Developing Playful and Tangible Approaches to the Gap Between Academia and Civil Society: Inclusion, and Access Through Participatory Action-Research

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Abstract. Over the years, academia has had the role of leading the processes of research and development, generating evidence to inform social change. However, this same evidence does not always seem to make these processes effective, based on the premise that there is a gap between higher education institutions and the various civil society organizations. The present work aims to systematize the insights regarding a set of playful resources, originated through Participatory Action Research (PAR) experiences, developed between academia and civil society organizations. These are characterized by a multistakeholder vision of this connection, which includes professors, researchers, students, Non-Governmental Organizations (NGOs), and cultural institutions. In addition, these experiences have a specific focus on increasing access and accessibility of distinct cultural forms through interaction and playfulness. In this context, four case studies are presented, as a strategy to bridge this gap, through the operationalization of the notions of social value, tangibility, playfulness, and pedagogical value. Different types of games and an interactive installation were developed from 2015 to 2022 and emerged from concrete problems experienced in the field by the different organizations. The results from these experiences highlight how media research can simultaneously study the users' needs and produce innovation and change, while bridging the above-discussed gap.

Keywords: Access · Inclusion · Tangibility · Social Value · Games · Playfulness · Participatory Action Research

1 Introduction

Although the closely cooperation between practitioners and research is seen as the gold standard for policy innovation [1], the gap between academia and civil society seems to persist, with a lack of connection between the notions of "know" and the notions of "do" [2]. An emergent critique to this extent is related to how these gaps are mainly pointed by academia – namely related with NGO programmes and their research capacity – but

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there is a scarcity of practical proposals to solve these issues, characterized by difficulties in recognizing practitioners' strengths and knowledge [3].

Strategies to address the gap between academia and civil society – represented to this extent by Non-Governmental Organizations (NGOs) – are mainly framed on the collaborative definition of projects and research ideas, opposed to the traditional perspectives of only involving these institutions a posteriori, in the results dissemination phase. This premise intends to foster the ultimate goal of research, development and innovation – influence decision-making by practitioners at a micro-level, and by policymakers at a macro-level. The figure of a knowledge broker, either an organization or an individual, can work as a facilitator factor in this process, by identifying contextual needs, and transforming evidence into an effective and usable form for policy and practice [3].

The present research will present the insights from a set of action-research experiences for the development of playful resources, trying to critically reflect on the concepts of access and inclusion. Due to its wide usage on daily discourses, the concept of access might be rather difficult to define. For this purpose, the closest fit would be defining it to its link to the concept of presence as proposed by Carpentier [4]:

> "(…) the definition of access, combined with the absence of restrictions towards this presence; whether this is the presence of objects and people, the presence of information (and ideas and knowledge), presence in specific spaces or presence in specific institutions (or organizations)."

Regarding inclusion, the proposed approaches are mainly linked with the broad concept of social inclusion as a construct based on the experiencing of meaningful and expected social roles, and how these result from "complex interactions between personal and environmental factors" [5].

2 Methodological Considerations

Traditionally, qualitative research with a specific focus on participatory approaches tends to be seen as a path to challenge the traditional power relations between the researcher (s) and the object of research [6], which can be seen as a strategy to foster the empowerment, engagement, and even emancipation of marginalized groups [7]. Participatory Action Research (PAR) is an example of this type of approach, characterized by the involvement of participants during the entire project life cycle [8].

PAR can be defined as a specific branch of action research, driven to implement action, foster change, and generate empirical and scientific evidence through the systematic collection of data [9], in a more diversity-driven and representative manner [10].Moreover, PAR's main characteristics imply its categorization as an approach that not only aims to understand a complex problem but simultaneously to solve it [11]. Identifying the actual problem that needs to be tackled in a specific context is, therefore, the first component of a PAR process. This identification originates from the community and must be defined in a shared and multistakeholder manner [12], emphasizing the democratic nature of PAR [13].

Considering the set out methodological premises, as well as the need to bridge the gap between academia and civil society, the present study aims to reflect on the main insights

and challenges generated through a set of participatory innovation-driven approaches developed in the last seven years, grounded in the inclusion of underrepresented groups, such as deaf children and people with Intellectual Disability (ID). By using PAR, we intend to support the reimagining of some aspects of public spaces, with joint contributions from academia – represented by researchers/professors and students – and civil society – represented by NGOs, schools, cultural institutions, educators, children, individuals with specific accessibility needs, and all the potential end-users. To this extent, we propose the development of media objects to tackle the identified needs, prioritizing inclusivity, accessibility, and tangibility.

