood by everyone, the scale used, in the other hand, could be a cause of confusion by people who are not familiar with it. Even though the MoSCoW scale was adapted and translated to Portuguese, it could still be hard to answer for those who are not used to it.

2. The questions were written in the form of user stories, making it easy for the participants to classify the relevance of the requirement. However, describing the questions this way could impose a threat in which the respondent might find difficult to suggest new functionalities, because the "creative work" was already done for them.

3. The lack of clarity in definitions and amibiguity might also be considered threats. In some cases, the participant could not answer because he did not know what an OA was.

5.2.2 External Validity

Regarding external validity, there are some inherent threats that come with how the scope of the study was defined. It is also impossible and unnecessary to completely neutralize this, as too much generalization would make the study less useful. Some of the threats were:

1. By the nature of the defined scope, the study is limited to participants which are familiar with the academic environment and preferably participated in an outreach activity in Unipampa.

2. The scope could be expanded to other HEI without adding much risks, but then the study would become less useful, since this term paper describes a goal product directed at Unipampa.

5.3 Results

In the 18 days that the questionaire was available for responses, 123 responses from students, teachers, and ATEs were collected. As all of the quantitative questions had an obligatory nature, a response rate of 100% was obtained for each respondent's profile. On the other hand, when all of the qualitative questions were answered, including those on the final page of the questionnaire and those asking for general suggestions for the tool, the percentage of responses from teachers and students was approximately 23% and 12%, respectively. This low value was one of the factors contributing to the validity threat mentioned in Item 3 of Section 5.2.1.

The charts related to participant identification and their participation in outreach academic activities will be presented in the following section, Section 5.3.1. The results obtained in objective and quantitative questions where the MoSCoW requirement prioritization technique was applied are described in Section 5.3.2. Last but not least, in Section 5.3.3, the final ranking of the requirements based on the respondents' written and qualitative feedback as well as their most pertinent suggestions will be presented.

5.3.1 Respondent Identification

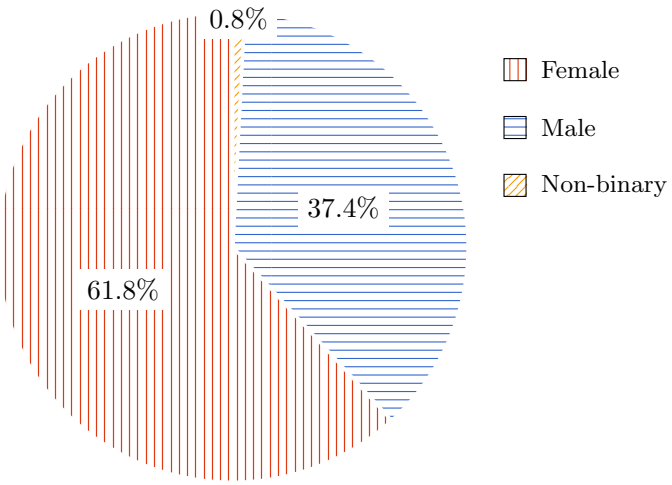
This section presents information pertaining to the respondent profile and the survey's demographic is depicted. Figure 10 and Figure 11 show that most of the respondents identify as the female gender, while also being within the 19-39 age ranges. This infor-

mation is relevant to understand the demographic, which is comprised mostly by college students, as can be seen in Figure 12 and Figure 13.

Another important piece of information obtained through analyzing the identification results is the city and campuses most respondents come from. As it was shown earlier in Figure 9, more students from Uruguaiana - the campus which executed most Outreach Activities in 2021 - were expected to respond, which was not the case, as can be seen in Figure 14.

Lastly, it is presented the charts regarding the participation of respondents in OAs. Figure 15 shows an interesting result. Over a quarter of respondents have never participated, not even as listeners, in an OA. This posed a possible threat, described in items 2 and 3 of Section 5.2.1. Finally, Figure 16 aims to map the roles each respondent had when participating in OAs. Over half of them had participated as listeners.

Figure 10 – Participants Sex Distribution



Source: Author.

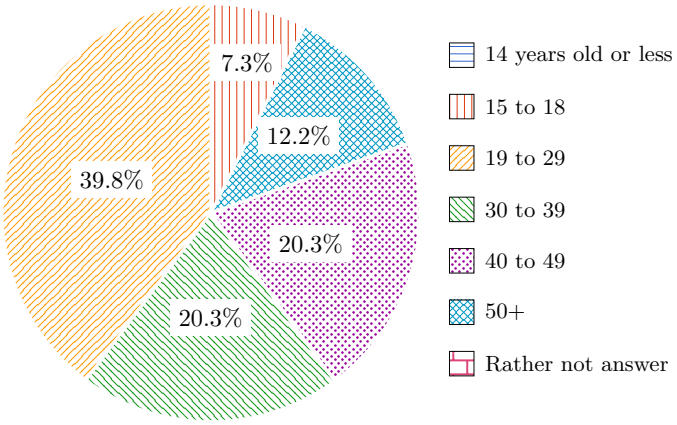
5.3.2 Quantitative Results

The quantitative results were gathered by asking objective questions in which the respondant had to prioritize the user story in the question using the MoSCoW scale, described earlier.

By analyzing the results obtained in each of the questions asked in the questionnaire, which is available at Appendix A[1], some interesting results were found regarding each user role defined for the MVP, which are going to be discussed later in more detail in

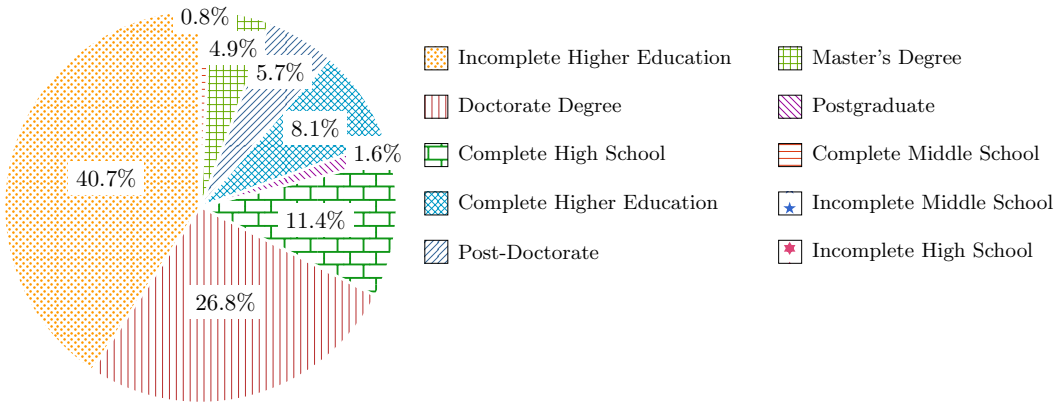
[1] As a note, to better navigate from the charts to the questions themselves, which are all the way down in the appendix, open the PDF in the browser and hit "CTRL + F", searching for the question ID and using the arrows to navigate between occurrences.

Figure 11 – Participants Age Distribution



Source: Author.

Figure 12 – Participants Formation Distribution



Source: Author.

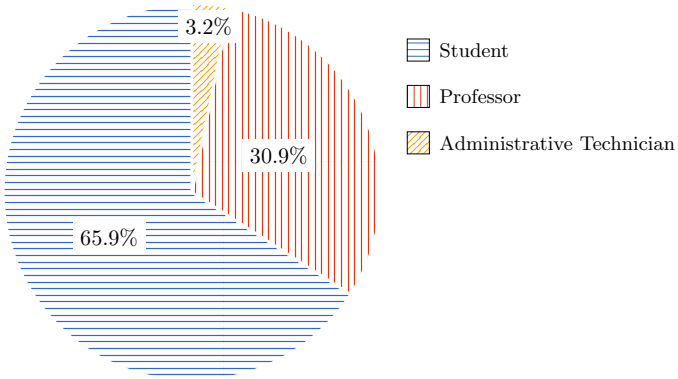
Section 6.1. The following sections describe the results obtained on each of their quantitative questions. The roles are as follows: (a) Proponent, (b) Coordinator, (c) Instructor and (d) Participant.

5.3.2.1 Proponent

Regarding the proponent role, the results collected were a success. The presented written survey questions identified by P(1-8) were on point, with most of them scoring Musts and Should haves as it can be seen in Figure 17, meaning they are great features which the future target users would like to see in the system. The only exceptions were P2 and P5, scoring the most of Could and Will not haves out of all of the questions.

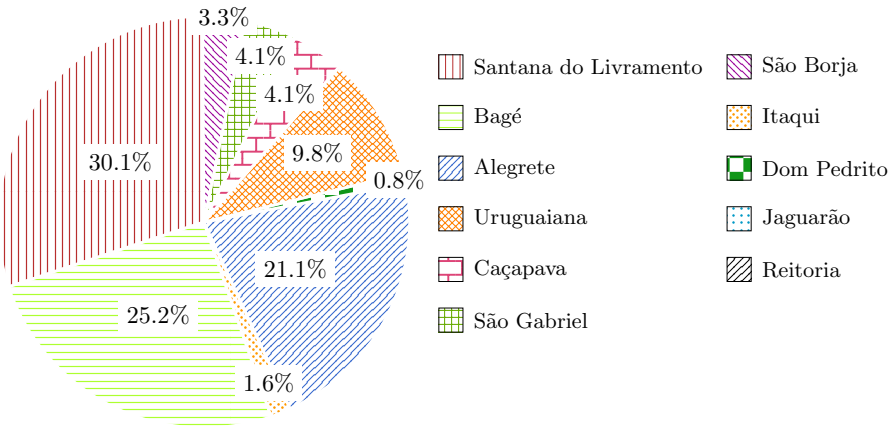
A sub question of the user story described by P7 can be seen in Figure 18. The

Figure 13 – Community Roles Distribution



Source: Author.

