

Reflecting on Expertise, a Key Factor When Designing for Professional Development in Informal Science Institutions

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Abstract. Informal Science Institutions (ISIs) like museums and zoos are increasingly employing mobile technology to support their interpretive staff (explaners). One approach to designing technology to support existing tasks is participatory design (PD), where end-users are involved as experts in the task domain who can help envision the application of technology. Our participatory design sessions engaged explainers from two different ISIs, with different levels of expertise and age (youth and adults). We implemented a socio-technical PD approach in engaging participants in examining and proposing features for a Facilitation, Reflection, and Augmented Interpretation Mobile System (FRAIMS). Involving novices and emerging professionals in participatory design is as important as involving experienced and expert participants, especially when designing in supports for professional development. Our analysis highlights the benefit of considering the level of expertise of participants as a key factor that shapes a design, having as a result, different supports for the design of the mobile interpretation application.

Keywords: Participatory design · Mobile tools · Museums · Interpreters · Expertise · Professional development

1 Introduction

Our research group has studied how mobile technology can be adopted to improve interpretation at Informal Science Institutions (ISIs), like museums and zoos. Since explainers are a diverse population in terms of expertise and age, we had to think about how our designs would serve users with different levels of professional expertise, and in turn, what design methods we should use to elicit design requirements from users with different levels of professional expertise.

One approach to designing technology to support existing tasks is participatory design methods, where end-users are involved as experts in the task domain who can help envision the application of technology. However, novices and emerging

professionals have unique needs even though they lack advanced expertise with the task domain. Involving them in design is important, but (as other HCI researchers have noted) the design process may need to be altered to support their successful participation. In our prior work, we examined how the structure of Participatory Design sessions could impact the design contributions made by non-experts [7]. In this paper, we examine in more depth the types of design requirements generated by participants with varying levels of professional expertise. Although it might seem controversial, since by definition non-experts may not have a deep understanding of their work tasks, through this work we have come to consider non-expert explainers to be an important and distinct group of participants who could share their perspectives and add to the design. This work describes the results of including of youth novices and emerging professionals in participatory design sessions.

For the purpose of this research, we differentiated novices, emerging professionals and experts based on the years and frequency they had worked as explainers. An explainer is labeled as novice when he/she has performed interpretation for visitors for less than one year in an ISI. We stress the word youth when the novices are enrolled in high school/college and are less than 21 years old. They are labeled as experts when they have worked in the ISI as a full staff member for more than two years and performed as explainers in a daily basis or equivalent, or they are responsible for the training and supervision of the ISI interpretive programs. An emerging professional is anything in between a novice and an expert.

2 Background and Prior Work

2.1 Museum Context: Challenges of Supporting Interpretation in Informal Learning Science Institutions

Explainers are front-line informal educators—often a mix of adult full-time and youth part-time employees—who help museum guests learn from exhibits at ISIs, while also introducing additional learning goals that deepen guests’ engagement [9]. Explainers scaffold guest learning through the use of analogies, visual aids, or simplified thematic statements [5]. However, novice and volunteer explainers generally lack the rich knowledge of exhibit content [4], or the pedagogical content knowledge [10] necessary to engage in these practices. Unfortunately, explainers have little time for structured professional development, and are rarely the focus of evaluation. Most of their professional development occurs in fleeting on-the-job conversations [8], which represents missed opportunities for reflecting and building on explainers’ experiences at a programmatic level. Explainers need extensive exposure to gain understanding of the diversity and range of guest backgrounds, interests, and behaviors [4], which creates gaps between more novice and more expert explainers.

2.2 Participatory Design Methods

In the museum context, few researchers have seen the value of including participants such as teenagers or children in the design process [2, 6, 11] alongside curators and

museum staff. In [11], researchers found that youth participants—including youth explainers—had trouble taking control in projects involving adults and supervisors. These difficulties only faded after extensive time was spent on the project, which is a luxury of time that few youth-collaborative projects have available. Our methodological approach involves centering the contributions of youth novice explainers, in sessions where they are perceived as the main contributors of design ideas. This approach is meant to elicit explainers' contributions as both employees and users, by having them reflect on their own prior practice. Youth explainers are seen as experts about their own professional context, as they face unique challenges that might not be noticed by their more expert peers.

2.3 How Novices Are Different from Other Target Populations

Novices can be distinguished from experts by their relatively shallow training, lack of experience, disorganized domain knowledge, and insufficient metacognitive skills [3]. Explainers, like other learners, need support with noticing problems with their learning process, reflecting on what they do and don't know, and adjusting their behavior based on these determinations. Developing these metacognitive skills is highly important for explainers' professional development. With the characteristics of novice explainers as a guide, we designed participatory design sessions that should support explainers' focus and ability to express rich design contributions. We applied Socio-technical Systems (STS) theory [1] to craft participatory design sessions incorporating sociotechnical strategies such as role-play (e.g. demonstrations of the intersecting technical and social aspects of working designs), well-defined task-focused activities (e.g. technology-supported brainstorming and design activities around specific goals) and expert scaffolding for idea organization (ensuring that discussion is goal-aligned, without overriding or evaluating participants' design contributions). In this way, our participatory design approach should hopefully yield desirable and practical design recommendations that benefit novice interpreters.