The present approaches also capitalize on an exploration of the existing inequalities in public and civil organizations, with the higher degree of participation possible. This includes the indirect reflection on how these inequalities are sustained by a set of ideological and material conditions that tend to naturalize them, historically growing in social and institutional settings in an embodied and legitimized manner [6].

The operationalization of these reflections was mainly done through participant observation in the development and implementation processes, grounded on the potential of an ethnographic approach to assessing the intersubjective experiences and contexts of interaction that arise from the empirical study of media objects, going beyond the qualitative and quantitative debate [14]. Complementary to this, quantitative pre and post-process data was also gathered for the third case study that will be presented, as analyzed by Sousa et al. [15, 16].

2.1 Adopted Processes

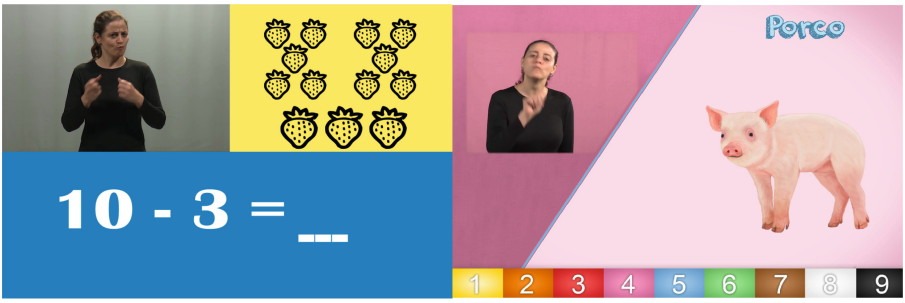
Based on the conceptualization and methodological premises explored above, the presented case studies and respective research and development processes were founded on three main pillars: (a) social value, defined by the degree to which the aims of each study were shared between the different involved stakeholders; (b) tangibility and/or playfulness defined by the type of interaction that each developed media object aims to produce; and (c) pedagogical value of the developed actions directly for higher education students, and indirectly through the involvement of their professors and the university in collaborative processes.

Through the operationalization of these pillars, the four different PAR projects have been developed, as explored in the following section.

3 Case Studies

3.1 EducaçãoAcessível.pt

The Educacaoacessivel.pt project arose from a need identified by a mathematics teacher specialized in deaf children's educational process. This teacher from Casa Pia de Lisboa CED Jacob Rodrigues Pereira (CEDJRP) – a Portuguese reference school in deaf teaching – reached the researchers and reported the difficulty she had in finding educational resources accessible to deaf children, namely integrating Portuguese Sign Language (LGP). It is with this knowledge of the field that we set out to develop video games with



(a) (b)

Fig. 1. Screenshots from (a) *Cardbox*; and (b) *Rodopia*.

Mathematics themes and LGP. Examples of this set of games can be found in Figs. 1, 2 and 3.

The project resulted in 26 mini games developed under the scope of two subjects from Lusófona University's bachelor's degree in Videogames. They are therefore digital games created by students, where the logic of multistakeholder collaboration was followed between the creators of the games, mathematics teachers, and deaf students of CEDJRP.

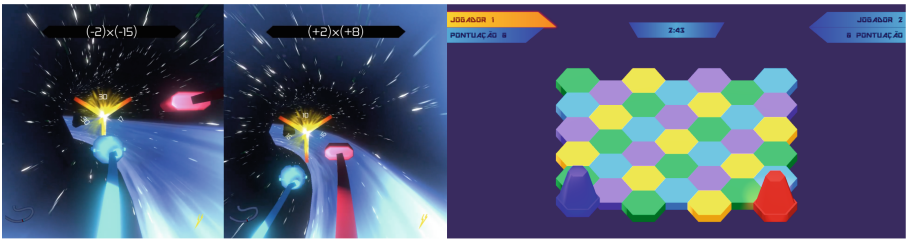
In a synthetic manner, the development process followed these step, as thoroughly as possible: a) informal contact between the videogame students and deaf students of the school year for which the games were intended, to discuss the preferred game genres and needs related to deafness were identified; b) identification, by the mathematics' teachers, of the preferred topics for that year; c) presentation of the alpha 1 version of the game, to collect feedback from deaf students and teachers about the general mechanics and graphic environments; d) delivery by the mathematics teachers of the questions and final texts to be integrated into the game; e) presentation of the alpha 2 version of the game, to collect feedback from deaf students and teachers in terms of bugs and adjustments of mechanics and graphics; f) delivery to CEDJRP of the beta version for testing and validation; g) delivery to CEDJRP of the final version of the game; h) publication of the game for download in through an open access police in the online repository of the project (https://educacaoacessivel.ulusofona.pt/).