Figure 14 – Participants City Distribution



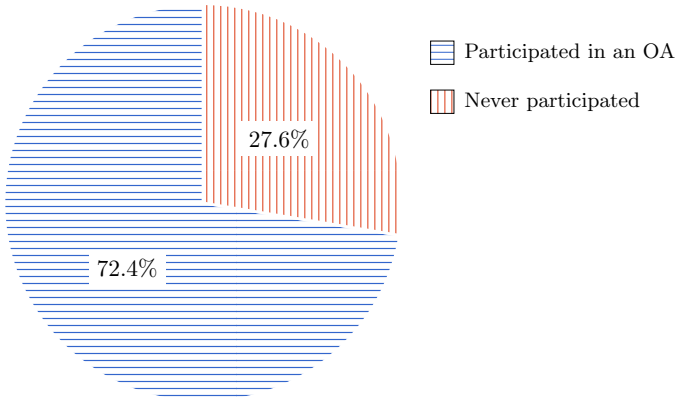
Source: Author.

respondents could check both alternatives for communicating with the future OA participants, and it was unexpected that *WhatsApp* got over half of votes, considering the history of using emails most of the time for communication in the university.

5.3.2.2 Coordinator

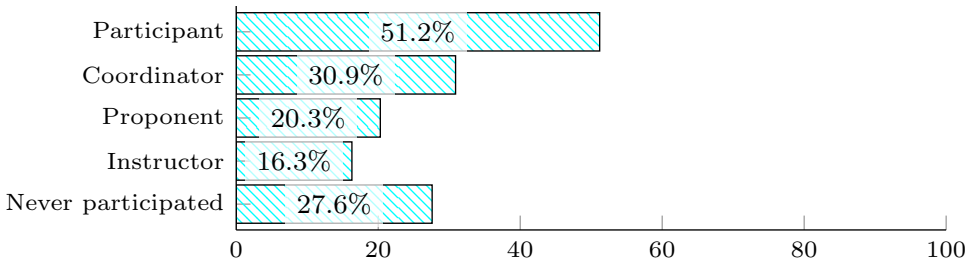
Not many questions were asked about this user role. It was interesting to see the first question, C1, not receiving as much Must haves as C2, since it was assumed that the review and approval process of OAs was as much if not more important than issuing participation certificates. The results can be seen in Figure 19.

Figure 15 – Outreach Participation Distribution



Source: Author.

Figure 16 – Outreach Roles Distribution



Source: Author.

5.3.2.3 Instructor

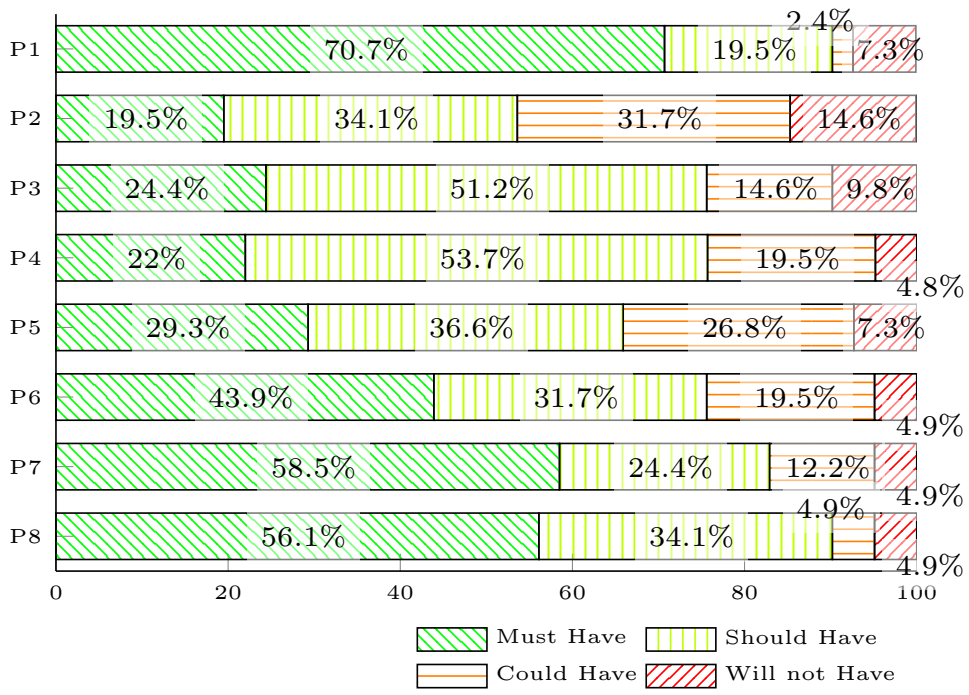
As it was realized before, the survey respondents value greatly the issuance of participation certificates. The same can be said for the only question regarding the Instructor role, which can be seen in Figure 20. Having over 60% Must haves, it's one of the user stories with highest priority in the study.

5.3.2.4 Participant

This is where most of the survey demographics was directed to. Since all of the students were chosen to respond only to the participant system user role, while the professors and ATEs answered for three different profiles, a balanced number of questions was aimed for. In total, students had 14 questions, while teachers and ATEs had 11.

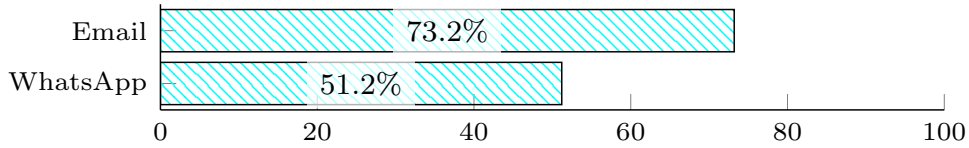
The results are divided in two charts, the first can be seen in Figure 21 and presents the first 1-7 questions, while the second, shown in Figure 22 displays the last 8-14 questions. It was great to see the respondents prioritizing most of the user stories as Must haves, especially the first seven (7), meaning the requirements were once again well

Figure 17 – Questions Regarding Proponent Role



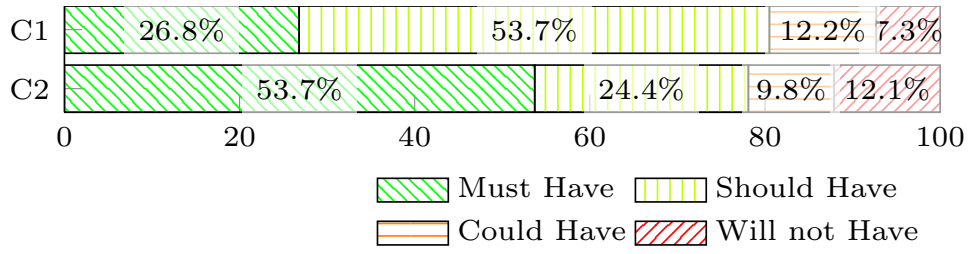
Source: Author.

Figure 18 – Which communication channel the proponent prefers



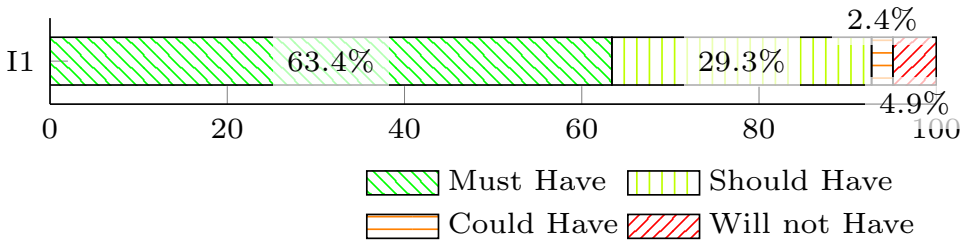
Source: Author.

Figure 19 – Questions Regarding Coordinator Role



Source: Author.

Figure 20 – Questions Regarding Instructor Role



Source: Author.

described and important for the system. However, not all of them were ranked highly, such as A11 and A13, which showed an above average number for Could and Will not haves.

A11 makes sense, since it could be hard to think as someone who is not enrolled in the university. This user story is also a little bit of out scope for an MVP, so the feedback was important to rank it lower in the requirements. A13 was a bold feature, which came up during a brainstorm with the supervisor. It's interesting to see it wasn't as exciting for the respondents as it was when the idea of assigning grades to OAs was conceived.

Lastly, A14 had a sub question, similar to P7, in which respondents should choose where they would rather see the upcoming OAs they were enrolled in. Implementing a calendar view in the website itself could be very time consuming, so it was great to know beforehand that the majority of users would rather export the OA to their own calendar apps.

5.3.3 Qualitative Results

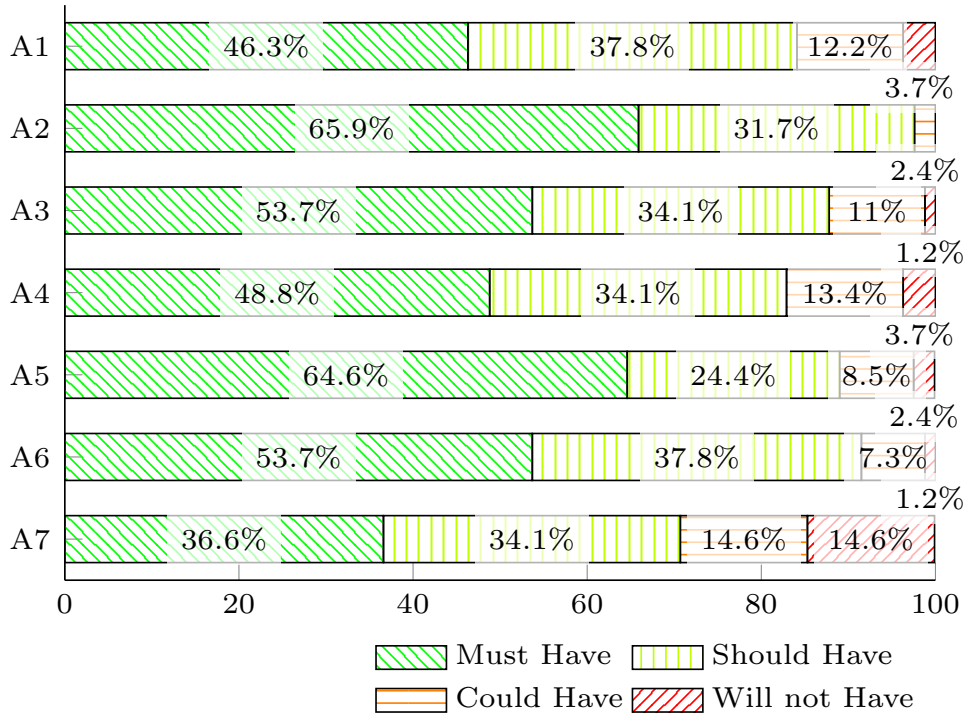
Regarding the written feedback respondents were free to write in each page, most of them were short and somewhat out of scope, saying things that were already said in the questions and compliments about the iniciative of doing this study. However, a few of them were very useful feedback, presenting critics of the present way of doing things and expanding the knowledge of the authors by explaining more about the respondent's individual experiences.

