A Systematic Review of Grey Literature on Outreach Activity Management Tools

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Abstract. *This paper presents a systematic review of grey literature focused on existing tools and solutions for managing outreach activities in the context of higher education institutions. Given the mandatory integration of outreach activities into the curriculum starting in 2023, this review aims to identify relevant tools, assess their features, and inform the development of a new management tool currently in progress. The study follows a structured methodology, applying rigorous inclusion and exclusion criteria to filter and evaluate relevant tools. Initial findings highlight key functionalities and common challenges in the current landscape, providing a foundation for the ongoing development of our solution.*

1. Introduction

The integration of **Outreach Activities (OA)** into the academic curriculum has become an essential aspect of higher education, particularly following the implementation of Resolution Nº 7/2018 by the National Council of Education (CNE) [CNE 2018]. This resolution mandates that, beginning in 2023, all undergraduate programs in Higher Education Institutions (HEI) must allocate at least 10% of their curriculum's total workload to OAs. This shift reflects a growing recognition of the importance of engagement between academic institutions and the broader community, which serves to enrich both educational experiences and societal development.

An OA is broadly defined as an initiative that integrates teaching and research with community engagement, fostering an interdisciplinary, educational, cultural, and scientific environment within HEIs. Such activities are designed to enhance the application of academic knowledge in addressing real-world challenges, thereby strengthening the interaction between HEIs and society [Guo and Paradis 2018].

In implementing these requirements, HEIs have identified five key modalities for OAs [CNE 2018]: (i) **Program**: A coordinated set of actions with a medium to long-term focus on a specific objective; (ii) **Project**: A targeted initiative with a clear goal and a defined timeframe, often linked to a broader program; (iii) **Course and Workshop**: Short-term educational activities designed to provide specific skills or knowledge; (iv) **Event**: Time-bound actions with a distinct artistic, cultural, or scientific focus; and (v) **Service Provision**: Activities or contracts performed for third parties that do not result in ownership of a tangible good, often characterized by intangibility and inseparability of the process/product.

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Despite the structured framework provided by the resolution, the practical implementation of OAs within HEIs often faces challenges. These challenges are largely due to the lack of adequate Information and Communication Technology (ICT) resources to support the management of outreach programs. As a result, many institutions continue to rely on manual processes, which are not only time-consuming but also prone to inefficiencies and errors. The need for a comprehensive digital tool to manage these activities effectively has become increasingly apparent.

The historical evolution and effectiveness of outreach as an essential element in educational and social programs have been critically analyzed, showing that when outreach is effectively implemented, it significantly extends the reach and impact of these programs by actively involving participants from underserved populations. This proactive engagement helps bridge the gap between academic institutions and the communities they aim to serve. In the context of higher education, such an approach is especially pertinent, as integrating outreach activities into the curriculum fosters social responsibility and enhances community engagement among students [Leviton and Schuh 1991].

The evolution and challenges in integrating extension activities within Brazilian higher education have been thoroughly examined, revealing that despite the long-standing presence of these activities in universities since 1911, there has been a persistent struggle to elevate them to the same level of importance as teaching and research within the academic curriculum. The need for a more structured approach to curricularize extension activities is highlighted, ensuring that they are recognized as an essential component of higher education, contributing to the social mission of universities and enhancing their interaction with broader society [de Oliveira et al. 2020].

In light of the challenges in managing OAs, this study aims to develop a web-based tool that addresses the current shortcomings in outreach management within Higher Education Institutions (HEIs). By automating key processes, the proposed tool seeks to enhance the efficiency and effectiveness of outreach programs, ultimately contributing to the successful integration of these activities into the academic curriculum. To inform the design of this tool, this paper conducts a systematic review of grey literature, identifying and evaluating existing tools that manage outreach activities but fall short of providing comprehensive solutions. This review gathers insights on the functionalities and limitations of these tools, which will be incorporated into the proposed system to meet the unique needs of HEIs.

We also analyzed three additional papers that utilized grey literature to explore specific challenges and solutions within their respective fields. In ”ChatGPT Implications on Higher Education: Educational Apocalypse or Educational Reboot?”[Ogunleye 2023], grey literature was employed to identify the opportunities and challenges of integrating AI tools like ChatGPT in higher education, mirroring our approach to evaluating outreach management tools. The paper ”On Using Grey Literature and Google Scholar in Systematic Literature Reviews in Software Engineering”[Yasin et al. 2020] highlighted the role of grey literature in minimizing publication bias, similar to our strategy for gaining insights into outreach tools. Additionally, ”AI-based Test Automation: A Grey Literature Analysis”[Ricca et al. 2021] used grey literature to map AI solutions in test automation, akin to our review of tools for managing outreach activities. These studies collectively underscore the value of grey literature in identifying practical solutions and guiding the

development of new tools or methodologies across various domains.

2. Gray Literature Review

A systematic review of the gray literature to map and evaluate existing tools and solutions that already solve the problem of managing outreach activities in the context of HEI was conducted before starting the development of the solution itself.

The protocol defined to conduct the review will be discussed in this chapter, citing points such as research questions, inclusion and exclusion criteria, extracted data and search strings, in addition to the analysis of the results.

Grey literature is defined by the following quote from [Garousi et al. 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."

2.1. Research Questions

Table 1 presents the Research Questions (RQ) to be answered with the systematic review.