(a) (b)

Fig. 2. Screenshots from (a) *Cavaleiro Jacob*; and (b) *Explorador*.

Sorting the games by study cycle, four are for preschool and first cycle (1st–4th grade), six for second cycle (5th and 6th grade), and 18 for third cycle (7th–9th grade). Regarding video game students involved during the project, which ran from 2015 to 2020, five classes participated with around 25 students each. The same number of test groups/participation of deaf students applies, with an average of 12 students per year with some students participating for more than one year.

At CEDJRP, the digital games have been integrated into the classroom dynamics through a mathematics promotion project, which allocates 45 additional weekly minutes to the students' schedule. Due to the lack of computers, the games were played in pairs. This dynamic has a simultaneous reflection, promoted by the teacher, where the possible and right answers are discussed and explained, framing not only a game-based but also a critical pedagogical strategy. On some occasions, the digital games were also used in the regular weekly classes to perform consolidation exercises in a playful manner. In both approaches, the digital games mainly aim to consolidate, motivate, and foster math communication among students.



(a) (b)

Fig. 3. Screenshots from (a) *Ficha Tripla*; and (b) *Hexaquest*.

Some constraints in the inclusion of the video games in the classroom dynamics are posed by other educational dynamics that must be promoted during the mathematics promotion project time, framed in the school's tight schedule, and loaded curricula.

Finally, regarding the dissemination of the games, in addition to CEDJRP, we have records of their use in three other schools, two of them being reference schools for the teaching of the deaf in the center and north of the country. On an international level, a partnership with the English company Thriiver allowed the adaptation to English – written and British Sign Language (BSL) of 10 games. These new versions will now integrate the project's website and a package of accessible technologies and resources for children in the UK, provided by the Family Fund social grants programme (www.familyfund.org.uk).

On the scope of the generation of scientific evidence, the main insights produced through EducaçãoAcessível.pt emphasize the relevance of this pedagogical resources in the school context in which they were applied, as well as the impact in the higher education students involved in the creative process [17].

3.2 Itinerante: (…)

The collection of Bordalo Pinheiro Museum – dedicated to the legacy of Rafael Bordalo Pinheiro – is largely based on the display of ceramics and images in an exhibition logic where touch and hearing remain unexplored. As is traditional in a museum collection of this kind, the ceramics cannot be touched for preservation purposes and sound, as an experience that goes beyond the descriptive of what is visible, is not explored. It is in this context that the piece *Itinerante: (…)* arises, with a view to programming interactive support between the visitor and the work of Rafael Bordalo Pinheiro, in the context of accessible cultural mediation (Fig. 4).

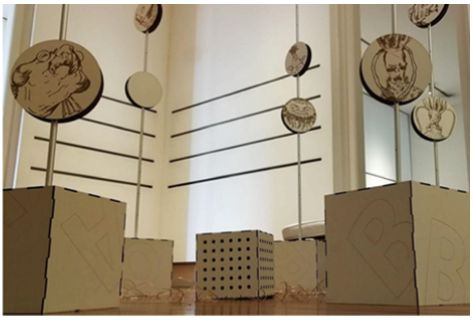
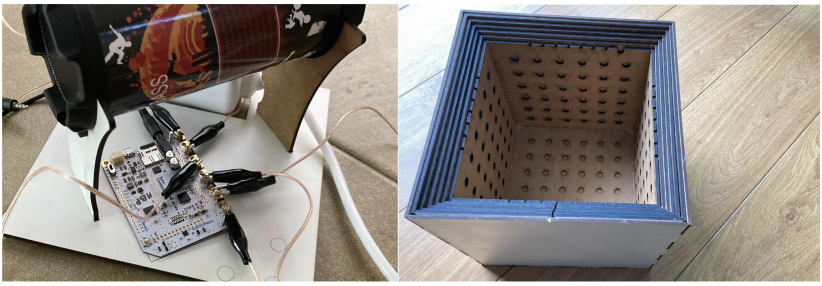


Fig. 4. Low-angle shot from *Itinerante: Canções de Marear*.