The responses will be translated freely from their original language, Portuguese, and described below.

As expected, there was a lot of differences between students' feedbacks and professors/ATEs feedbacks. Most relevant ones were written by teachers and ATE, which will be discussed in more detail briefly. The following, however, are judged to be noteworthy feedbacks by students:

- "*Regarding A9, it would be cool to send out notifications, for instance, when an*

Figure 21 – Questions Regarding Participant Pt.1



Source: Author.

OA's registration deadline is approaching". This was a very interesting and valid suggestion, which, besides the notifications part, opens doors to features such as having an OA watchlist and saving favorites.

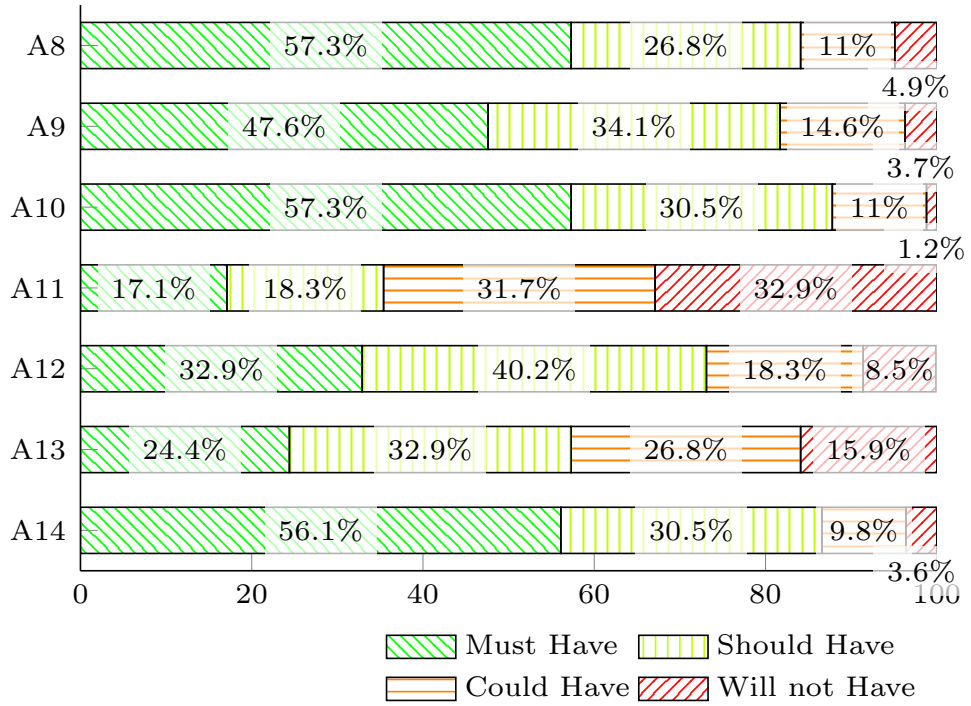
- "*The questions are repetitive, leading the individual to declare them irrelevant*". This was unexpected input on the survey's questions because it wasn't raised at any point during the survey's development. Nevertheless, it was excellent feedback.

- "*Change the order of importance and the highest level of satisfaction since the order of presentation of the points was incorrect at the beginning of the question because it starts with number 4*". Maybe setting the MoSCoW scale in reverse, starting with Must Have as a 1, instead of a 4, would add more value. However, this was the only criticism written on this topic.

Next are the noteworthy feedbacks received by professors and ATEs:

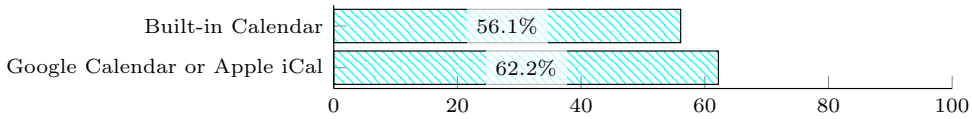
- Two respondents raised the topic of work and the volume of information to be provided as one of their points. They emphasize that because outreach activities must currently be recorded in the Academic Project System (SAP) project, it is crucial that the final tool be able to provide a report in the format accepted by this tool; otherwise, teachers would have to complete more work in both tools. One of

Figure 22 – Questions Regarding Participant Pt.2



Source: Author.

Figure 23 – Where the user would rather see their upcoming OA



Source: Author.

them also points out that it would be much more interesting the forms in the tool were as succint as possible, as this would make preenchiment easier and add less burocratic burden.

- Another important point to keep in mind is that participants who have a history of absenteeism or low participation in the activities in which they are registered are abusing their slots. It was suggested as a solution to this that the system be aware of these people and give them less priority than someone who is on time for their commitments when they are placed in a line for registration for an OA.

- A concern raised by a coordinator of outreach activities is the generation of PROEXT certificates that frequently do not provide the estimated time of return to the coordinator. For this reason, participants who are unsure of how this procedure works end

up asking the coordinator instead of the actual PROEXT, which is inconvenient. He suggests sending notifications or perhaps a visualization tool that provides information on the expected date for certificate generation.

- According to a professor, the generation of presence certificates is currently done one by one on the Electronic Information System (SEI), and this process is very slow. He suggests speeding up the procedure so that all of the certificates can be generated at once. Another respondent claims that the possibility of generating presence certificates without having to wait for the OA completion date would be interesting, particularly for the external public.

5.4 Chapter Summary

In this chapter, the survey as a whole was discussed, describing points such as details about the followed protocol, strategies used in developing the questions, threats to validity and both quantitative and qualitative analysis of the results obtained. Chapter 6 will discuss more about the specifics of the Front-end MVP developed, presenting about pertinent design decisions.

6 EXTENSIONLY FRONT-END DESIGN

This chapter describes how the solution will be developed and the process behind its implementation, presenting information about the applied software engineering to create the system. In Section 6.1, it is briefly presented how the front-end relates to the other TP written about Extensionly, which focuses on the back-end implementation. The chapter also discusses user roles. Section 6.2 presents how the system requirements were managed. Lastly, Section 6.3 presents some of the design decisions made in order to develop a robust application.

It is also important to note that the terms “front-end”, “system”, “application”, “web app” and “tool” are used interchangeably to refer to the goal product of this study.

6.1 Initial Considerations

The Extensionly 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 (EDUCATION, 2020). 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 (CHACON; STRAUB, 2014). The source code will be available in the official repository[1]. 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 campuses within the university system and potentially by other Brazilian institutions in the future.

6.2 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 grey literature systematic review described in detail in Chapter 4. The second refinement of the requirements was applied after analyzing the survey results, presented earlier in Chapter 5.

[1] Extensionly front-end code is available at `https://github.com/Dalepfell/extensionly-frontend`

6.2.1 Requirements Obtained through the Grey Literature Review

In total, twenty eight (28) Functional Requirements (FRs) were defined prior to the planning and execution of the survey. Clarkson and Eckert (2005) explain that FRs have the purpose to establish the behavior between inputs and outputs that characterizes a system's or component's function.

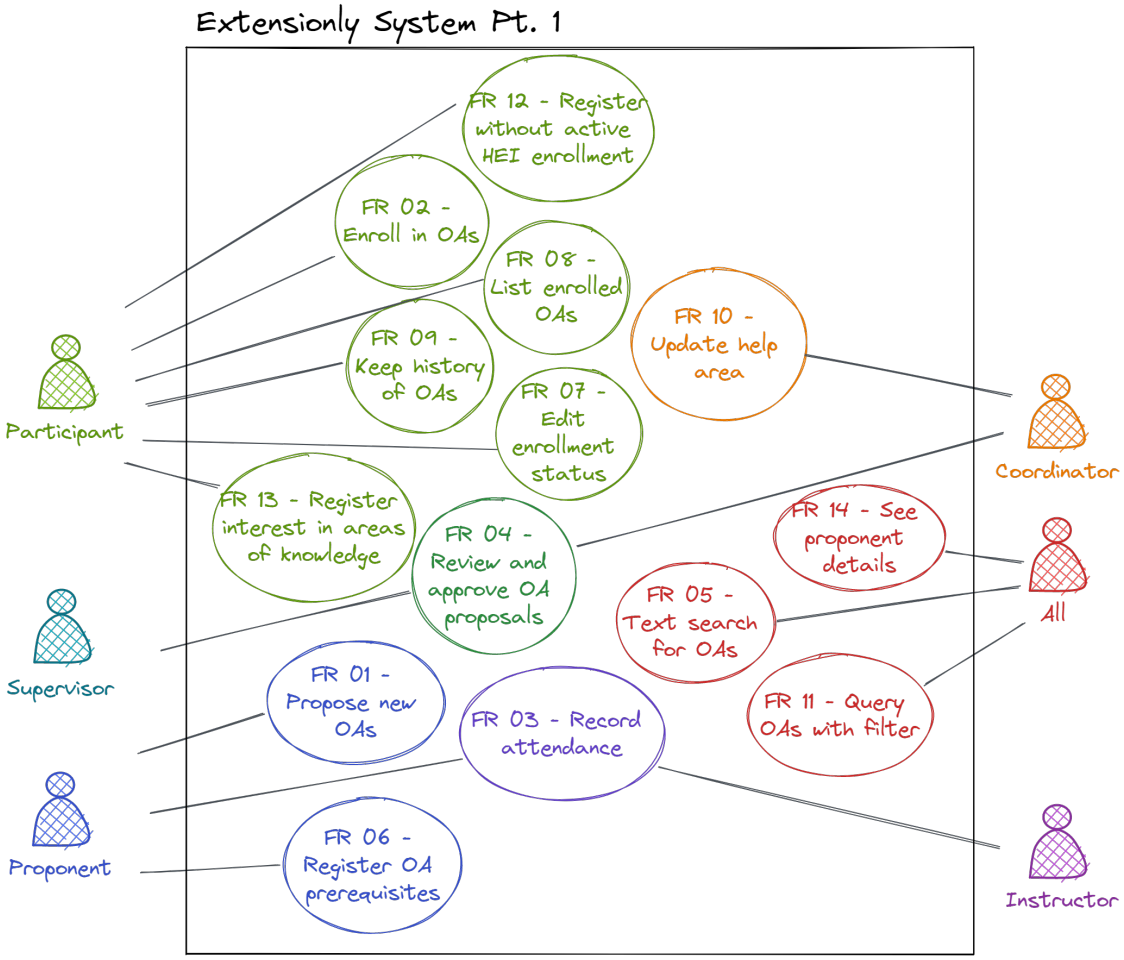
These requirements were created after analyzing other tools found during the grey literature review, presented earlier in Section 4.3.2.1, which had similar scope to the system being developed. Out of these requirements, six (6) of them were ruled out for now after discussions between both authors and their supervisor, 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. The complete list of initial requirements and their priority ranking can be seen in Table 12.

