FEDERAL UNIVERSITY OF PAMPA

Lucas Alexandre Fell

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

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. PhD. Maicon Bernardino da Silveira

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Term Paper presented and approved on .... of ......
Committee members:

Prof. PhD. Maicon Bernardino da Silveira
Supervisor
UNIPAMPA

Prof. <titulação> Nome Professor
<sigla da instituição>

Prof. <titulação> Nome Professor
<sigla da instituição>

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.

ACKNOWLEDGEMENTS

I would like to thank my family, Isabel, Marco and Maitê for their unbounded love and support. I wouldn't be here without their help throughout the years and the education they were able to provide me. For that, I will be always grateful.

I am also thankful for the knowledge and education I received from each of my professors during my time at the University. This work wouldn't be possible without them. College has been a challenge since the start, especially during the COVID pandemic, but thanks only to their patience and effort in teaching, that was I able to reach this far in the course.

My advisor, Maicon Bernardino, for motivating, guiding, and being a great supervisor. For without his help and patience, this whole study could've been much more difficult than it needs to be.

My friend and roommate throughout the college years, Igor, for the bond we created through college that I'm sure will last for many years to come. Also, thanks for all the discussions and knowledge sharing we've had during each discipline of the course. It would've been much, much harder to come this far without his help.

"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, escala de importância, os requisitos previamente coletados com a revisão na literatura cinza. Os resultados foram analisados e, a partir deles, iniciou-se o desenvolvimento da solução 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. Frontend. Extensão. Universidade.

ABSTRACT

In 2023, the process of curricularization of new outreach actions will be implemented by the country's Higher Education Institutions. 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 the development of 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 solution began: 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. Frontend. Outreach Activities. University.

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LIST OF ABBREVIATIONS AND ACRONYMS

ATE Administrative Technician in Education

CAEX Outreach Actions Control

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

HECI Higher Education Community Institution

HEI Higher Education Institution

IT Information Technology

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

MVP Minimum Viable Product

NGO Non-governmental organization

OA Outreach Activity

OCA Outreach Curriculum Activity

PROEXT Dean of Outreach and Culture

SGCE Electronic Certificate Management System

SIGAA Integrated Academic Activities Management System

SIPPEE Information System for Research, Teaching and Outreach Projects

Unipampa Federal University of Pampa

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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, 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 separate implementations and live in different version control repositories, and both have their own specific DevOps pipelines and deployments.

The Federal University of Pampa offers several opportunities for students to participate in environments external to the university. According to the 317th CONSUNI Resolution from April 29th, 2021, an outreach activity can be described as the following: An action that integrates the curricular matrix and the organization of research, constituting an interdisciplinary, political, educational, cultural, scientific and technological process UNIPAMPA (2021b). It also promotes the transforming interaction between Unipampa and society, through the production and application of knowledge, in permanent articulation with teaching and research.

There are four (4) different modalities for outreach activities UNIPAMPA (2021b): (i) Program: a set of actions that are oriented towards a common objective, with a medium to long term duration; (ii) Project: usually linked to a Program, it has a specific objective and a fixed term; (iii) Course: training activity, with short duration, and; (iv) Event: an action with an artistic, cultural and scientific character, with a well-defined duration.

An example is the JEDI Program, which aims to solve local problems and stimulate capacity building and training in Information Technology (IT) with the involvement of the community (academic and external) together with public or private companies (BERNARDINO, 2021).

To register a new Outreach Curriculum Activity, it is first necessary to identify whether it is a Specific or Linked OCA - whether it is linked to an Undergraduate Curriculum Component or not. The OCA 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 (UNIPAMPA, 2021b).

Among the supervisor's responsibilities are: the evaluation of the formative nature of the action carried out by the student, the validation of the use of Specific OCAs and also the construction and dissemination of a biannual report containing the outreach activities carried out in the course.

After contacting the supervisor, showing interest in an OCA, it is the student's responsibility to request the use and validation of the hours spent in the activity with the

Academic Secretary of the course (UNIPAMPA, 2021b). And the professor is responsible for selecting and enrolling each student interested in the OCA, until there are open slots.