3 Design Studies

We devised a participatory design approach to better elicit design contributions from non-expert participants using a socio-technical framework, detailed further in [7]. We enacted this participatory design approach in two different ISIs: a large zoo and a medium-sized science center, each located in a major metropolitan area with a diverse audience. Details of the sessions can be seen in Table 1. The participatory design framework – fully implemented in session III – aims to facilitate the elicitation process to take advantage of the inclusion of non-experts in participatory design sessions, by implementing socio-technical strategies: (1) starting the activity with a role-play scenario in a real setting and (2) including an outside expert to scaffold the organization and categorization of ideas.

Table 1. Participatory design sessions

Participatory design sessions	Session I (Zoo)	Session II (Zoo)	Session III (Science Center)
Participants (explainers)	Experts (7 participants) 19–63 years old	Novices (12 participants) 14–17 years old	Novices and in-development (8 participants) 16–22 years old
Initial exhibit example	Introduction of an interactive exhibit that uses a mobile interpretation tool and that the explainers participants have experience facilitating for visitors	Demonstration of a mobile interpretation tool used to start an interactive exhibit/game and to summon digital content that complements the game experience	Role play in-situ to demonstrate the mobile interpretation tool working with an exhibit that display interactive visualization of census data
Help during categorization process	None	Scaffolded by outside expert explainer	Scaffolded by outside expert explainer

3.1 Protocol

The workshops sessions were about 2–3 hours long. Each session began with a short pre-survey to gather information about participants’ confidence and comfort sharing ideas, as well as basic demographic information. This was intended to identify differences in the explainers’ level of expertise. Next, the facilitators of the session (members of the research team) introduced themselves, the workshop goal, and the general idea behind mobile support to be designed. After this introduction, the facilitators followed the guidelines of the socio-technical framed session; each involved idea generation, idea categorization, paper-prototyping of designs, and sharing of designs with the group. The participants focused on three main areas/themes of the Tablet Support Tool (TST) design: (1) categorization and grouping of resources/features used when having discussions with visitors; (2) ways in which explainers can use the TST to seek help during interpretation; (3) ways in which explainers can use the TST to seek help after interpretation.

4 Data Collected

Participants generated paper prototypes designs of different features, being this a visual way they can communicate their needs. These were drawn on pages showing an outline of an iPad frame, or freehand on blank paper. From the discussions of the design paper prototypes and drawings, a set of 19 unique functional requirements were captured during the workshops, such as: “An interactive map of the venue (along with exhibit information)”, “Fun fact category”, “List of activities/ideas to share/ask based on age”,

“Recording interaction with visitors”, “Rating of exhibit material”, “Create a virtual space where explainers can chat, message each other, or manage schedules with the mobile,” among others. These requirements were categorized and quantified based on the phase of interpretation (Preparation, Enactment, or Reflection) they belong to, see Table 2.

Table 2. Amount of functional requirements by interpretation phase. Columns E:Expert, I: In-development, N:Novice.

Phase of Interpretation	Amount of functional requirements per phase	E	I	N
Preparation	4	1	4	3
Preparation / Enactment	2	-	2	1
Enactment	5	3	5	4
Enactment / Reflection	1	-	1	-
Reflection	6	-	6	1

We can see that the in-development interpreters suggested the majority of the functional requirements, and that these requirements covered all phases of interpretation. Experts reported almost no need for reflection or preparation to be implemented in a mobile tool, even though they are very knowledgeable of reflection time as being important for professional development. Expert explainers expressed that current practices of getting verbal feedback during occasional meetings and right after an enactment are enough – and while this may be enough for *them* to reflect on their practice, it seems that non-experts did not necessarily share this view.

Also, expert explainers did not suggest a significant number of features that would assist them in the preparation phase, in contrast to novice and in-development explainers who reported ideas such as: “Allow access to share documents that everybody can share and edit”, “An interactive map of the venue (along with exhibit information)”, “Have a diagram of the exhibit with detailed information”, among others. This suggests that experts may take for granted their familiarity with the institution’s exhibits and their content; whereas non-experts clearly expressed a need for reference material to help them develop this familiarity.

5 Conclusion and Future Work

This paper implemented a theory-derived participatory design technique for eliciting requirements from youth emerging professionals and examined the nature of the design requirements suggested by participants with different degrees of expertise. The performed participatory design sessions used two strategies informed by socio-technical

systems theory (role-play scenario in a real setting, and discussion guidance by an expert) to elicit design recommendations from non-experts. Our data shows that participants with different levels of expertise contributed to the generated set of requirements in different ways. Previous work [12] has demonstrated how children's context expertise can influence the resultant designs in participatory design; here, we suggest that "domain expertise" is also an important factor to consider in participants when running participatory design sessions.

We believe novices and emerging professionals are a key population to include as contributors in participatory design sessions for technology that aims to improve their professional development. Although they do not have the same expertise level, the same amount of on-the-job experience, or level of reflection on their practice as experts have, youth non-experts can bring to the discussion perspectives that might be missed by experts. In a sense, novices and emerging professionals are bringing their own kind of "expertise" to the design: their intimate knowledge of the types of supports they need to reach professional goals set for them by their institutions.

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