Fostering parental co-development of technology for children with special needs informal learning activities

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ABSTRACT

Parental participation during children's free-time activities, schooling, and therapy is of core importance. However, parents' participation in long-term technology development is very rare, even though its importance has been widely noted. This paper looks at technology co-development with parents within informal learning club contexts for children with special needs. In this study, we describe how fostering technology co-design and co-development with parents contributes positively to the parents' participatory experience and involvement in the children's activities. The research was carried out by utilising the principles of participatory action research and participatory design. Our work highlights that providing an active role for parental co-development of technological activities fosters technology acceptance and family integration in long-term technology co-design, co-evaluation and co-intervention. This has strong implications towards social inclusiveness, technology demystification and innovative co-creation.

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1. Introduction

Technology has been shown to influence learning and teaching and to facilitate the full participation of individuals with special needs ([1–7]). Among the various types of technologies that have been developed for assisting children in their learning contexts we find assistive technologies [8], technologies for the mediation of learning [7], and technologies for practicing certain skills or abilities [1,5].

However, regardless of the benefits of technology-enhanced learning, such technology has often been abandoned by teachers and parents with children with special needs [9]. The reasons for this are many. First, technology has been designed and developed *for* rather than *with* the children with special needs. A common result is that the technology does not fit the needs of the children appropriately [9]. Second, parents, teachers, and other educational professionals are not always familiar with the all possibilities that the use of technology could offer in supporting the development of the children [10]. This, in turn, limits the children's use of existing technology. Third, technology design and development has typically been done by technical experts while the role of

the children and their families have been that of users of the technologies [11]. Hence instead of being the active controllers or creators of the technology, the passive user role limits the children's and parents' motivation for use and free exploration of the technologies capabilities. As a consequence, this passive role of the families in relation to decision making and technology use is one of the main reasons why assistive technology has been abandoned at home as educational "professionals [are] not listening to preferences expressed by the child and family" (Phillips and Zao, 1993, as cited in Kroth and Edge 2007, p. 193, [12]).

1.1. Research on parental co-development of technology

Involving both children and their families in long-term technology design, development and evaluation processes is rarely seen, even though its importance has been widely noted [13–17]. For example, Xiao and Martin [18] state that parental participation in technology design supports the interaction between a child and a parent because the parent becomes aware of his/her role as a co-player or collaborator with the child. However, despite the benefits of family engagement in co-design, parental involvement in the design process has been examined less. Lindstrand, 2001 (as cited in Lindstrand, 2002, [16]) argues that an understanding of different families' needs, lifestyles, and cultures is missing. For a family, this can easily lead to minimal use of technology or,

worst of all, to technology abandonment because the technology does not meet the family's needs. Parents playing an active role and partnering with education and health professionals has a positive impact on several areas of children's development including children's academic and social performance [12,19], early intervention programs [20], extracurricular activities [21], and therapy [22]. However, when it comes to technology design, family members generally participate only as testers of ready-made products while researchers observe their activities with ethnographic methods [15].

A reason for this apparent disconnect could lie in the difficulties and restrictions that may arise during partnerships with parents as have been noticed in both the education and co-design arenas (see for example [15,23,24]). For instance, for researchers the heterogeneity of the families challenges technology co-design since family members have diverse skills and interests. Also, the power relations that exist between family members can affect the interaction with researchers during design activities [14,15]. For parents, the researcher's formality, language, as well as the lack of easy to understand information can foster the feeling of not being capable of making a meaningful contribution [25,26]. Also, practical issues such as time, transportation, childcare and activities' schedules pose challenges for co-design participation [15,12]. In attempts to meliorate these challenges researchers have also invited grandparents to co-design activities instead of parents of children [27]. However, difficulties in co-designing and co-developing with families have led to the situation where families are included in these processes much less compared to other user groups.

In order to tackle these issues, many parents and researchers are calling for non-traditional ways for parents to be involved in school contexts [12] and in technology co-design [15], where traditional approaches are replaced. The desired way to collaborate should include relationships that are more active and encouraging, where reflexivity and 'opening out' are required (see [26]). New ways of increasing parents' involvement in the design process are also needed [29]. For example, in their study Hutchinson and her colleagues [29] examined how technology probes can be used as tools for inspiring technology design for and with families. The technology probes involved installing a technology into a real use context, watching how it was used, and gathering information about the users, and inspiring ideas for new technologies. According to Hutchison et al., 2003 [29], technology probes are a promising new design tool for working in partnership with families. In the case of children with special needs, Dawe, 2006 [30] co-designed a picture-based distance communication system with the help of 13–23-year-old young people with moderate cognitive disabilities, their parents and teachers. The participants used the system for 8 to 12 weeks and participated in design and reflective activities during the study. Dawe, 2006 [30] claimed that the use such a technology can support participation of parents in planning and reflection. Furthermore, participation in the technology co-design helped youth with moderate cognitive disabilities to proceed from being passive bystanders to be active participants in a design process.

Additionally, research has also indicated that participation in technology development may increase children's and parents' sense of ownership towards technology, their satisfaction and sense of meaningfulness and usefulness of the technology [31]. This is of vital importance for the successful deployment of new technologies such as digital games and robotics to the educational realm and in families' everyday lives.

1.2. Our contribution

Given the considerable lack of research on the topic of parental co-design, co-development and collaboration with designers, researchers and teachers, our work stands to fill in this gap. We see technology co-development as a process through which parents are involved in the selection and customisation of already existing technology, as well as the design and creation of technological tools and content or activities that are carried out with the technologies. This paper introduces the results of a research project in which parents with children with special needs were active participants for co-designing and co-developing technologies for their children's everyday life. Particularly, our contribution highlights:

– how much and what kind of feedback parents provided during technology co-development,
– how this feedback was taken into account in the co-design process, and
– how parents felt about sharing feedback and about being involved in technology co-development.

The answers to the questions above put forward our contribution to the child–computer interaction (CCI) community at two levels: theoretical and practical applications.

From the theoretical perspective our work introduces the combination of participatory design (PD) and participatory action research (PAR) processes, providing a link between the social sciences and technology design. This multi-disciplinary process pays attention to both the end products (such as technological design and implementation) and the social processes (such as users–technology–environment interactions) that take place during the research.

From the practical application perspective we expect that our contribution informs experts in the CCI community about best practices and procedures to overcome the difficulties and restrictions that may rise during partnership with parents. The ultimate aim is to foster parents' active participation, reflexivity, and expertise, and the family long term acceptance and usage of the co-designed and co-developed technology.

2. Methodologies and settings

2.1. Participatory design and participatory action research

The participatory design and participatory action research principles implemented in our research included empirical planning, implementing, and researching environments through evaluation of activities and technologies [32–34]. While participatory design has traditionally emphasised the planning and designing of activities and products [35], participatory action research pays more attention to reflecting and evaluating these activities afterwards [36]. At the same time, the goal of participatory action research is to develop social processes [37]. Participatory design, on the other hand, strives to create a functional product [33]. Instead of seeing participatory action research opposite to participatory design (see [38]), we concentrated both on the whole process (i.e. what kind of ideas parents gave for the development of technologies, and how parents evaluated their participation process) and the end product (i.e. what ideas were implemented and how the implementation was done).

Fig. 1 shows our integration of the participatory design (PD) and the participatory action research (PAR) processes. The planning, implementing and evaluating phases are iteratively carried out throughout from the problem solution finding space (PD) to the creation of functional products (PAR). Table 1 shows details of the role of each of the actors (children, parents, researchers