1.1 Motivation

It's not a mystery that time is of utmost importance on the academic environment. It is an invaluable resource, and as such, must be dealt with with great care. Thinking about time is what drives this project forward, as currently, there is no solution to take care of all the requirements of creating and managing outreach activities in Unipampa.

In 2023, due to Res. Nº317 (UNIPAMPA, 2021b), the process of curricularization of new Outreach Curriculum Activity will be obligatorily implemented by Higher Education Institutions in Brazil. However, all management would be carried out manually by the coordinator or collaborators of the Outreach Programs and Projects. With that in mind, a number of issues were identified with this manual approach that would be easily resolved by introducing a tool to support the management process.

This means that everything - from developing a project, submitting and having it approved, sending emails and creating registration forms to open it for the students to join and later on receive their participation certificate - has to be manually done by the professors and coordinators. From the student's perspective, there is a possibility that one or more of the offers will go unnoticed amid the large amount of emails received daily from the university. The whole process is unoptimized, and takes a great amount of time and effort to be concluded.

So in order to create a more efficient and welcoming environment for the outreach activities in HEIs, the idea of a system to support the needs of this whole process was conceived.

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 (UNIPAMPA, 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 Term Paper has the research aim of developing the front-end part of a tool in which all the current management of OCAs 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 the research aim, 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.

The 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 can 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'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.
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 Outreach Activities (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 is the implementation of an MVP, in the form of a web application, to support and automate the whole process of Outreach Curriculum Activities 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 Term Papers. This one focuses on the development of a web app, with all its related challenges, but it doesn't encompasses the backend 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.

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 e 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 e 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 e Freitas (2013) also mentions that without the scientific method, there is no science.