Those responsible for the museum's educational services and exhibition department were not only looking for an interactive structure that could be displayed in the museum with principles of accessibility. Besides this premise, they also intended to answer the need to easily include this resource in interventions outside the museum space, capitalizing on the object's easy and cohesive content reformulation potential. Therefore, it could be renewed in time and respond to different educational needs and audiences – the "(…)" in the name is an open space to different versions that the structure could take. The fact that it is an itinerant piece to be used by an educational service with limitations in terms of means of transport and techniques, required a design that would be easy to assemble and transport (Fig. 5).

The version delivered to the museum and exhibited in 2021 is called *Itinerante: Canções de Marear*[1] taking for the time being the graphic and sound recordings of the sound and interactive mobile piece *Canções de Marear*. Illustrations of several fish characters created by Rafael Bordalo Pinheiro have been low-relief engraved on wood composite and placed on vertical metal tubes. The option of engraving allows the images to be perceived by touch, and the placement in vertical pre-drilled tubes allows the images to be positioned at different heights from the floor and thus adjust their height to different ages and motor characteristics, including individuals in wheelchairs. The voices of the announcers that used to sell fish and other environment sounds are activated by touching

[1] The most approximate English translation of this installation's original name would be *Itinerant: Sea Songs.*



(a) (b)

Fig. 5. *Itinerante: (…)* components: (a) sound column, bare conductive board and connections; and (b) bases ready for transport/storage.

the wafers and tubes – the sound is therefore a crucial part of the experience and not mere accessible captioning. *Itinerante: Canções de Marear* will give way to another *Itinerante* as soon as the museum curators see fit, taking advantage of the tube structure, interaction logic and computer support to activate the sound contents (Fig. 6).

Fig. 6. General view of *Itinerante: Canções de Marear*.

As mentioned before, *Itinerante: Canções de Marear* was already exhibited in the museum space, with a notable engagement from diverse audiences. As for *Itinerante(…)*, its design plans and computational processes are available for download, as open educational resources (https://operat.ulusofona.pt/recursos/interfaces/itinerante/). These observations might be aligned with the potential of tangible interaction in the field of engagement and learning, based on Piagetian notions that emphasize sensorimotor experiences and the promotion of the concrete versus abstract representations dichotomy [18]. It can be further explained by the concept of embodied interaction, based on the role of bodily actions in orientation in the environment, social organization, collaboration, thinking, and perception, able to provide rich meaning-making experiences to museum visitors [19]. Moreover, this could include further audience studies, including the relationship between specific accessibility needs and cultural engagement in

museum spaces, such as the work developed by Marchetti & Valente [20] with children with Autism Spectrum Disorder (ASD).

3.3 diPlay

The relevance of developing games aimed at people with Intellectual Disability (ID) arises following the professional experience of one of the project's researchers, as a psychologist in this field, as well as her background research into the potential for well-being and inclusion of digital games in that population. This combination of factors led to the development of digital games through a collaborative and participatory methodology, including people with ID from two specialized NGOs and students from Lusófona University's bachelor's degree in Videogames (Fig. 7).

(a) (b)

Fig. 7. Screenshots from (a) *Canoe*; and (b) *Endless Runner*.

The development model applied is based on the procedure used in the *EducaçãoAcessivel.pt* project already described before, which was adjusted to better correspond to the target audience of these games, as well as to the objectives of the research in question. Considering that the two sets of games already designed suffered constraints due to the COVID-19 pandemic situation, particularly regarding the impossibility of face-to-face contact between students and people with ID of the partner institutions, we chose to highlight here the main moments of the normalized process that is being applied in the third set now underway. These are: a) playtesting session with games from previous years, involving the video game students and people with ID from the partner institution and support staff, to get to know the working groups, identify preferred types of games, interests, and needs related to ID, accessibility, and inclusion; b) presentation of alpha 1 version of the game, to collect feedback from people with ID and support staff, regarding general mechanics and graphic environments; c) presentation of alpha version 2 of the game, to people with ID and support staff, mapping the level of bugs and adjustments in mechanics and graphics; d) delivery of the beta version of the game at the partner institution; g) open access publication of the game in the online repository of the project (https://operat.ulusofona.pt/categoria/recursos/videojogos/).