Table 12 – Initial Requirements

ID	Requirement	Priority
FR. 01	Propose new OAs	High
FR. 02	Allow enrollments in OA	High
FR. 03	Record participant attendance	High
FR. 04	Review and approve OA proposals	High
FR. 05	Text search for OAs	High
FR. 06	Registration of OA prerequisites	High
FR. 07	Edit enrollment status in OAs	High
FR. 08	List OAs the user is enrolled in	High
FR. 09	Maintain history of OAs participated	High
FR. 10	Help area (frequently asked questions, manuals)	High
FR. 11	OAs query with filter	Medium
FR. 12	External user registration	Medium
FR. 13	Registration of interest in areas of knowledge	Medium
FR. 14	Show proponent details	Medium
FR. 15	Favorites list for OAs	Medium
FR. 16	Declare interest in an OA (when enrollments are not open)	Medium
FR. 17	Share OA information	Medium
FR. 18	OA past versions history	Medium
FR. 19	Teacher's note in the OA details	Medium
FR. 20	Final OA assessment by the student	Medium
FR. 21	Detailed schedule for upcoming OAs	Low
FR. 22	Fill in final OA report	Low
FR. 23	Print enrollment status	Removed
FR. 24	Testimonies/reviews from past participants in the OA details	Removed
FR. 25	Instructor/student communication channel	Removed
FR. 26	Environment for evaluation of students submitted works	Removed
FR. 27	List of OAs by teacher	Removed
FR. 28	List of related OAs	Removed

The following are sketches of how the initial requirements relate to the defined user roles. Figure 24 presents the first 14 FR and Figure 25, the remaining 8, excluding the ones that were removed.

Figure 24 – User Roles on the First 14 FR



Source: Author.

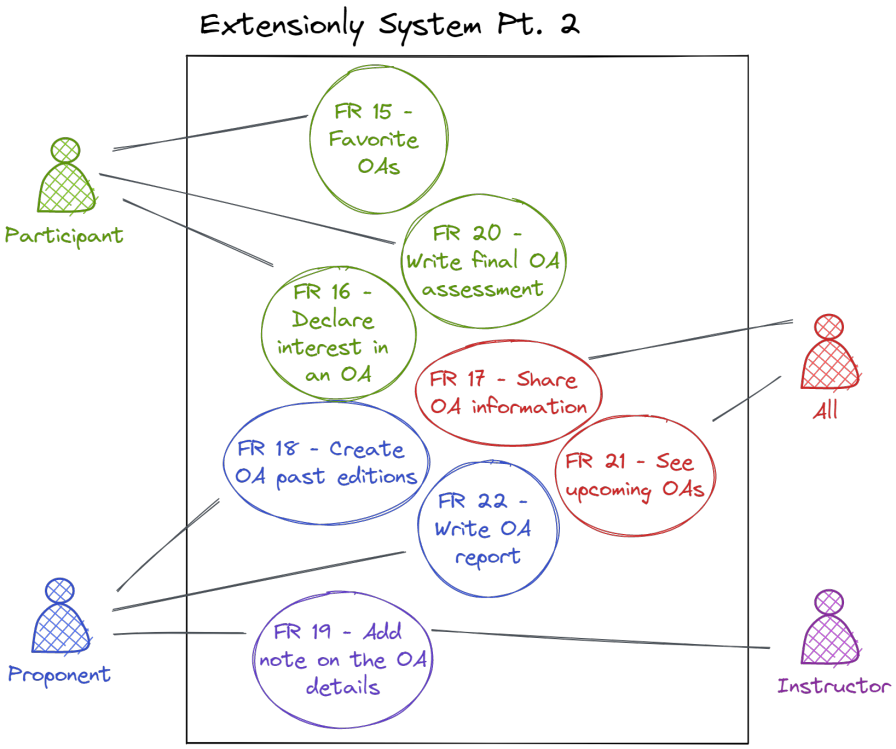
6.2.2 User Stories derived from the Requirements

After the first round of defining the FRs, it was necessary to turn them into user stories, to use them in the survey, in a more descriptive form for the respondents. The stories were written with the system user roles in mind, which were presented earlier in Section 6.1. They were used directly, with no other refinements, in the final survey and were defined in Table 13, Table 14, Table 15 and Table 16.

However, in order to relate FRs with the questions and also update their ranking based on the survey results, Table 17 was created.

There were some cases where multiple FRs were assigned to a single user story, because the requirements are usually more technical, while a user story is supposed to have a higher level of abstraction (DIMITRIJEVIĆ; JOVANOVIĆ; DEVEDŽIĆ, 2015).

Figure 25 – User Roles on the Last 8 FR



Source: Author.

Table 13 – Proponent User Stories

ID	User Story
P1	As a Proponent, I would like to propose an outreach activity, creating knowledge opportunities for other people.
P2	As a Proponent, I would like to define desired prerequisites for enrollment in my outreach activity proposal, so that my applicants do not come unprepared.
P3	As a Proponent, I would like my data to be shown along the details page of my outreach activity, so that participants have more details of who I am.
P4	As a Proponent, I would like to leave comments on the outreach activity page, to request some special material for carrying out the activity or just leave a note of mine for the participants.
P5	As a Proponent, I would like to fill in a general report on the progress of the outreach activity carried out, for archiving purposes.
P6	As a Proponent, I would like to register multiple editions of the same outreach activity, so that new participants can check past editions.
P7	As a Proponent or Instructor, I would like to get in touch with the participants of the outreach activity, so that it is easy to pass on information relevant to the activity.
P8	As a Proponent, I would like to receive the evaluation of the participants of my outreach activity in a detailed report/form format, so that I am aware of what I should improve for the next edition.

Table 14 – Instructor User Stories

ID	User Story
I1	As an Instructor, I would like to manage the attendance of registered participants so that certificates can be issued for those present.

Table 15 – Participant User Stories

ID	User Story
A1	As a Participant, I would like to apply for outreach activities such as events, courses and lectures, to enter the waiting list and be accepted in the activity.
A2	As a Participant, I would like to be able to search for outreach activities, so that I can find what I am looking for more easily.
A3	As a Participant, I would like to cancel or edit the information of an outreach activity enrollment made by me, to have more freedom in case I change my mind.
A4	As a Participant, I would like to see previous editions of outreach activities, so that I can read past proposals.
A5	As a Participant, I would like to view the history of all the outreach activities I have participated in, so that I don't have to keep the record outside of the tool.
A6	As a Participant, I would like to have a help area within the system, to guide me with any questions or problems that I may face with the activity I signed up for.
A7	As a Participant without college enrollment, I would like to register in the system to participate in outreach activities that interest me.
A8	As a Participant, I would like to inform my interest in areas of knowledge, so that I can see outreach activities related to them.
A9	As a Participant, I would like to favor outreach activities that I deem interesting, so that I have easy access to them when I need them.
A10	As a Participant, I would like to show my interest in unavailable outreach activities, so that I will be notified when a new issue opens.
A11	As a Participant, I would like to register for outreach activities without registering in the system, so that my information is not saved.
A12	As a Participant, I would like to share information about the outreach activity, so that I can share it more easily with my friends.
A13	As a Participant, I would like to evaluate the outreach activity in which I participated, so that other participants can see the grade I assigned.
A14	As a Participant, I would like to see the outreach activities in which I am enrolled in the form of a calendar, so that I can organize myself better.

Table 16 – Coordinator User Stories

ID	User Story
C1	As Coordinator, I would like to manage the submissions of new outreach activities carried out, so that each proposal goes through a review process before being accepted.
C2	As Coordinator, I would like to issue certificates of participation with a certain number of hours for all involved, participants, instructors and coordinator, so that the individual's involvement in the outreach activity is proven.

6.2.2.1 User Roles

The system as a whole, including the back-end service, was designed with multiple user roles, or actors, in mind. According to OMG (2017), in the Unified Modeling Language, an actor designates a function performed by a user or by any other system that communicates with the subject. In this case, it was referred as the user.

This was a necessity identified very early on, since there are many actors involved in the OA ecosystem in HEIs, as was presented earlier in the study. They are as follows:

Participant - a listener, someone 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;

Table 17 – User Stories

Requirement ID	Question/story ID	Priority
FR. 01	P1	Must have
FR. 02	A1	Must have
FR. 03	I1	Must have
FR. 04	C1	Must have
FR. 05	A2	Must have
FR. 06	P2	Should have
FR. 07	A3	Must have
FR. 08	A5	Must have
FR. 09	A5	Must have
FR. 10	A6	Must have
FR. 11	A2	Must have
FR. 12	A11	Will not have
FR. 13	A8	Must have
FR. 14	P3	Should have
FR. 15	A9	Must have
FR. 16	A10	Must have
FR. 17	A12	Should have
FR. 18	P6	Must have
FR. 19	P4	Should have
FR. 20	A13	Should have
FR. 21	A14	Must have
FR. 22	P5	Should have

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 campuses.

Initially, there was also an "External Participant" role, whose difference from the Participant was that no HEI enrollment was required in order for it to enroll in OAs. It is being put on hold for now, because it is considered to be somewhat out of scope of an MVP.