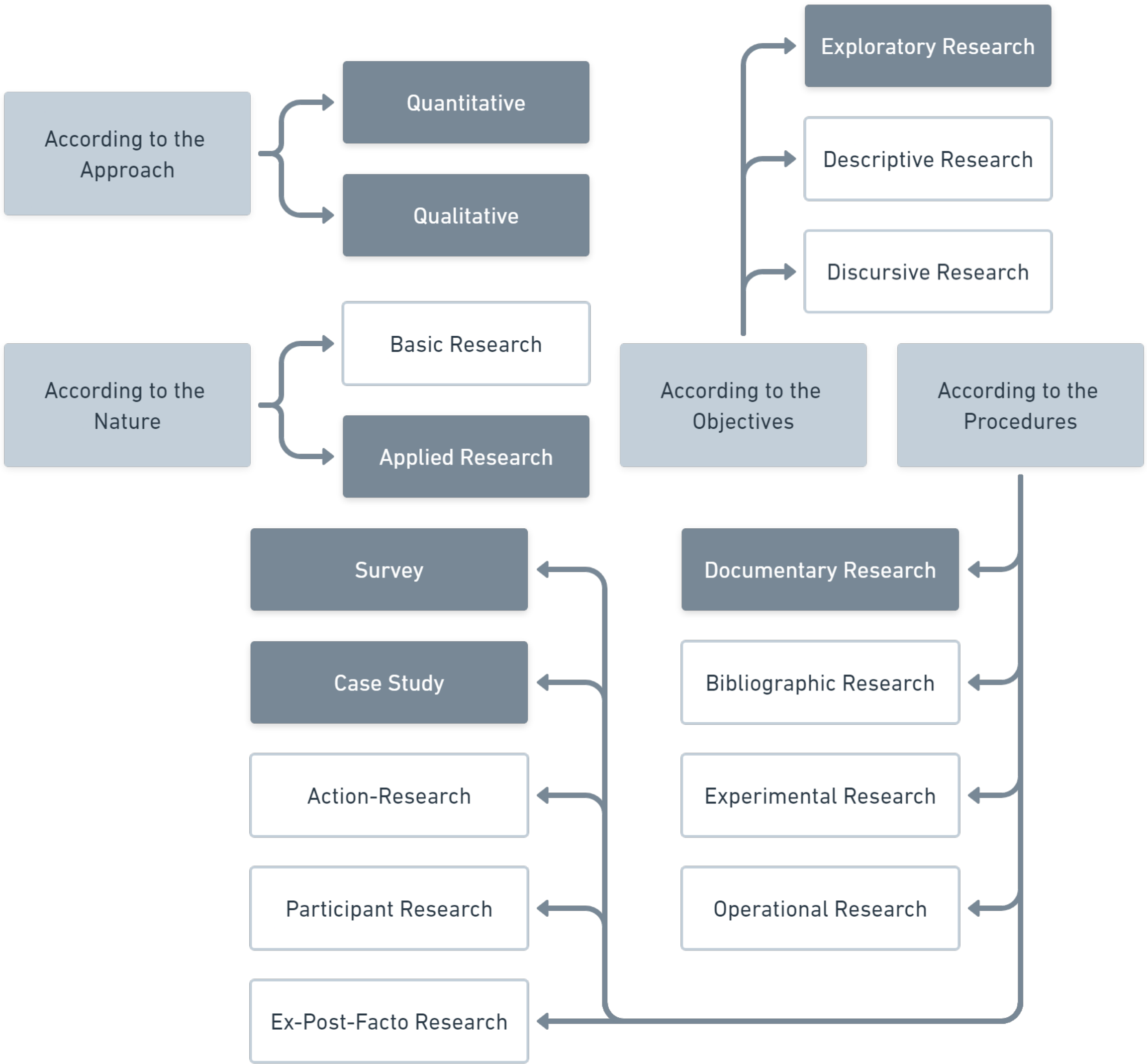
2.2 Research Classification

This research study is defined according to the classification created by Prodanov e 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.

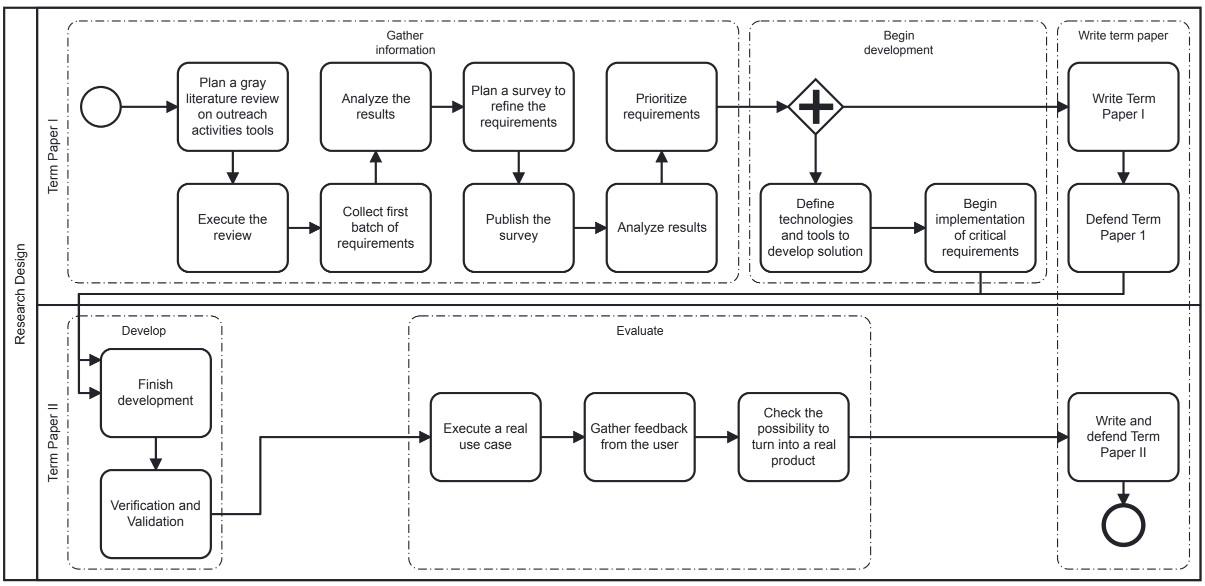
According to the technical procedures, this research also features a **Survey**. They are much more suitable for descriptive rather than explanatory studies. They are inappropriate for the deepening of more complex psychological and psychosocial aspects, but very effective for less delicate problems, 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. The 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 Outreach Activity (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. The 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 (UNIPAMPA, 2021c).