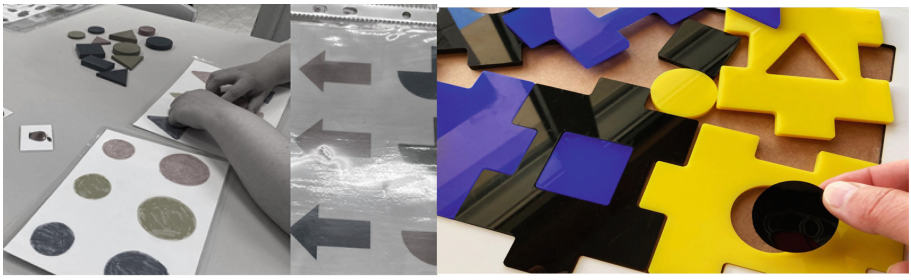
So far 20 mini-games have been developed over four academic semesters, with two classes of video game students involved, with around 26 students each. Of the 20 video

games mentioned, five have been published in the repository, and 15 are in the process of validation or preparation for online publication (Fig. 8).

(a) (b)

Fig. 8. Screenshots from (a) *Orbiter*; and (b) *Chicken Shooter*.

This process of collaboration between students and people with ID allowed the identification of several factors that justify the relevance of accessible games for people with ID, as well as the participatory development process adopted. Among these we high-light the promotion of empowerment and well-being in these individuals [15], as well as the skills development and promotion of inclusive-driven attitudes in the students [16].

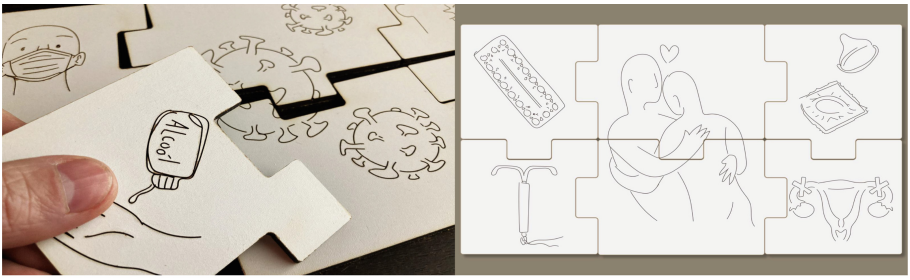


(a) (b)

Fig. 9. (a) Example of the existing resources; (b) Developed tangible game – *Double Geometry Puzzle* (*Puzzle Duplo Geometria*).

Besides digital games, this project of developing accessible games for people with ID includes the creation of tangible games, which emerged from different procedures and sets of needs. In this case, the relevance results from the evaluation of the resources at that level available in the two partner institutions already mentioned, as well as from the feedback given to the researchers by the respective support staff. In both institutions, the tangible resources were based on two main sources: (a) children's games which work on initial training competences, such as fine motor skills, memory, or as-sociation; and (b) material developed by the support staff using low-cost material, such as plastic bottles, lids, plastic straws, among others, as shown in Fig. 9.

These resources pose problems, but also opportunities. In what concerns children's games, if it is true that they can be adjusted to the competencies to be worked on in many cases of people with ID, it is unquestionable their maladjustment to the people who attend those institutions, because most of them are adults who do not identify themselves in the themes and illustrations of children's games. The materials developed by the support staff, although in general adjusted to the interests of people with ID, are conditioned by the materials, techniques, and machines available in the institution; besides that, they will tend to remain within the scope of the institution and not be disseminated. If these are problems, it is no less true that there is field work which should be valued and used, if it can respond to questions of aesthetics, durability of materials, ease of reproduction at low cost and dissemination. This is a field of creation and development coherent with the FabLab type laboratories that are emerging in many cities in Europe, either in universities or entrepreneurship poles (Fig. 10).



(a) (b)

Fig. 10. Example of the developed puzzles to promote (a) public health; and (b) sexual health.