6.3 Design Decisions

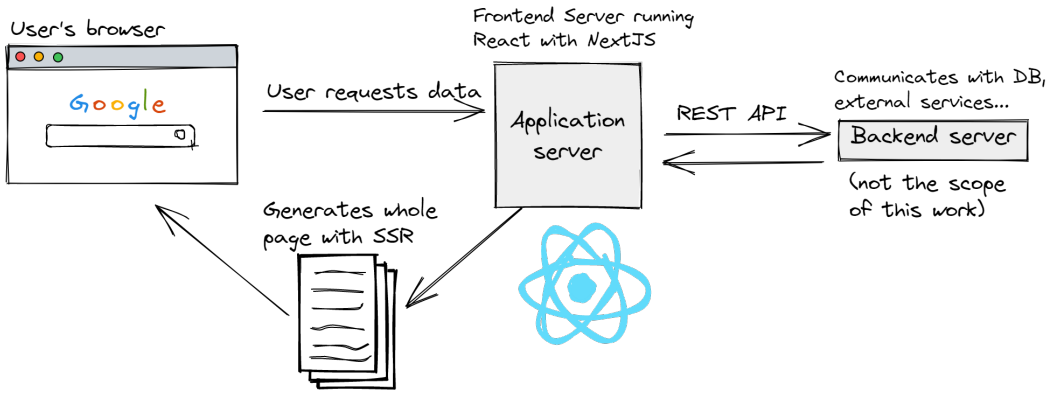
The decisions made regarding the development of the goal product are discussed in this section.

Programming Language: TypeScript (TS) was chosen because of the incredible ecosystem of tools and technologies built around it. It expands the capabilities of common JavaScript (JS), a dynamic typed language, by enforcing the usage of types in it. This makes it more strict, which increases robustness and predictiveness (BIERMAN; ABADI; TORGERSEN, 2014).

Architecture: The architecture comes with the chosen framework the tool is being developed in: NextJS with React, a JS library used in the web to create User Interfaces. The UI is component based, meaning each element can be treated as an individual component, such as buttons and cards (FACEBOOK, 2022). It enables reusability,

reducing duplicated code and in consequence, less convoluted applications. The website the user sees is a tree where each node is a component. The architecture can be seen in Figure 26.

Figure 26 – Front-end Architecture



Source: Author.

Regarding NextJS, it was chosen because it extends React by enabling Server Side Rendering (SSR)[2] capabilities. This greatly reduces loading times for the user, because the whole page document with its HyperText Markup Language (HTML) - the standard markup language for documents designed to be displayed in a web browser (PATEL, 2013) - tags are pre generated on the application server and delivered all at once when the page loads (DOYLE; LOPES, 2008).

However, this is not normally the case for React applications, which rely commonly on Client Side Rendering (CSR)[3]. With this approach, the React framework sends the bare minimum information needed in the first load, followed by a loading screen to the user until the page itself is generated locally in the user's browser (DOYLE; LOPES, 2008). Figure 27 and Figure 28 aim to illustrate this behavior.

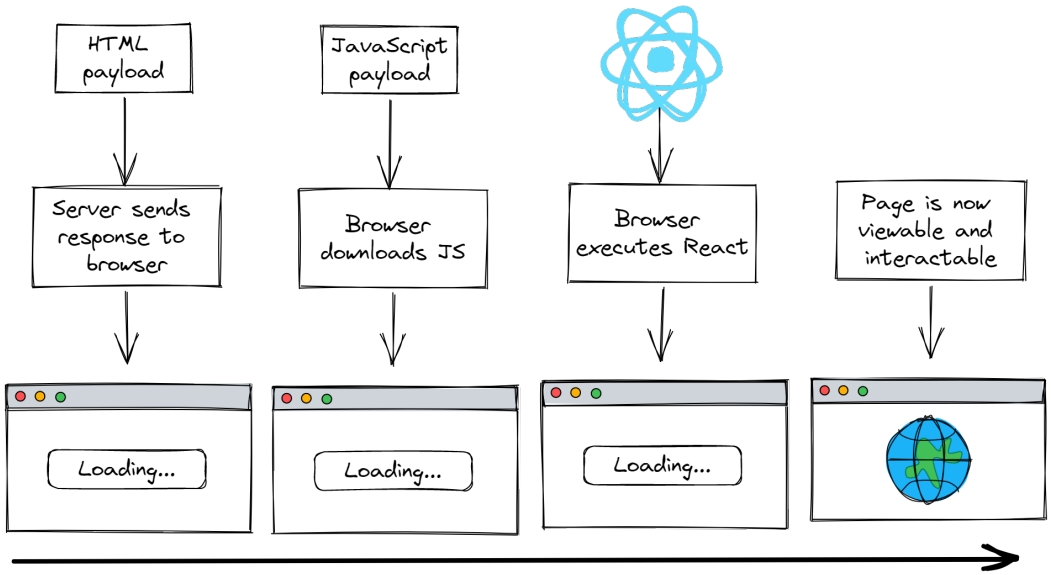
This approach has a number of drawbacks, including the inability to support users who do not have JavaScript enabled, potential security risks, much longer page load times, and negative effects on the site's overall Search Engine Optimization (SEO) (THAKKAR, 2020).

License: The front-end web application is licensed under the GNU General Public License v3.0, which is an open source license and is very permissive, allowing even for commercial use. It is very important to note, however, that any works or modifications must be licensed under the same license, while also making available their

[2] The term Server Side Includes (SSI) is used by Doyle and Lopes (2008), but is interchangeable with Server Side Rendering.

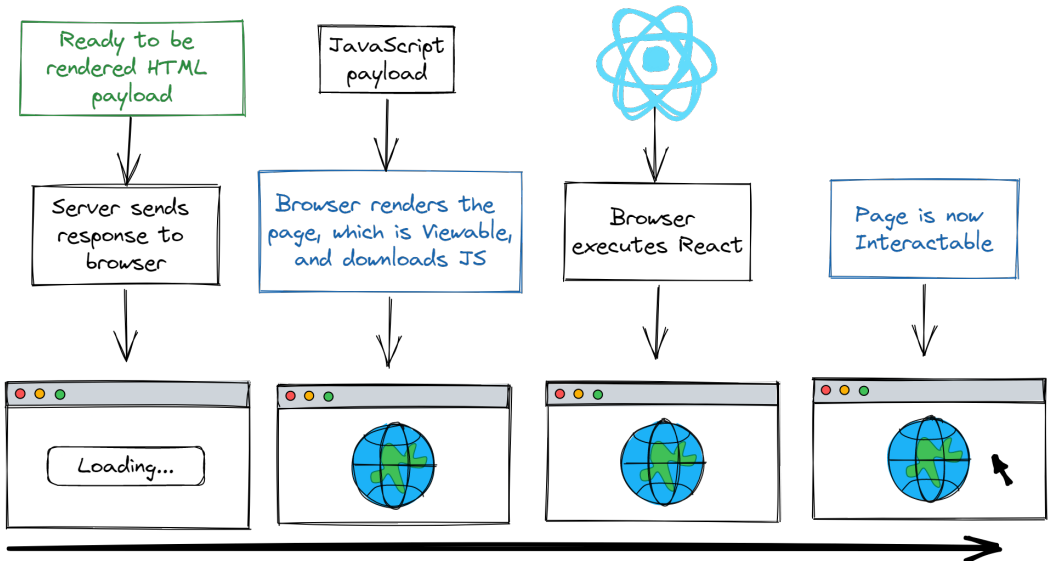
[3] The term Client Side Includes (CSI) is used by Doyle and Lopes (2008), but is interchangeable with Client Side Rendering.

Figure 27 – Client Side Rendering



Source: Adapted from (GRIGORYAN, 2017).

Figure 28 – Server Side Rendering



Source: Adapted from (GRIGORYAN, 2017).

source code and that the distribution of closed source versions is prohibited. It also does not provide any kind of warranty or liability regarding the software (FOUNDATION, 2007).

Multiple Languages: The application will be translated to multiple languages, being available at first in Portuguese and English. While this does not hold much impor-

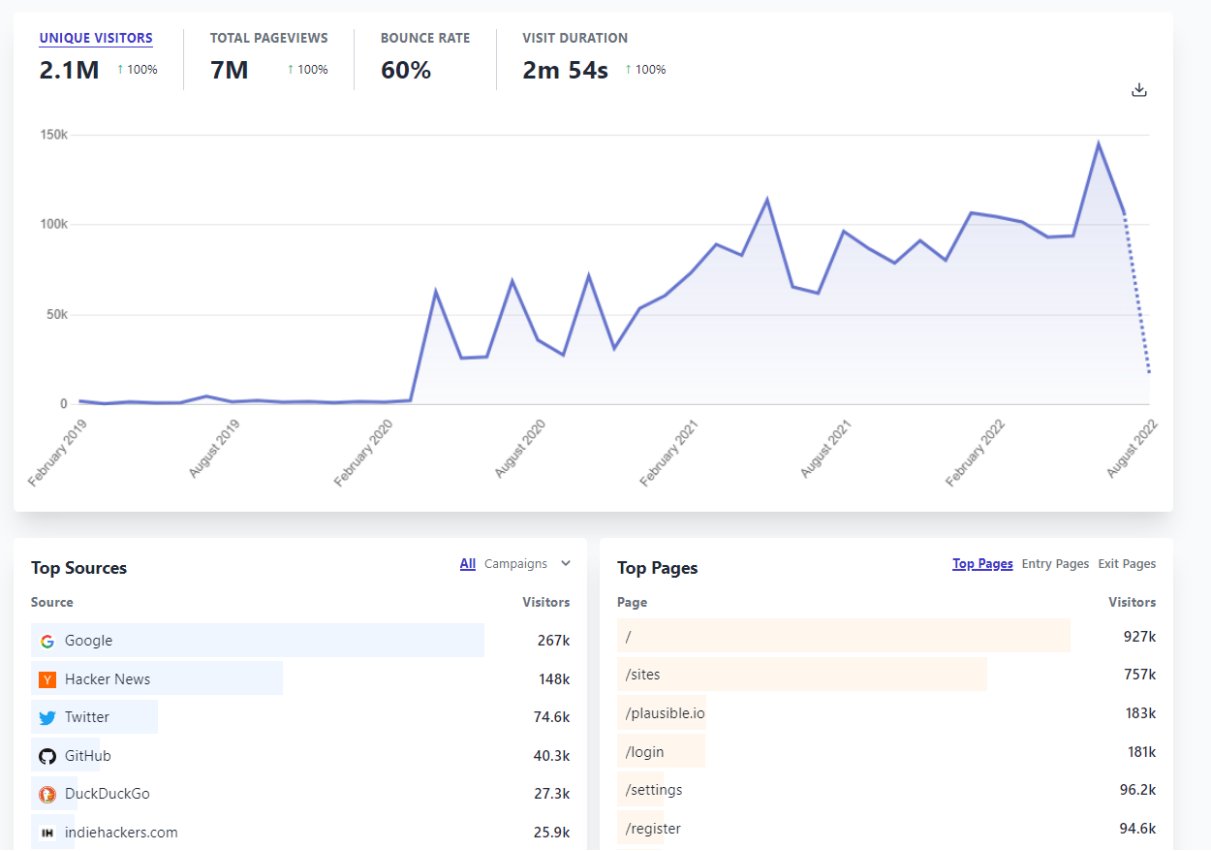
tance right now, as the current focus is to cater for the local Portuguese-speaking community, having this in mind since the beginning will save a lot of time in the future, if the software ever expands globally (REYNOLDS, 2020).