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 (UNIPAMPA, 2021b): (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.

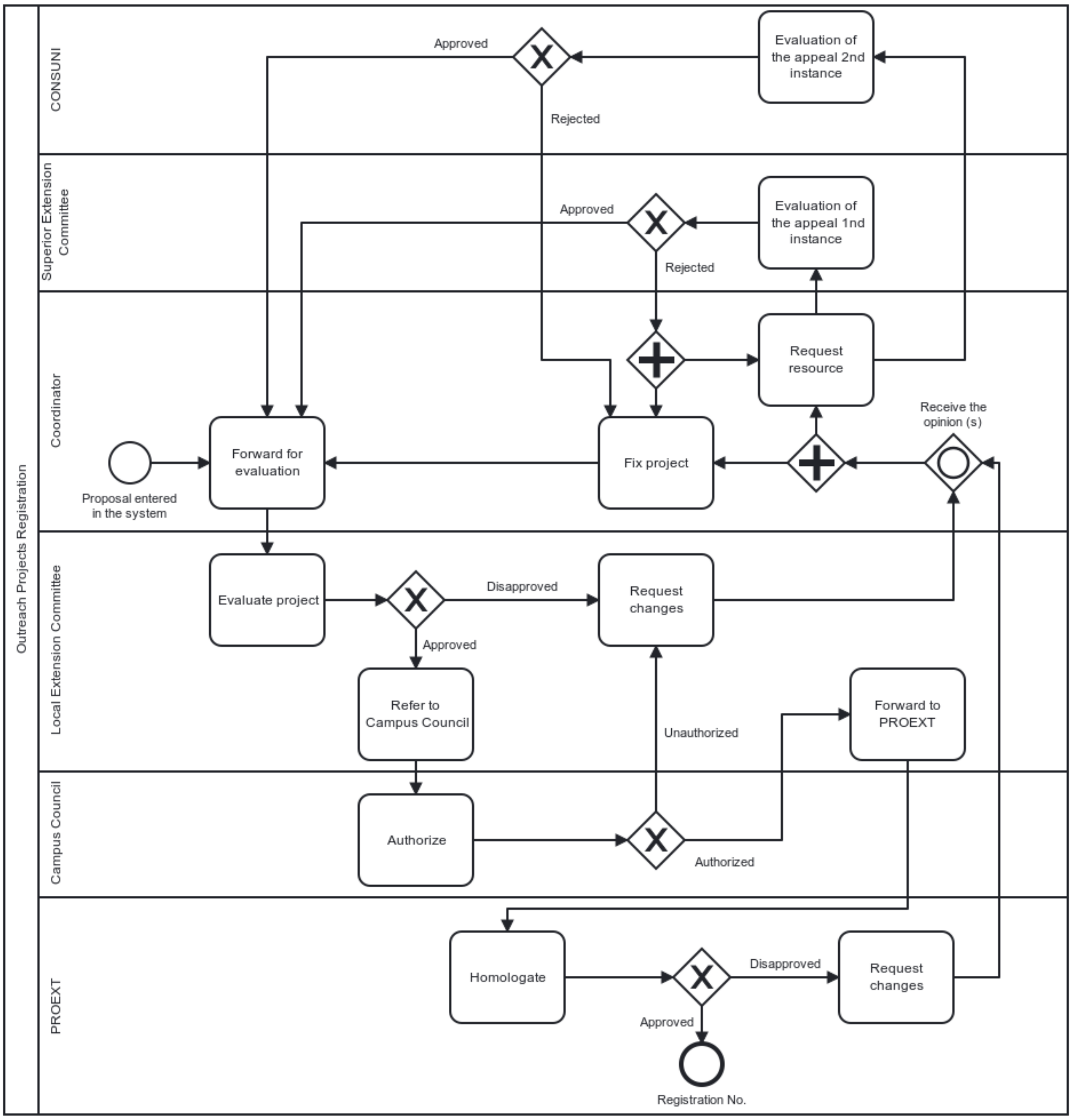
A good example of an outreach program is JEDI (2022), which, as mentioned earlier in Chapter 1, aims to solve local problems using technology and involvement with the community. In the first cycle of the program four outreach projects were proposed, each with its own objectives, methodologies and activities: (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, UNIPAMPA (2021c) 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 (UNIPAMPA, 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 (UNIPAMPA, 2021a), making use of Resolution No. 317, (UNIPAMPA, 2021b), 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