The plans and instructions to reproduce the tangible games (available at https://operat.ulusofona.pt/categoria/recursos/jogos-tangiveis/) are the result of a creative and production process which had as a starting point a selection of resources developed within the institutions, always having as guidelines the already mentioned aesthetic dimensions, durability, reproduction, low-cost and dissemination. The games produced are tested by the support staff with their clients with ID, being always open to correction and adjustment of the published plans. The reproduction technique used until now is laser cutting, common in this kind of laboratories, with MDF or acrylic boards being used due to their resistance and affordability.

The feedback from people with ID and support staff, collected informally in the playtesting sessions carried out so far, has been exciting and promising, and at the moment we are in the process of collecting information from those who are applying the games. This will help us in the development of broader evidence of the added value of these games in the daily life of people with ID and NGOs in this field.

4 Results and Discussion

Through the systematization, observation, and reflection on the case studies developed between 2015 and 2022, a set of results emerged, as presented in Tables 1 and 2. In

the first one, it is possible to understand the identified needs that each study tried to answer, considering how this resulted from the convergence between the expectations of the different stakeholders. Moreover, the results also acknowledge how knowledge brokers are relevant triggers to start these processes while working as a bridge between the needs and the potential solutions academia can provide. The target audiences seem to be mainly characterized by a set of specific accessibility needs and the emergence of their social inclusion, with most of the studies approaching disabilities. Finally, the developed resources seem to be characterized by their playfulness, multimodality, and accessibility.

Table 1. Case studies summary

Case study	Identified needs	Knowledge broker	Target audience	Developed media object (s)
EducaçãoAcessível.pt	The lack of pedagogical resources that provide mathematical learning support in Portuguese sign language	Mathematics' teacher specialized on the field of deaf education	Deaf students	26 mini digital games
Itinerante: (…)	The reduced engagement of the visitors of a ceramics author museum with interactive and tangible materials	Museum educational services	General public	1 adaptable playful installation, with tactile stimulation and sounds
diPlay - digital games	The lack of accessible games for people with ID, with a specific focus on resources that prioritize their engagement, over therapeutic or clinical purposes	Member of the research team and psychologist in the field of ID	Adults with ID	20 mini digital games

(*continued*)

Table 1. (*continued*)

Case study	Identified needs	Knowledge broker	Target audience	Developed media object (s)
diPlay - tangible games	The lack of occupational resources adapted for adults with ID, considering their interests, age group, and the reduced digital access of the NGOs	NGOs in the field of ID and their professionals	Adults with ID	6 tangible games/occupational resources

As presented in Table 2, the main results can be organized considering their contribution to the access and inclusion premises explored before. In terms of access-driven results, it is possible to highlight how the presented experiences seem to translate feasible strategies to enhance the presence of media objects in the daily lives of different populations – with or without complex accessibility needs – promoting engagement, playfulness, and meaningfulness. Regarding inclusion-driven results are mainly related to how these approaches promoted well-being-related variables in individuals' daily lives, including the promotion of factors that reduce the barriers between them and the social roles they expect to perform.

Table 2. Main results grouped by their contribution for the promotion of access and inclusion

Case study	Access-driven results	Inclusion-driven results
EducaçãoAcessível.pt	Provided access to accessible pedagogical resources adapted for the educational process of deaf students, with a specific focus on mathematics	Evidence on this approach value to promote the inclusion of deaf students in mathematical education, with an impact that transcended the first partner school, reaching the international level
Itinerante: (…)	Fostered the engagement of museum visitors with the exhibition artistic proposals through a tangible and interactive format	Observation of visitors' engagement with a specific focus on youth and educational initiatives, and a potential extension for their consideration of motor and cognitive diversity

(*continued*)

Table 2. (*continued*)

Case study	Access-driven results	Inclusion-driven results
diPlay - digital games	Promoted digital games cognitive accessibility with a specific focus on the needs of adults with ID	Evidence of the impact of the proposed practice in the well-being and empowerment of individuals with ID, aligned with its pedagogical value for higher education students
diPlay - tangible games	Produced accessible tangible resources to foster engaged and meaningful occupation activities for adults with ID	Ongoing feedback of the involved stakeholders related with the occupational value of the produced resources

4.1 Main Opportunities

By reflecting on the experiences explored above, it is possible to identify a number of opportunities that emerge from participatory approaches to the connection between academia and civil society. These opportunities frame potential triggers for concerted growth strategies, defined through concrete development for real problems expressed by these organizations, their implementation in contexts, and the generation of scientific evidence that feeds a cyclical process of development and reflection.