Transparent Analytics: Analytics is used to identify, explain, and communicate significant trends in data. It also involves using data patterns to make smart decisions (KOHAVI; ROTHLEDER; SIMOUDIS, 2002). However, as opposed to collecting and tracking data using the commonest solution in the market, Google Analytics (W3TECHS, 2019), it was decided that the web application should be privacy-friendly and user focused.

Plausible was chosen, because they have proven that it is possible to measure a website's usage without utilizing cookies, collecting any Personally Identifying Information (PII) about the website's visitors, or collecting any personal data at all (PLAUSIBLE, 2022). This is done through an analytics dashboard available publicly and accessible by anyone, which displays anonymous data about the traffic in the website. Figure 29 illustrates an example of this dashboard[4].

[4] The dashboard is available for anyone on their website, through `https://plausible.io/plausible.io`.

Figure 29 – Plausible Analytics Dashboard



Source: (PLAUSIBLE, 2022)

7 PRELIMINARY CONSIDERATIONS

The goal of the current work was to thoroughly examine the administration of Outreach Activities in order to create a tool that supports the administrative procedures, makes it easier to communicate with the outside world, and improves student participation and dissemination. For this, two artifacts were produced: a review of the gray literature to locate comparable solutions already in use, eliciting their critical features, and a survey of potential end users of the tool to order the requirements by importance and gather additional ideas on the topic.

Five particular goals were established in order to accomplish the overall goal of the work, which is to create the tool's front-end to support the management of Unipampa's outreach programs and projects. They were previously described in Section 1.2.

The first goal was to conduct a review of the gray literature to look for features in tools that were similar to what is being proposed. Based on the results, it is clear that this goal was accomplished, as it was possible to identify a number of tools and, in the end, to produce a list of tools that was significant in size, complete with their functionalities and specific information, which was especially helpful in planning.

The second goal relates to the development of a survey to ascertain the viewpoints of potential end users. This goal was accomplished since it was feasible to examine the problems and worries that users had, which made it possible to draw out a number of enhancements and features for the suggested tool.

The third particular goal is the creation of a development roadmap and tangible tasks. This goal was only partially attained because the transition from FR to development tasks won't take place until the second phase of this work's development, or TP II.

The fourth goal is to research, evaluate, and select a development stack, including a programming language, an architecture, and a framework, for the front-end of the suggested tool. This goal was accomplished; prior decisions were presented earlier in Chapter 6.

The creation of a MVP for the tool's front-end is the fifth and final specific goal, and it has not yet been accomplished because the tool's development is still on the horizon.

The hypothesis of this work, which can't yet be confirmed or disproved because the application hasn't yet been developed and tested with end users, is that "With a tool to support the management of outreach programs and projects, it's possible to have a reduction on the effort needed to create an outreach activity and an increase in the engagement of volunteer outreach participants." However, given all of the good feedback that the survey respondents supplied, it is extremely probable that this theory will be proven with the accurate and thorough development of the application.

With a tool of this kind, it is feasible to lessen the manual and repetitive work required in the registration of new proposals for outreach efforts, facilitating operations

like generating certificates more effectively. This is the research question of this work, described in Table 1. Additionally, students will know where to go if they need assistance with the subject thanks to a platform that centralizes information about university outreach, which will increase the dissemination of new initiatives. With the use of the technology, the connection between the teacher and the participant will also be reinforced, enabling richer interactions and experiences for both parties.

The survey's results gave the researchers insight into what potential end users could think about the presence of a tool like this to help them with related tasks. It allowed for the reevaluation of various implementation-related difficulties while taking into consideration suggestions made. It is safe to state that without a study of these users' opinions, the tool would be in serious danger of not meeting of the previously established expectations.

A lot of effort will be devoted to the application's development for the second iteration of this TP so that real-world use case scenarios involving professors and students can be tested. The goal is to demonstrate the tool's value to the university as a whole by integrating its capabilities into actual outreach initiatives and projects from Unipampa.

REFERENCES

BECKER, Richard. **What is a minimum viable product (MVP)?** [S.l.]: Techopedia, Aug. 2020. Available from: <https://web.archive.org/web/20220805180502/https://www.techopedia.com/definition/27809/minimum-viable-product-mvp>. Cit. on p. 27.

BERNARDINO, Maicon. **Chamada Interna do Programa JEDI Nº1/2021**. [S.l.: s.n.], 2021. Universidade Federal do Pampa. Available from: <https://web.archive.org/web/20220706153648/https://eventos.unipampa.edu.br/programajedi/2021/08/05/ola-mundo/>. Cit. on p. 25.

BIERMAN, Gavin; ABADI, Martn; TORGERSEN, Mads. Understanding TypeScript. In: ECOOP 2014 Object-Oriented Programming. [S.l.]: Springer Berlin Heidelberg, 2014. DOI: 10.1007/978-3-662-44202-9_11. Available from: <https://doi.org/10.1007/978-3-662-44202-9_11>. Cit. on p. 78.

CHACON, Scott; STRAUB, Ben. **Pro Git**. [S.l.]: Apress, 2014. Cit. on p. 73.

CLARKSON, John; ECKERT, Claudia (Eds.). **Design Process Improvement**. 2005. ed. Guildford, England: Springer, Feb. 2005. Cit. on p. 74.

DIMITRIJEVIĆ, Sonja; JOVANOVIĆ, Jelena; DEVEDŽIĆ, Vladan. A comparative study of software tools for user story management. **Information and Software Technology**, v. 57, p. 352–368, 2015. ISSN 0950-5849. DOI: https://doi.org/10.1016/j.infsof.2014.05.012. Available from: <https://www.sciencedirect.com/science/article/pii/S0950584914001293>. Cit. on pp. 59, 75.

DOYLE, Barry J.; LOPES, Cristina Videira. Survey of Technologies for Web Application Development. **CoRR**, abs/0801.2618, 2008. arXiv: 0801.2618. Available from: <http://arxiv.org/abs/0801.2618>. Cit. on p. 79.

EDUCATION, IBM Cloud. **What is an application programming interface (API)**. [S.l.: s.n.], 2020. Available from: <https://web.archive.org/web/20220805141639/https://www.ibm.com/cloud/learn/api>. Cit. on p. 73.

FACEBOOK. **React - a JavaScript library for building user interfaces**. [S.l.: s.n.], 2022. Available from: <https://web.archive.org/web/20220721194557/https://reactjs.org/docs/getting-started.html>. Cit. on p. 78.

FOREXT. Referenciais para a construção de uma Política Nacional de Extensão nas ICES. In_____. **Extensão Nas Instituições Comunitárias De Ensino**

Superior. Brazil: XX Encontro Nacional de Extensão e Ação Comunitária das Universidades e Instituições Comunitárias, 2013. UNIVALI, p. 64. Available from: <https://web.archive.org/web/20220303023244/http://www1.pucminas.br/imagedb/documento/DOC_DSC_NOME_ARQUI20150309182334.pdf>. Cit. on pp. 35, 37.

FORPROEX. **Política Nacional de Extensão Universitária**. [S.l.: s.n.], 2012. Universidade Federal de Minas Gerais. Available from: <https://web.archive.org/web/20220722190808/https://www.ufmg.br/proex/renex/images/documentos/2012-07-13-Politica-Nacional-de-Extensao.pdf>. Cit. on p. 35.

FORZA, C. Survey research in operations management: a process-based perspective. **International Journal of Operations and Production Management**, v. 22, p. 152–194, 2002. DOI: 10.1108/01443570210414310. Cit. on p. 59.

FOUNDATION, Free Software. **GNU General Public License v3.0**. [S.l.: s.n.], 2007. Available from: <https://web.archive.org/web/20220802034844/https://choosealicense.com/licenses/gpl-3.0/>. Cit. on p. 80.

GAROUSI, Vahid; FELDERER, Michael; MÄNTYLÄ, Mika V. Guidelines for including grey literature and conducting multivocal literature reviews in software engineering. **Information and Software Technology**, Elsevier, v. 106, p. 101–121, 2019. Cit. on pp. 43, 44.

GODIN, Katelyn et al. Applying systematic review search methods to the grey literature: a case study examining guidelines for school-based breakfast programs in Canada. **Systematic reviews**, BioMed Central, v. 4, n. 1, p. 1–10, 2015. Cit. on p. 45.

GRAÇAS VIEIRA, Maria das; MACHADO, Fábio Firmino. Sistema Integrado de Gestão de Atividades Acadêmicas SIGAA–Módulo Biblioteca: uma oportunidade de retomar a credibilidade da comunidade acadêmica com a efetivação da gestão do Sistema de Bibliotecas da Universidade Federal da Paraíba. **RDBCI: Revista Digital de Biblioteconomia e Ciência da Informação**, v. 11, n. 2, p. 159–175, 2013. Cit. on p. 45.

GRIGORYAN, Alex. **The benefits of server side rendering over client side rendering**. [S.l.]: Walmart Global Tech Blog, Apr. 2017. Available from: <https://web.archive.org/web/20220805180529/https://medium.com/walmartglobaltech/the-benefits-of-server-side-rendering-over-client-side-rendering-5d07ff2cefe8>. Cit. on p. 80.

IUNG, Aníbal et al. Systematic mapping study on domain-specific language development tools. **Empirical Software Engineering**, Springer, v. 25, n. 5, p. 4205–4249, 2020. Cit. on p. 46.

JEDI, Programa. **Programa JEDI**. [S.l.: s.n.], 2022. Universidade Federal do Pampa. Available from: <https://web.archive.org/web/20220731043844/https://eventos.unipampa.edu.br/programajedi/>. Cit. on p. 37.