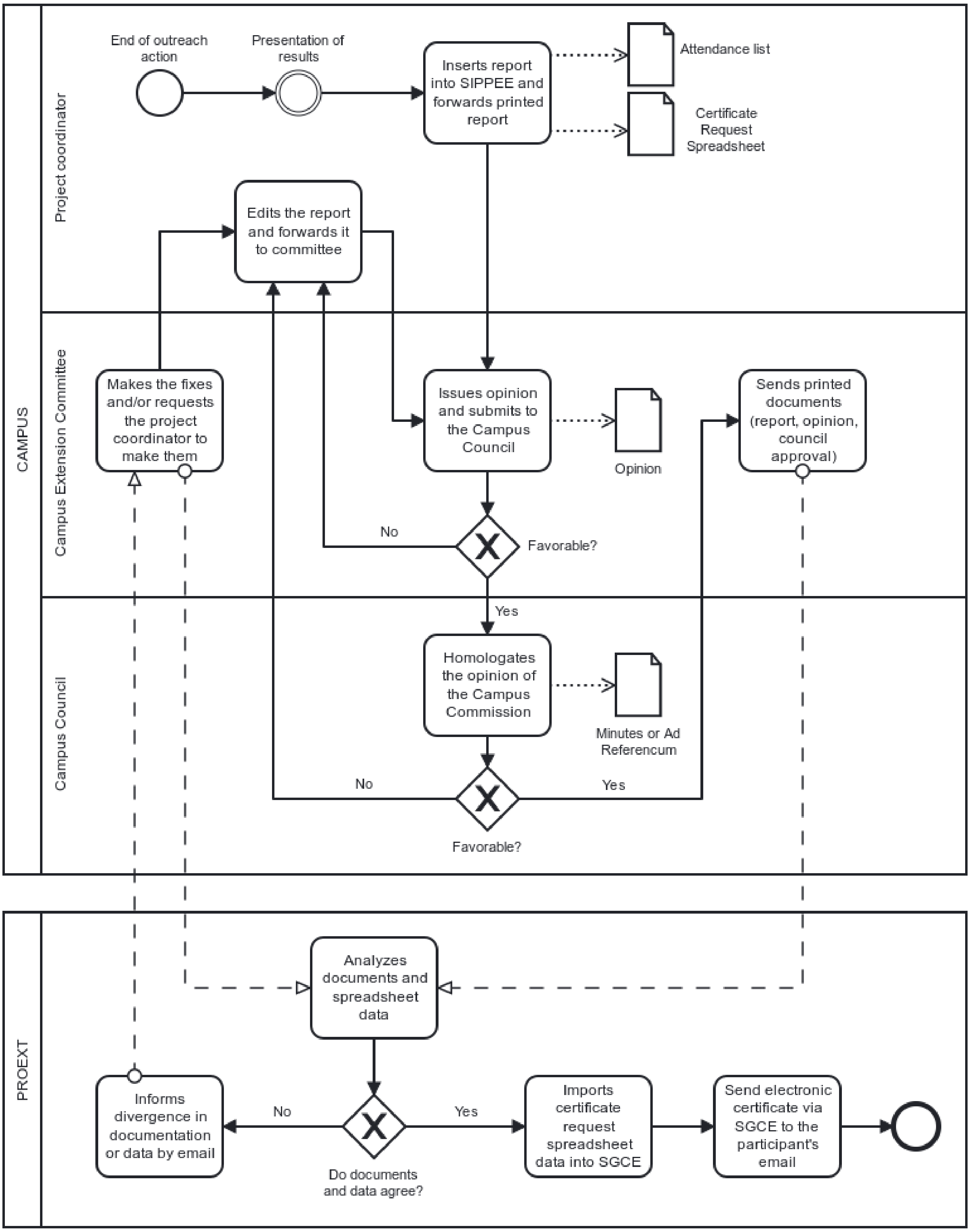
As Chapter 4 will later present in more detail the systematic review performed in the grey literature, a research has been done to collect tools related to outreach activities which are available currently in the market. With the results it was possible to list features, details and common points among 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 (UNIPAMPA, 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: The 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 e Mäntylä (2019):

> <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 e 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 the 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 e 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 Vieira e 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.