The present proposals are opportunities to operationalize the citizen science model, defined as "a series of activities that link the general public with scientific research" [21]. Most specifically in the present study, and also according to the model proposed by the EC [21], it is possible to identify the promotion of several cross-cutting aspects of citizen science, including: problem definition; interdisciplinarity; social value; scientific impact; digital resources; results sharing; reproducibility; education and training; inclusion; accessibility; and design. Moreover, based on the Quality Criteria for Citizen Science Projects (QCCSP) [22], it is important to emphasize that the proposed approaches ensure: (a) scientific standards based on an improved understanding of certain needs and phenomena, the definition of field-specific methodologies, and clear aims; (b) collaboration based on the participation of different stakeholders and the unachievability of the proposed aims without citizens involvement; (c) open science framed with the open dissemination of all the produced resources and evidence; (d) ethics, grounded in the compliance of the developed project with human rights frame-works, such as the Convention on the Rights of Persons with Disabilities (CRPD); and (e) data management policies and regulations.

Considering these notions, it is possible to highlight how this type of participatory experience seems to represent feasible strategies to implement person-centered and empowering knowledge transfer. The developed projects and continuous interest of different individuals and organizations seem to emphasize this – how can academic-produced knowledge be transferred in a representative and collaborative manner, also supporting the role of participatory and inclusive research in these community-driven and innovation-driven projects.

Accessibility also seems to emerge as a crucial outcome of the explored experiences. This was registered both for specific and complex accessibility needs – such as the ones from deaf or cognitively impaired individuals – as well as for broader demands for more engagement and tangibility with more passive art forms. The relevance of this opportunity is even more notable considering how accessibility has been increasingly linked with human rights [23].

Another very relevant opportunity identified is related to the pedagogical opportunities provided by the presented projects. From a more formal education perspective, *EducaçãoAcessível.pt* and *diPlay* provide relevant strategies to involve higher education students in meaningful, diversity-driven, and inclusion-driven learning experiences, characterized by their social value and impact. Simultaneously, from a more informal education perspective, specifically framed in museum pedagogy [24], the potential of *Itinerante: (…)* is also clear.

4.2 Main Challenges

Considering the results obtained, it was possible to identify a set of challenges, characterized by constraints to the implementation of the proposed approaches, as well as barriers to their effective use in the daily life of end-users and NGOs. Regarding the first ones, the identified factors included the hindrances imposed by the university's loaded academic schedule, making both students and professors prioritize compulsory evaluation credits-providing tasks. This is aligned with previous results that schematized the barriers to innovation in higher education, with a specific focus on people-related barriers and external relations, most specifically related to the disparities between the needs of higher education institutions and the regulatory frameworks [25].

The constraints to the effective use of the produced resources by the NGOs and end-users were mainly linked to the lack of digital access, characterized by the low number of computers in the institutions and schools, as well the poor quality of the existing ones. Furthermore, the severe lack of funding experienced by the organizations poses issues in the broad reproduction of the resources in their daily work, even with the adoption of low-cost laser cutters and engraving techniques.

Lastly, the pandemic restrictions imposed by the spread of COVID-19 generate barriers to the direct contact with end-users during the creative processes, which were done through mediated indirect strategies, which might pose challenges to their full participation.

4.3 Limitations and Future Directions

The main limitations of the case studies presented are related to the interdependence between this type of research design and the social and cultural context in which they are developed. This factor may be important, namely when thinking about the generalization potential of the obtained results. Moreover, studies with larger samples and more experimental-driven approaches might ease the influence of this type of insight in policy-making, considering the relevance that such factors have in fostering large-scale change [26].

Future studies to this extent could include potential approaches to understand the societal impact of this approach, more systematically. The analysis of the produced insights through the lens of the triple or quadruple helix [27], to better approach the systemic nature of the innovation arising from PAR in the relationship between academia and civil society.

Regarding the research team's future directions, a need for adopting systematic open dissemination strategies emerged, culminating in the creation of the Accessible Resources Workshop (*Oficina de Recursos Acessíveis*; OPERAT). Developing this project as an integrative perspective of all these case studies is on the horizon, including also protocols with other institutions that might support the easy reproduction of the produced resources in national and international levels.

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