JOSHI, Ankur et al. Likert scale: Explored and explained. **British journal of applied science & technology**, SCIENCEDOMAIN International, v. 7, n. 4, p. 396, 2015. Cit. on p. 59.

KASUNIC, Mark. **Designing an effective survey**. [S.l.], 2005. Cit. on pp. 26, 55–58, 60, 61.

KOHAVI, Ron; ROTHLEDER, Neal J.; SIMOUDIS, Evangelos. Emerging Trends in Business Analytics. **COMMUNICATIONS OF THE ACM**, v. 45, n. 8, p. 45–48, 2002. Cit. on p. 81.

LINÅKER, Johan et al. **Guidelines for Conducting Surveys in Software Engineering**. [S.l.], 2015. Cit. on p. 58.

MARTINS, G. L. **Towards a Performance Testing Body of Knowledge (PTBOK)**. [S.l.], 2021. Cit. on p. 58.

MOLLÉRI, J.S.; PETERSEN, K.; E., Mendes. An empirically evaluated checklist for surveys in software engineering. **Information and Software Technology**, 2020. DOI: 10.1016/j.infsof.2019.106240. Cit. on p. 57.

NIDHRA, Srinivas; DONDETI, Jagruthi. Black box and white box testing techniques-a literature review. **International Journal of Embedded Systems and Applications (IJESA)**, v. 2, n. 2, p. 29–50, 2012. Cit. on p. 43.

OMG. **OMG Unified Modeling Language (OMG UML)**. [S.l.]: Object Management Group, 2017. Available from: <https://web.archive.org/web/20220716081844/https://www.omg.org/spec/UML/2.5.1/PDF>. Cit. on p. 77.

PATEL, Karan. Incremental journey for World Wide Web: introduced with Web 1.0 to recent Web 5.0–a survey paper. **International Journal of Advanced Research in Computer Science and Software Engineering**, v. 3, n. 10, 2013. Cit. on p. 79.

PLAUSIBLE. **Plausible: Privacy focused google analytics alternative**. [S.l.: s.n.], July 2022. Available from: <https://web.archive.org/web/20220805180329/https://plausible.io/privacy-focused-web-analytics>. Cit. on pp. 81, 82.

PRODANOV, Cleber Cristiano; FREITAS, Ernani Cesar de. **Metodologia do trabalho científico: métodos e técnicas da pesquisa e do trabalho acadêmico-2ª Edição**. [S.l.]: Editora Feevale, 2013. Cit. on pp. 29, 30.

PROEXT. **Documentos Extensionistas**. [S.l.: s.n.], 2022. Universidade Federal do Pampa. Available from: <https://web.archive.org/web/20220731164654/https://sites.unipampa.edu.br/proext/documentos/documentos-e-fluxos>. Cit. on pp. 38, 41.

_____. **Instrução Normativa Nº 18. Normativas do Programa Institucional "UNIPAMPA Cidadã"**. [S.l.: s.n.], 2021. Universidade Federal do Pampa. Available from: <https://web.archive.org/web/20220706155520/https://sites.unipampa.edu.br/proext/files/2021/08/sei_unipampa-0585474-instrucao-normativa-gr-unipampa-cidada.pdf>. Cit. on pp. 26, 39.

_____. **Prestação de contas de 2021**. [S.l.: s.n.], 2021. Universidade Federal do Pampa. Available from: <https://web.archive.org/web/20220328201547/https://sites.unipampa.edu.br/proext/files/2022/03/prestacao_de_contas_2021.pdf>. Cit. on p. 57.

_____. **Resolução CONSUNI/UNIPAMPA Nº317. Regulamenta a inserção das atividades de extensão nos cursos de graduação, presencial e a distância, da Universidade Federal do Pampa**. [S.l.: s.n.], 2021. Universidade Federal do Pampa. Available from: <https://web.archive.org/web/20220706154002/https://sites.unipampa.edu.br/proext/files/2021/05/res-317_2021-politica-de-extensao.pdf>. Cit. on pp. 25, 26, 37, 39.

_____. **Resolução Nº 332. Revoga a Resolução CONSUNI/UNIPAMPA nº 104, de 27 de agosto de 2015 e Institui as Normas para Atividades de Extensão e Cultura da Universidade Federal do Pampa.** [S.l.: s.n.], 2021. Universidade Federal do Pampa. Available from: <https://web.archive.org/web/20220726032529/https://sites.unipampa.edu.br/proext/files/2021/12/sei_unipampa-0700488-resolucao-consuni.pdf>. Cit. on p. 37.

REA, L. M.; PARKER, R. A. **Designing and conducting survey research: a comprehensive guide**. 3. ed. [S.l.]: San Francisco: Jossey-Bass Publishers, 2005. Cit. on p. 58.

REYNOLDS, Cormac. **The benefits of translating your website into other languages**. [S.l.: s.n.], Apr. 2020. Available from: <https://web.archive.org/web/20220805180711/https:

//tech.co/news/benefits-translating-website-languages-2015-07>. Cit. on p. 81.

SELLOU, Linda; HARRISON, Tim; RIVETT, Alison. The many positive impacts of participating in outreach activities on postgraduate students. English. **New Directions in the Teaching of Physical Sciences**, University of Leicester Open Journals, n. 7, p. 13–18, July 2011. ISSN 1740-9888. Cit. on p. 35.

SUPERIOR, MINISTÉRIO DA EDUCAÇÃO CONSELHO NACIONAL DE EDUCAÇÃO CÂMARA DE EDUCAÇÃO. **RESOLUÇÃO Nº 7, DE 18 DE DEZEMBRO DE 2018. Estabelece as Diretrizes para a Extensão na Educação Superior Brasileira e regimenta o disposto na Meta 12.7 da Lei nº 13.005/2014, que aprova o Plano Nacional de Educação - PNE 2014-2024 e dá outras providências**. [S.l.: s.n.], 2018. Ministério da Educação. Available from: <https://web.archive.org/web/20220312180103/http://portal.mec.gov.br/index.php?option=com_docman&view=download&alias=104251-rces007-18&category_slug=dezembro-2018-pdf&Itemid=30192>. Cit. on p. 36.

THAKKAR, Mohit. Next.js. In: BUILDING React Apps with Server-Side Rendering: Use React, Redux, and Next to Build Full Server-Side Rendering Applications. Berkeley, CA: Apress, 2020. P. 93–137. ISBN 978-1-4842-5869-9. DOI: 10.1007/978-1-4842-5869-9_3. Available from: <https://doi.org/10.1007/978-1-4842-5869-9_3>. Cit. on p. 79.

VIERO, Tatiane Vedoin. Programa de extensão universitária: perspectivas emergentes na educação em ciências. **Dissertação de Mestrado (Programa de Pós-Graduação em Educação em Ciências: Química da Vida e Saúde)**, 2012. Cit. on p. 37.

W3TECHS. **Usage statistics of traffic analysis tools for websites**. [S.l.: s.n.], 2019. Available from: <https://w3techs.com/technologies/overview/traffic_analysis>. Cit. on p. 81.

WATERS, Kelly. Prioritization using moscow. **Agile Planning**, v. 12, p. 31, 2009. Cit. on p. 59.

Appendix

APPENDIX A – TRANSLATED SURVEY QUESTIONNAIRE

Extensionly - Survey

Dear collaborator,

We are graduate students in software engineering at the Federal University of Pampa, and our Course Completion Work is a tool to make life easier for the academic community. It will concentrate on automating the management of extensive activities, such as events, minicourses, lectures, and workshops. Process that is currently carried out manually, both in terms of participant registration and teacher proposals for new initiatives.

With this in mind, we are conducting a study to better understand the needs of our target audience. We would appreciate your assistance in responding to this form, which takes about 10 to 15 minutes.

Before moving on, it's crucial to clarify the following information about the study:

- Your participation in the study is entirely voluntary, thus you are not required to provide the information requested by the researchers or to participate in their activities. You are free to stop participating in the study at any time.

- The responses collected are anonymous and private. Only the restriction of responses to one per person requires the need of a login. We don't collect any personal information.

Finally, we put ourselves at your disposal for any questions via the email addresses lucasfell.aluno@unipampa.edu.br or igorcosta.aluno@unipampa.edu.br.

Supervisor: Maicon Bernardino da Silveira.

* Required

LESSE

Laboratory of Empirical Studies in Software Engineering

1. Do you agree to continue the research? *

Mark only one oval.

- ◯ Yes
- ◯ No

Identification

To evaluate the respondents' profile, we ask for a few anonymous data.

2. Are you part of Unipampa? *

Mark only one oval.

- ◯ Yes *Skip to question 8*
- ◯ No *Skip to question 27*

3. Gender *

Mark only one oval.

- ◯ Male
- ◯ Female
- ◯ Other: _____

4. What is your age? *

Mark only one oval.

- ◯ 14 years or less
- ◯ 15 to 18
- ◯ 19 to 29
- ◯ 30 to 39
- ◯ 40 to 49
- ◯ 50+
- ◯ I would rather not respond

5. Education *

Mark only one oval.

- Incomplete middle school
- Finished middle school
- Incomplete high school
- Finished high school
- Incomplete higher education
- Finished higher education
- Postgraduate
- Masters
- Doctorate
- Post Doctoral

6. Have you ever taken part in Outreach Activities? *

Mark only one oval.

- Yes
- No

7. If yes, what was your role? *

Select all that apply

Check all that apply.

- [ ] Participant / Listener
- [ ] Outreach Program or Project Coordinator
- [ ] Outreach Program or Project Proponent
- [ ] Outreach Activity Instructor / Speaker
- [ ] I have never participated in any Outreach Activity

Identification

To evaluate the respondents' profile, we ask for a few anonymous data.

8. What is your role in the academic community? *

Mark only one oval.

- ◯ Student *Skip to question 10*
- ◯ Professor
- ◯ ATE *Skip to question 12*
- ◯ Other: _____

9. Campus / City:

Mark only one oval.

- ◯ Alegrete
- ◯ Bagé
- ◯ Caçapava
- ◯ Dom Pedrito
- ◯ Itaqui
- ◯ Jaguarão
- ◯ São Borja
- ◯ São Gabriel
- ◯ Santana do Livramento
- ◯ Uruguaiana
- ◯ Rectory

Identification - Course

To evaluate the respondents' profile, we ask for a few anonymous data.