Tabela 1. Research Questions

ID	Question
RQ1.	What tools currently exist that perform academic management?
RQ1.1.	Which ones have related functionality or support outreach activities?
RQ1.2.	What are the features offered by these tools?
RQ1.3.	What are the most common features between this type of tool?
RQ1.4.	What data do the tools use in relation to activities, participant registration and user registration?

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.

2.2. 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).

There were 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 (As shown in Table 2). 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 search for the strings itself was performed on the Google search engine.

2.3. Inclusion Criteria

Due to the large number of institutional sites that were just catalogs of outreach activities, the following filter was applied to differentiate tools from catalogs. To be included, the result should include at least three of the following criteria: (a) User login; (b) Registration

Tabela 2. 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

of activities; (c) Activity listing; (d) Possibility of signing up for outreach activities. After filtering the results with the criteria established above, an even more rigorous inclusion criteria was applied. They are presented in Table 3.

Tabela 3. Inclusion Criteria

ID	Inclusion Criteria
IC1.	The tool or website supports the management of outreach activities.
IC2.	The tool or website has a stable version.
IC3.	If it is a tool, it must have documentation.

2.4. 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. A total of 4 defined exclusion criteria were applied to the results and are displayed in Table 4.

Tabela 4. Exclusion Criteria

ID	Exclusion Criteria
EC1.	If it is a tool, it does not have a source code download or an online page.
EC2.	The tool or the website has not received updates for more than 10 years.
EC3.	The tool or website is for the exclusive use of the organization, *i.e.* closed to the external public.
EC4.	The tool or website is paid and does not provide a trial version or all outreach activities are paid.

2.5. 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, they are: (i) **Y**es: 1.0; (ii) **P**artially: 0.5; (iii) **N**o: 0. The defined criteria are presented in Table 5.

2.6. Feature Matrix

After the search 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, it was possible to understand which features were 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 1.

Tabela 5. Quality Criteria

ID	Quality Criteria	Score		
		Yes (1)	Partial (0.5)	No (0)
QC1.	Does the tool use a relevant amount of data related to outreach activities?	The tool uses >=20	10 - 19	10 or less pieces of information
QC2.	Does the tool have unique features among the selected tools?	The tool has 1	1	No unique features
QC3.	Does the tool have a relevant amount of features among those collected?	The tool has >=14	9-13	8 or less features in common with other tools
QC4.	Does the tool have specialized support?	Yes	Partially	No
QC5.	Has the tool been maintained frequently?	The last update was in 2022	2021-2019	2018 and before

		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

Figura 1. Feature Matrix

The most common features among all the evaluated tools and websites were highlighted in lighter grey. Another data extraction was conducted with the goal 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 Table 6.

2.7. 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 7.

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.

3. Answering the Research Questions

RQ1. *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 1, totaling 12 tools.

RQ1.1. *Which ones have related functionality or support outreach activities?*
As it was already shown in Figure 1, 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.

RQ1.2. *What are the features offered by these tools?*
All the features found were listed in the features matrix, present in Figure 1, with a total of 37 features.

RQ1.3. *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) Listing 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.

RQ1.4. *What data do the tools use in relation to activities, participant registration and user registration?*
By analyzing the second data extraction presented in Table 6, the most common fields for an Outreach Activity 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

Tabela 6. Additional Information Extraction

Tools	Features			
	Listing of outreach activities	**Detailed page of an activity**	**Enrollment of a participant into an activity**	**Registration of users external to the institution**
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, subactivities, how it works.	Add to cart and checkout.	Name, CPF, RG, date of birth, gender, email, cell phone, telephone, address.

Tabela 7. Quality Criteria Evaluation

	Quality Criteria										
	QC1.		QC2.		QC3.		QC4.		QC5.		Final
TOOLS	Ans.	Score	Ans.	Score	Ans.	Score	Ans.	Score	Ans.	Score	Results
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

(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. Final Remarks

This paper presented a detailed systematic review of grey literature focused on identifying and evaluating tools for managing outreach activities in HEIs. The review highlighted several existing tools, providing an in-depth analysis of their features, strengths, and weaknesses. The findings from this review have directly informed the ongoing development of a new management tool, designed to address the gaps identified in the current landscape. As the tool progresses through development, its deployment within our university will provide valuable insights and feedback, which will be crucial in refining its features and ensuring it meets the diverse needs of HEIs. Ultimately, this tool aims to provide a comprehensive, flexible, and integrated solution for managing outreach activities, enabling HEIs to effectively integrate these activities into their curricula and fulfill their mission of fostering societal engagement through education.

With the systematic review completed, the next steps involve the continued development of the new management tool. The tool already has a solid version implemented, and plans are underway to deploy it within our university to gather feedback from real-world use cases. This feedback will be instrumental in refining the tool's features and ensuring it meets the needs of all users, from faculty members to students and administrative staff. Additionally, the next phases of development will focus on enhancing the tool's integration capabilities with existing academic systems, expanding its customization options, and improving its overall usability. The goal is to create a comprehensive solution that fully supports the management of outreach activities within HEIs, ensuring these institutions can effectively meet the new curricular requirements.

Data Availability

We are committed to promoting transparency and reproducibility in research. Following this commitment, we provide all the data supporting the findings of our study, which are openly available on Zenodo at `https://doi.org/10.5281/zenodo.13328853`.

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