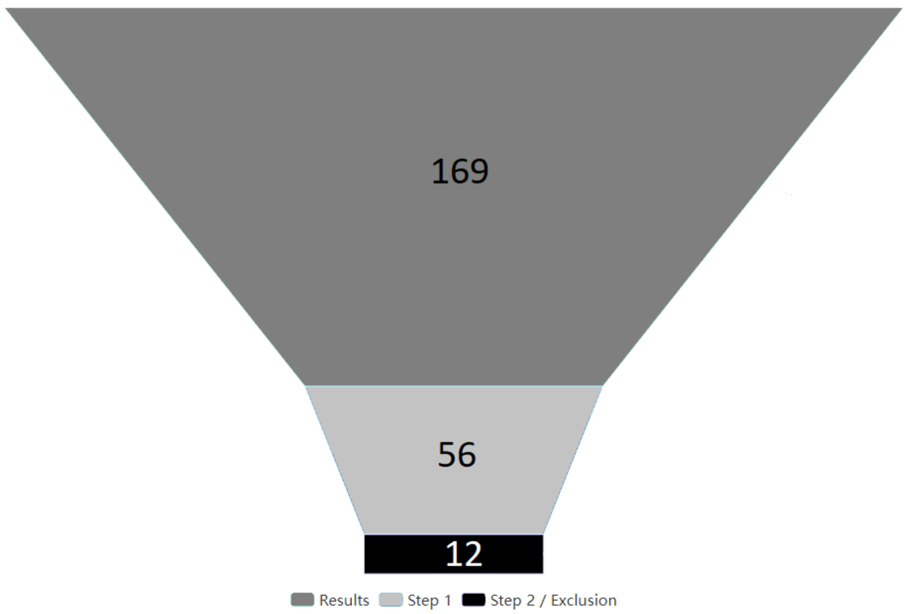
After applying the first step of the inclusion criteria, 56 results were left. Subsequently, the verification with the second stage of the inclusion and exclusion criteria was carried out, which further reduced the results, with 19 tools failing **IC 1.**, 8 did not pass **IC 2.** and 24 tools were denied 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											
Features	Cachalote	CAEX	Einstein	ENS	Santa Marcelina	SGE	SIEX	SIG	SIGAA	Suap	UNINASSAU	UNINTER
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

The 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
Tools	CAEX	4	0,0	7	1,0	22	1,0	Yes	1,0	2022	1,0	4,0
Tools	Einstein	12	0,5	1	0,5	13	0,5	Partially	0,5	2022	1,0	3,0
Tools	ENS	11	0,5	3	1,0	12	0,5	Partially	0,5	2022	1,0	3,5
Tools	Santa Marcelina	6	0,0	No	0,0	7	0,0	Partially	0,5	2022	1,0	1,5
Tools	SGE	8	0,0	1	0,5	14	1,0	Yes	1,0	2016	0,0	2,5
Tools	SIEX	53	1,0	1	0,5	7	0,0	Yes	1,0	2022	1,0	3,5
Tools	SIG	18	0,5	No	0,0	15	1,0	Partially	0,5	2022	1,0	3,0
Tools	SIGAA	28	1,0	1	0,5	16	1,0	Yes	1,0	2022	1,0	4,5
Tools	Suap	8	0,0	No	0,0	10	0,5	Yes	1,0	2022	1,0	2,5
Tools	UNINASSAU	14	0,5	No	0,0	10	0,5	Partially	0,5	2022	1,0	2,5
Tools	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.

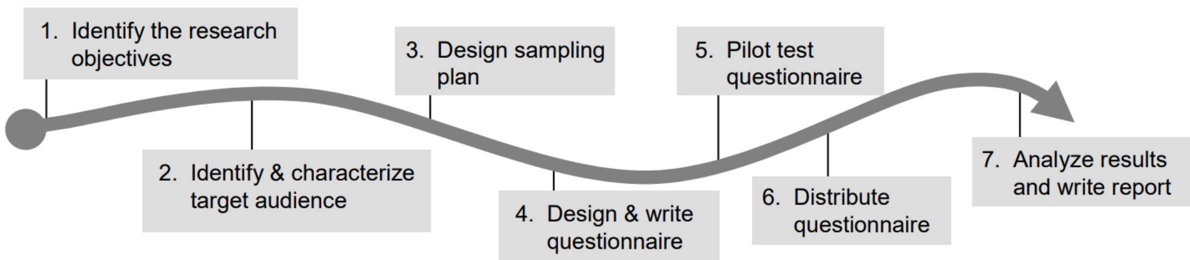
5 SURVEY

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. The 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

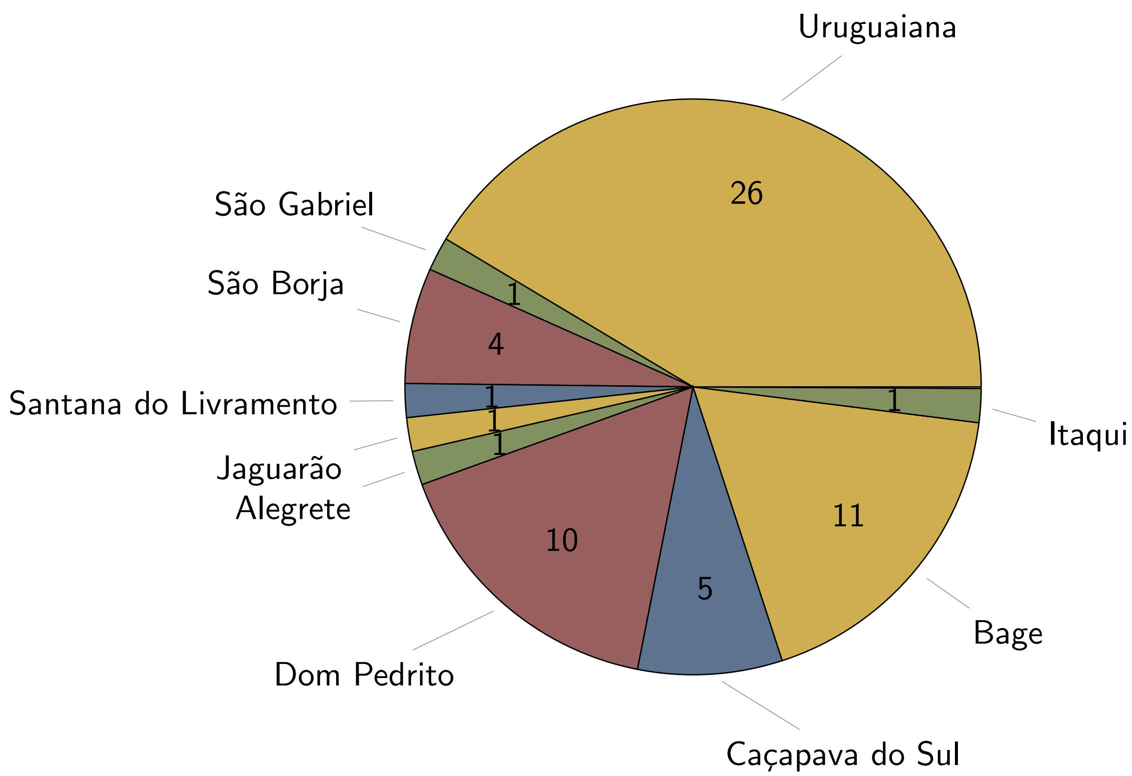
In this stage, an analysis is made to identify possible target groups and to properly select the one that best fits with the research. The population is also defined, and is composed by the academic community as a whole. To represent the population sample, the outreach program and project coordinators, 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 (CULTURA, 2021), 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 Cultura (2021)

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 e 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 **??**. 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. 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.

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

5.3 Results

6 EXTENSIONLY

7 PRELIMINARY CONSIDERATIONS

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