10. Course: *

Mark only one oval.

- Management
- Public Management
- Agronomy
- Aquaculture
- Biotecnology
- Computer Science
- Food Science and Technology
- Biological Sciences
- Nature Sciences
- Economic Sciences
- Exact Sciences
- Human Sciences
- Social Sciences
- Advertising and Marketing
- Public Administration
- Law
- Physical Education
- Nursing
- Agricultural Engineering
- Environmental and Sanitary Engineering
- Cartographic and Surveying Engineering
- Civil Engineering
- Food Engineering
- Aquaculture Engineering
- Computer Engineering
- Energy Engineering
- Production Engineering
- Software Engineering
- Telecommunications Engineering

- [ ] Electrical Engineering
- [ ] Forest Engineering
- [ ] Mechanical Engineering
- [ ] Chemical engineering
- [ ] Pharmacy
- [ ] Physiotherapy
- [ ] Orcharding
- [ ] Physics
- [ ] Geophysics
- [ ] Geography
- [ ] Geology
- [ ] Environmental Management
- [ ] Tourism Management
- [ ] History
- [ ] Science and Technologies
- [ ] Journalism
- [ ] Spanish and Hispanic Literature
- [ ] Additional Languages English, Spanish and Their Literature
- [ ] Portuguese and Spanish
- [ ] Portuguese and Portuguese Language Literatures
- [ ] Portuguese
- [ ] Mathematics
- [ ] Medicine
- [ ] Veterinary Medicine
- [ ] Mining
- [ ] Music
- [ ] Nutrition
- [ ] Pedagogy
- [ ] Production and Cultural Politics
- [ ] Chemistry
- [ ] International Relations
- [ ] Public Relations
- [ ] Social Services

Social Services
Other: _____

Identification - Course

To evaluate the respondents' profile, we ask for a few anonymous data.

11. Course: *

Mark only one oval.

- Management
- Public Management
- Agronomy
- Aquaculture
- Biotecnology
- Computer Science
- Food Science and Technology
- Biological Sciences
- Nature Sciences
- Economic Sciences
- Exact Sciences
- Human Sciences
- Social Sciences
- Advertising and Marketing
- Public Administration
- Law
- Physical Education
- Nursing
- Agricultural Engineering
- Environmental and Sanitary Engineering
- Cartographic and Surveying Engineering
- Civil Engineering
- Food Engineering
- Aquaculture Engineering
- Computer Engineering
- Energy Engineering
- Production Engineering
- Software Engineering
- Telecommunications Engineering
- Electrical Engineering

- [ ] Electrical Engineering
- [ ] Forest Engineering
- [ ] Mechanical Engineering
- [ ] Chemical engineering
- [ ] Pharmacy
- [ ] Physiotherapy
- [ ] Orcharding
- [ ] Physics
- [ ] Geophysics
- [ ] Geography
- [ ] Geology
- [ ] Environmental Management
- [ ] Tourism Management
- [ ] History
- [ ] Science and Technologies
- [ ] Journalism
- [ ] Spanish and Hispanic Literature
- [ ] Additional Languages English, Spanish and Their Literature
- [ ] Portuguese and Spanish
- [ ] Portuguese and Portuguese Language Literatures
- [ ] Portuguese
- [ ] Mathematics
- [ ] Medicine
- [ ] Veterinary Medicine
- [ ] Mining
- [ ] Music
- [ ] Nutrition
- [ ] Pedagogy
- [ ] Production and Cultural Politics
- [ ] Chemistry
- [ ] International Relations
- [ ] Public Relations
- [ ] Social Services

Other: _____

Skip to question 27

Extensionly

We ask the respondent to evaluate the question, assuming that they were a system user. The questions are arranged according to the MoSCoW scale, which is frequently used to prioritize requirements. The four levels in English are:

4 - Must have
3 - Should have
2 - Could have
1 - Wouldn't have

Outreach activities proponent

The one who idealizes an outreach activity and assembles a formal proposal with the project of what was thought.

12. P1 - As a Proponent, I would like to propose an outreach activity, creating knowledge opportunities for other people. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

13. P2 - As a Proponent, I would like to define desired prerequisites for enrollment in my outreach activity proposal, so that my applicants do not come unprepared. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

14. P3 - As a Proponent, I would like my data to be shown along the details page of my outreach activity, so that participants have more details of who I am. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

15. P4 - As a Proponent, I would like to leave comments on the outreach activity page, to request some special material for carrying out the activity or just leave a note of mine for the participants. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

16. Please leave your comment (suggestion, improvement or criticism) about the evaluated features:

Please, when commenting, write the question code (P1, P2...). Thanks!

Extensionly

4 - Must have
3 - Should have
2 - Could have
1 - Wouldn't have

17. P5 - As a Proponent, I would like to fill in a general report on the progress of the outreach activity carried out, for archiving purposes. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

18. P6 - As a Proponent, I would like to register multiple editions of the same outreach activity, so that new participants can check past editions. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

19. P7 - As a Proponent or Instructor, I would like to get in touch with the participants of the outreach activity, so that it is easy to pass on information relevant to the activity. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

20. Regarding the previous question (P7), I prefer to get in touch through: *

Check all that apply.

- [ ] Email
- [ ] WhatsApp

21. P8 - As a Proponent, I would like to receive the evaluation of the participants of my outreach activity in a detailed report/form format, so that I am aware of what I should improve for the next edition. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

22. Please leave your comment (suggestion, improvement or criticism) about the evaluated features:

Please, when commenting, write the question code (P5, P6...). Thanks!

Extensionly

4 - Must have
3 - Should have
2 - Could have
1 - Wouldn't have

Outreach Activities Instructor

The person who passes the content in the case of workshops, gives a lecture or teaches a course. The agent who presents something to the participants.

23. I1 - As an Instructor, I would like to manage the attendance of registered participants so that certificates can be issued for those present. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

Coordinator of outreach projects or programs
One who reviews and approves proposed outreach activities.

24. C1 - As Coordinator, I would like to manage the submissions of new outreach activities carried out, so that each proposal goes through a review process before being accepted. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

25. C2 - As Coordinator, I would like to issue certificates of participation with a certain number of hours for all involved, participants, instructors and coordinator, so that the individual's involvement in the outreach activity is proven. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

26. Please leave your comment (suggestion, improvement or criticism) about the evaluated features:

Please, when commenting, write the question code (I1, C1...). Thanks!

_____

_____

_____

_____

_____

Skip to question 47

Extensionly

We ask the respondent to evaluate the question, assuming that they were a system user. The questions are arranged according to the MoSCoW scale, which is frequently used to prioritize requirements. The four levels in English are:

4 - Must have
3 - Should have
2 - Could have
1 - Wouldn't have

Participant

The Participant or Listener user is the one who enroll to some outreach activity and is present on the established dates.

27. A1 - As a Participant, I would like to apply for outreach activities such as events, courses and lectures, to enter the waiting list and be accepted in the activity. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

28. A2 - As a Participant, I would like to be able to search for outreach activities, so that I can find what I am looking for more easily. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

29. A3 - As a Participant, I would like to cancel or edit the information of an outreach activity enrollment made by me, to have more freedom in case I change my mind. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

30. Please leave your comment (suggestion, improvement or criticism) about the evaluated features:

Please, when commenting, write the question code (A1, A2...). Thanks!

Extensionly

4 - Must have
3 - Should have
2 - Could have
1 - Wouldn't have

31. A4 - As a Participant, I would like to see previous editions of outreach activities, so that I can read past proposals. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

32. A5 - As a Participant, I would like to view the history of all the outreach activities I have participated in, so that I don't have to keep the record outside of the tool. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

33. A6 - As a Participant, I would like to have a help area within the system, to guide me with any questions or problems that I may face with the activity I signed up for. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

34. A7 - As a Participant without college enrollment, I would like to register in the system to participate in outreach activities that interest me. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

35. Please leave your comment (suggestion, improvement or criticism) about the evaluated features:

Please, when commenting, write the question code (A5, A6...). Thanks!

Extensionly

4 - Must have
3 - Should have
2 - Could have
1 - Wouldn't have

36. A8 - As a Participant, I would like to inform my interest in areas of knowledge, so that I can see outreach activities related to them. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

37. A9 - As a Participant, I would like to favor outreach activities that I deem interesting, so that I have easy access to them when I need them. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

38. A10 - As a Participant, I would like to show my interest in unavailable outreach activities, so that I will be notified when a new issue opens. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

39. A11 - As a Participant, I would like to register for outreach activities without registering in the system, so that my information is not saved. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

40. Please leave your comment (suggestion, improvement or criticism) about the evaluated features:

Please, when commenting, write the question code (A9, A10...). Thanks!

Extensionly

4 - Must have
3 - Should have
2 - Could have
1 - Wouldn't have

41. A12 - As a Participant, I would like to share information about the outreach activity, so that I can share it more easily with my friends. *

Mark only one oval.

	1	2	3	4	
Wouldn't have					Must have

42. A13 - As a Participant, I would like to evaluate the outreach activity in which I participated, so that other participants can see the grade I assigned. *

Mark only one oval.

	1	2	3	4	
Wouldn't have					Must have

43. A14 - As a Participant, I would like to see the outreach activities in which I am enrolled in the form of a calendar, so that I can organize myself better. *

Mark only one oval.

	1	2	3	4	
Wouldn't have	◯	◯	◯	◯	Must have

44. About the previous question (A14), I: *

Check all that apply.

- [ ] I prefer a calendar on the website of the tool itself
- [ ] I prefer to export events to my calendar app (Google Calendar or iCloud Calendar)

45. Please leave your comment (suggestion, improvement or criticism) about the evaluated features:

Please, when commenting, write the question code (A13, A14...). Thanks!

_____

_____

_____

_____

_____

Skip to question 46

Extensionly - Suggestions

This section is reserved for you to suggest some functionality (requirement) that was not mentioned above, but that you consider important for the completeness of the system.

46. Suggestions (as a Participant):

Skip to question 48

Extensionly - Suggestions

This section is reserved for you to suggest some functionality (requirement) that was not mentioned above, but that you consider important for the completeness of the system.

47. Suggestions (as Coordinator, Instructor or Proposer):

Skip to question 48

Submission of participation certificate

If you want a certificate of participation in this survey, fill in all the fields below.

48. Your email:

49. Your full name: