Training designers for vulnerable generations: a quest for a more inclusive design

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Abstract. This paper presents findings from a project focusing on the specific needs of vulnerable generations - children and elderly people - in design teaching and training activities. The thirty-months project embodied a series of activities for developing, implementing and evaluating teaching materials focused on design for vulnerable generations, and identified two critical elements for the promotion of more inclusive design. First, knowledge and skills were identified through a collaborative process with stakeholders. We also applied in-depth data collection methods, surveys, interviews and case studies with experts and operators in relevant industry and research centres, in order to identify training needs. From this, nine teaching modules were developed and tested in pilot studies. These will be made freely available online. Second, we identified the need to disseminate, focus and increase awareness among teachers, design students and professionals for vulnerable generations. This was achieved through the establishment of an international design award. Three different categories of award with relevant sets of criteria were developed through an iterative process and have been launched and evaluated. The contribution of this paper is twofold. Firstly, to encourage educators, through the communication and dissemination of the results of the project, to extend their user groups to include design for vulnerable generations, and secondly to enhance designers' interest and knowledge in working with design for vulnerable generations.

Keywords: User-centred design, teaching, training needs, children, elderly people, vulnerable generations, design.

1 Introduction

In an inclusive society, the needs of all the society's members should be taken into account. While the scope of social inclusion is vast, there are several emerging trends which help focus and prioritize both the targeted problems we may want to address and their possible solutions: first, technology, in particular information and communication technology (ICT) increasingly permeates all parts of our lives; second, the elderly population is growing fast, and will within a few years be more than one third of the population; third, children hold growing importance, as parents spend more and more time and money on them.

Notwithstanding the capacity of technologies to empower elderly people and children, in a broad sense these groups can still be considered vulnerable. While there are likely to be many differences across individuals, as a group, children and elderly are likely to have less control over their lives compared with other groups and in some cases, they may be more dependent on the support of others in various situations: this contributes to the well-documented *digital divide* phenomenon [1, 2]. In addition, their vulnerability may also be due to age-related limitations in cognitive or physical ability. For these reasons, the term vulnerable generations (VG) will be used here to denote the group of both children and elderly as a whole (See Fig. 1). In line with the increased influence of these groups of people, there is a growing awareness of the needs of VG in both teaching and design [3], but more work is needed in order to investigate how to best educate designers to provide them with the appropriate tools to take into account the needs of these groups in the design process.

Fig. 1. Vulnerable generations – children and elderly.

This paper addresses how future and present designers can be trained or re-trained to design for VG. With a focus on design for elderly people and children, the project presented below seeks to strengthen education for designers by extending it to new user groups. The paper gives a brief summary of the early phases of the project and discusses in more detail a set of educational modules based on identified training needs relevant to VG.

2   The DEVICE Project

Recently, design solutions obtained through user-centred activities have been identified as an effective and efficient way to ascertain and address user needs and problems. These activities can be conducted either by studying users or by involving users in the design process: participatory design/co-creation [4]. User-centred design, in its broader capacity, identifies and highlights human needs, aspirations and abilities [5]. The project DEsign for Vulnerable generatIons: Children and Elderly (DEVICE) was initiated to address these needs through an educational and training framework, called Vulnerable Generation View (VGV) [6], which has guided all project activities. The VGV does not constitute an attempt to build a new methodology for design processes; rather, it simply proposes a new way to look at vulnerable generations. The intention was to direct the attention of both design students and professionals towards the needs of children and elderly people so as to facilitate the identification of opportunities to adapt existing methods of design for these user groups.

The DEVICE project started in late 2011 and aimed to modernize and broaden the Higher Education (HE) design curriculum with a specific focus on the needs of vulnerable generations through the VGV framework. The project consortium was drawn from five countries, consisting of teams from three enterprises and four research institutions. The partners' backgrounds included ergonomics, computer science, interaction design, industrial design, child education and Information and Communication Technology (ICT) [7]. The motivation for the project was that while much attention has been paid to design *per se* and to design for people with sensory impairments, very little has been done with respect to the identified vulnerable users for this project: children and elderly people. Accordingly, the overall goal of the project was to combine knowledge, competences and skills encapsulated in the traditional design HE curricula with insights on ergonomics, usability issues, and user-centred and participatory design techniques thereby keeping a specific focus on the identified vulnerable generations.

In the early phases of the project, a desktop survey was initiated with a focus on identifying courses and programs dealing with how to design for vulnerable generations [3]. The survey collected around 100 examples of educational programmes, courses or projects related to design for children and elderly, and the results from the survey is available in an online database [8]. General findings from the survey suggest that there are fewer courses targeted at design for children and elderly than expected, indicating that there is more work to do in this field. However, it should be noted that there was an over-representation of European countries in the material collected, and a wider search is warranted.

2.1 Project Objectives and Expected Results

The intention of the DEVICE project was to explore a possible path towards teaching inclusive design, by addressing the current gap in training and educational programmes oriented towards the needs of VG. The overall aim of the project was to bridge traditional industrial design programmes with ergonomics, usability concepts and user experience approaches with a specific focus on VG. In addition, it aimed to address the need to develop and modernize higher education programmes in design by facilitating collaborations between researchers and professionals. The main objectives and process of the project are summarized in Fig. 2 and the following list:
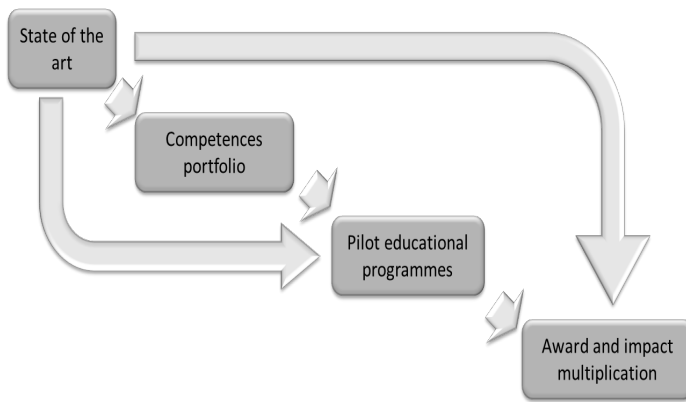

Fig. 2. Process diagram of the DEVICE project.

1. To review the current state of the art in the field of design for vulnerable generations, with special reference to scientific research and innovative practices;

2. In addition, the state of the art review will consider existing methodologies for involving VG in product design in order to study their inclusion as end-users in the design processes;

3. To create a competences portfolio that is suitable to guide programmes aimed at training designers and professionals operating in the area of design for VG;

4. To test and validate the proposed competences portfolio by developing and conducting a set of pilot educational programmes and training modules. This will be implemented in a way that facilitates the collaboration and co-operation between researchers (affiliated with either universities or research centres) and professionals;

5. To multiply the impact of the project by disseminating its achievements through a Vulnerable Generation Compliant Award and a searchable online database of best practices and e-learning materials on the project website, aimed at promoting knowledge sharing and management;

6. To analyse the transnational and sectorial transferability of the achieved results, by studying the feasibility of further applications to different target groups (e.g. people with disabilities or special needs) and different geographic contexts (e.g. USA and other developed countries);

7. To identify sustainability pathways aimed at fostering university-industry collaboration on design and innovation projects

The major outcomes of the project have been identified as follows:

1. A report reviewing the state of the art in terms of research and innovative practices both in the field of general/universal design and with a specific focus on VG (Obj. no. 1 and 2);

2. A competences portfolio encompassing all the relevant and constituent skills and knowledge in the field of design for VGs and a number of educational programmes and training modules suitable for both students and professionals (Obj. no. 3);

3. A report documenting the evaluation of pilot seminars implemented to test the relevance and effectiveness of the educational and training programmes (Obj. no. 4);

4. A Vulnerable Generation Compliant Award (Obj. no. 5);

5. A searchable online database containing educational materials and information regarding good practices in the field of focused design on VGs (Obj. no. 5);

6. A transferability and sustainability report indicating further possible developments and applications of the project's findings to other sectors and countries together with feasible pathways to sustain cooperation between industry stakeholders and universities or research centres in the VGs field (Obj. no. 6-7).

The objectives and expected results of the project are further presented and discussed on the website [7, 9]. In brief, there are three important characteristics of the proposed educational and training modules. First, they are tailored to match the training needs highlighted by both professionals and researchers in the field of VG design [7, 10]. Secondly, they take advantage of a learning tool, an e-learning platform has been developed to support e-learning materials and the exchange of good practices . Thirdly, the modules constitute a framework for learning and collaboration

activities that can be carried out through the sharing of good experiences for design professionals and students. The specific design compliance awards helped to facilitate this sharing of good practice across Europe.

3 Educational Modules and Pilot Studies

The competences identified in the assessment of the state of the art in design for VG are articulated in nine teaching modules. Each of these modules is intended to match specific training needs grouped into clusters of competences as identified in the Competences Portfolio. Training needs were assessed and aggregated by the project partners based either on the relevant scientific literature or on the relevant market experience. The training needs identified included: legal issues, empathy, end-user abilities and capabilities, ethics, methods, context of use, literature and theory, translation and tools, inspiration and information, constraints, evaluation, awareness raising, engagement, cost of usability, creativity, working in a multidisciplinary team, materials, accidents and near-miss analysis, anthropometric library.

The methodology can be described as a qualitative assessment carried out separately by experts affiliated with the different project partners via questionnaires. Experts were asked to rank each of the training needs identified through the literature, using a 5-point Likert scale (1 = very low priority and 5 = maximum priority). Training needs were grouped into clusters of competence and the average score was used to represent the cluster as a whole. The mean score of the competences encapsulated in a given module was then adopted as the overall priority ranking of that module. This evaluation method assesses the consistence among training needs, competences and modules. Using the same Likert scale, the project partners were asked to assign a score, for each training need they proposed to address in a module, before these were evaluated by the above-mentioned experts.

A panel of project partners then compared the different outcomes of the ranking made by the project partners and by the experts, and agreed on the final set of educational modules. The educational modules were developed by project partners and were subjected to an internal peer review process. The modules were then trialled and evaluated using a questionnaire completed by participating students and professionals [7].

3.1 Educational Modules

The main aim of the proposed techniques and methods for the modules is to raise the level of empathy and to promote an increased awareness of the different needs of VGs in the field of design. The modules are intended to be used as building blocks in courses aimed at training students and professionals in the area of design for VGs. A short description of each module is provided below. All the material of the modules including teaching guides can be found at the project website [7].

Module 1 - **Interaction design and HCI.** The first module consists of an initial overview of the topics and concepts to be addressed during the learning programme. These include: i) Human Machine Interaction: concept and history; ii) Usability; iii) Human Factors; iv) Natural Interfaces; v) Inclusive Design; vi) Interaction Design; vii) User-centred Design; viii) Emotional Design; ix) Design Principles; x) Prototyping; xi) Evaluation Methods.

Module 2 - **Market analysis and legislation.** This module aims at preparing students and professionals to be aware of societal issues and business principles related to designing activities with a specific focus on VG needs. Relevant topics are: i) Business scenarios: market and enterprises analysis, materials and technologies, future trends, marketing activities; ii) Legal and ethical issues: general information about the relevant legal framework and ethical issues that deal with working with users. The information given should be compliant with the national rules of the country in which the course is carried out; iii) Legislation: European and national legislation and directives.

Module 3 - **Context.** This module provides designers with appropriate tools to understand and analyse the context in which they are designing and thus represents the major focus on VG by addressing the following issues: i) Literature review and theory analysis: practical methods and research skills are provided (e.g. how to conduct workshops with children and elderly people etc.) ii) Inspiration and Information: how to gain access to relevant information and insight into everyday life; iii) Multidisciplinary approach to technologies: technology has to penetrate everyday life and match the needs of VGs needs; iv) Technologies and learning contexts: technologies as a connecting environment for different fields of knowledge and multidisciplinary explorations; v) Environment and settings: users' capabilities and implications of the context of use for design; vi) Children context and vii) Elderly person context: providing the most relevant information about the context and the cultural background of children and elderly people, keeping in mind their individual habits and characteristics.

Module 4 - **User capabilities.** The aim of this module is to improve knowledge concerning specific capabilities and limitations of VGs that should be taken into account when designing products, services and systems. The relevant topics are: i) Physical and cognitive ergonomics: introduction to education, psychology, and cognitive ergonomics; ii) Children capabilities and iii) The ageing individual and capabilities: information concerning physical, sensory and cognitive capabilities, and learning processes of the targeted VGs.

Module 5 - **User involvement.** This module shows how to involve VGs users in design processes. Approaches to user-centred design activities should involve the targeted users at all stages of the process in order to be regarded as sustainable. In such an approach, the roles of users and designers merge, enabling users to design for themselves in a way that provides what they actually need. The topics include: i) End user involvement and considerations: ethical issues in the involvement of the end users; ii) Methods for involving VGs in the design process. A number of methods are

described in general terms and then applied to the needs of the targeted VGs. The aim is to improve knowledge of available methods and how to apply them during the design process.

Module 6 - **Design.** The purpose of this module is to improve designers' skills in managing design processes with a specific focus on VGs product design. This module addresses the following topics: i) How to handle a design project: requirements collection analysis, designing, prototyping, evaluation and redesign; ii) Methods: task analysis with end users including interviews and observations; iii) Translation: to translate findings into design specifications; iv) Constraints: this topic emphasises the importance of having one focus at the time.

Module 7 - **Evaluation.** This module presents the main evaluation methods that allow designers to test and validate what they have designed with the end users. The standard evaluation methods are described and adapted for use with children and elderly people.
The following evaluation methods are considered: i) Heuristic evaluation; ii) Cognitive walkthrough; iii) Usability testing.

Module 8 - **Creativity.** The purpose of this module is to train the designers' ability in creative thinking and design for VGs. The module addresses the following topics: i) Innovation & creativity in design; ii) Strategies for sustainable innovation in the field of toy design; iii) Differences between innovation and creativity; iv) Engagement: how to create engagement for both designer and user.

Module 9 - **Empathy.** The purpose of this module is to provide students and professionals with tools that will increase their ability to use an empathic approach when working with design for vulnerable generations. The module encompasses the following topics: i) Inspiration and awareness raising: empathy with end users using empathic modelling and simulation; ii) Empathy: one of the most basic and profound competences is for the students to be able to properly describe a child or an elderly person, in order to understand their users and the users' needs and motivation.

3.2 Evaluation of the Teaching Modules - The Pilot Experience

The effectiveness of the educational modules has been tested in pilot seminars carried out in different locations across Europe: a total number of fourteen pilots were conducted by the six partners across four countries. Additional sessions were conducted to foster collaboration between universities and industry. The seminars were conducted at different organisations involving academic staff from the consortium. There were 272 participants representing 15 different nationalities, including 99 females and 173 males, with an average age of 24 years. Participants included professional designers (n=58) and students (n=214). At the end of the learning experience, participants were asked to complete an evaluation questionnaire

in order to express their opinion about the effectiveness and value of the learning experience.

It is interesting to highlight that the majority of participants declared that they had no previous training in design for children or elderly people (59%, n=160). This is in line with the findings from our review of the current state of the art in the field of research and innovative practices on design for VGs. Generally, participants found this learning experience intellectually stimulating and valuable for their training experience (67%, n=182) and most participants identified an increase in relevant skills after their participation.

Based on participant feedback from the pilot seminars, the teaching material went through a second iteration and an additional global evaluation by the project partners, in order to further improve the quality of the material.

4 Design Award

In addition to the surveys and pilot studies, an award of excellence in designing for VG was initiated. The award was divided in two; one targeted towards professionals and researchers, and the second towards students, and was open to all types of design [9]. The award provided an opportunity to disseminate the results achieved in the first phases to a large audience of stakeholders such as students, professionals and the general public. In order to have the broadest reach, the award was announced on the project website and on partners' websites as well as at relevant public conferences, workshops and other events which the partners attended during the project lifecycle. A considerable challenge in the development of the award was to identify appropriate evaluation criteria which would be suitable and consistent for projects which differed markedly in their scale as well as in their theoretical and methodological approaches.

As a first iteration on establishing the award, aiming to evaluate the first set of criteria, a student award was announced as part of the SIDeR international research conference for students in interaction design. Two winning projects were selected from amongst 12 submissions: one for the "design for children" category and one for the "design for elderly people" category [9].

In the second iteration, the intention was to reward innovative ideas in design for vulnerable generations - specifically for children and elderly people. Separate awards were given for professionals and students, with each based on the following criteria: i) Contributing to the development of design for VG; ii) Involving VG in the design; iii) The connection between the VG and their context; iv) Improving or adding to facilities, products or services for VG; v) Method development for VG design. Based on the criteria, the project partners graded the different submissions, and a winner was chosen. Eighteen original works were submitted from all over the world. The prize for the professional category was assigned to a design project about older people, while the prize for the student category was assigned to a design project about children [9].

Additionally, and based on the same criteria, an award for "best practice" was awarded to the best demonstration of VG design from amongst the 100 case studies identified as part of the state of the art analysis. The winning project was for a

tool aimed as an aid for designers working with design for children. For details about the winners, please refer to [9].

5   Transferability

An important aim of the project was to demonstrate the transfer of project outcomes to other countries and to other domains (i.e. people with disabilities and additional needs). Desk research was carried out in order to identify one or two projects for potential future collaborations with the project partners. In total, 46 projects were identified and ranked based on how well they met key characteristics of design for VGs using the same six criteria as for the award. Thus, results were grouped according to the most relevant target group (Children, Elderly, Other Target Groups). Additionally, the transferability activities involved the development of another learning module, which focused on design for children with special needs.

6   Discussion

Through a state of art analysis, expert interviews and a review of literature, the DEVICE project identified that currently, design for vulnerable generations - children and elderly people - is not an integral part of the general curricula for design teaching. In line with the changing population trends and influences of older population and children, it is clear that an increased focus on these user groups in design teaching is needed. Indeed, there is a compelling market potential to consider the needs of children and elderly in designs for mass-market products. While some companies do take the needs of children and elderly into consideration when developing products, for others, there is an apparent lack of knowledge of the user, and/or failure to consider elderly and children as consumers. By teaching the value of involving users in the design process, and specifically to focus on children and elderly, there is a vast potential to create change. The approach taken in this project has been to develop open access teaching material and to establish a design award, in order to increase the status, knowledge and interest of vulnerable generations in design.

In general, participants' evaluations of the educational modules focussing on design for VG were positive. Participants demonstrated a sound understanding of what it means to design for the needs of children and elderly people and how to consider the cognitive and physical abilities of the VG user at the centre of their design.

A question considered by the consortium when developing the modules was the extent to which the modules should be unique for vulnerable generations, and to what degree do they simply constitute general design knowledge and knowledge from the fields of universal and inclusive design. While some modules list very generic skills in interaction design/HCI like the use of Cognitive Walkthrough or User Centred Design, other modules such as the User capabilities module or the Context module are more specifically targeted towards vulnerable generations. The different methods and skills were also presented in a manner that makes it clear how each

method could be adapted and used when working with vulnerable generations. Within the modules there are also methods specifically designed for working with children or elderly people like Mission from Mars [11] or Everyday communities of practice [12].

The modular construction of the curriculum is intended to make it easy to select and use specific parts. For example, where students have strong design skills, modules 6) Design and 8) Creativity can be omitted and more attention can be directed to other modules, such as 3) Context and 4) User capabilities. In a crash course for design with vulnerable generations the most important modules may be 4) User capabilities and 9) Empathy.

While there is overlap between content in some of the modules, reference is made to the "Home" module, where that topic is covered in more detail. The advantage of the DEVICE project material is that it has a clear direction to the specific groups of children and elderly people and also that it consists of a number of well-defined modules each with a specific purpose. With a certain degree of monitoring and regular updating, this would give access to anyone with an interest in teaching design for vulnerable generations. For those with no or little experience in teaching this content, it will provide a starting point which can be practised and enhanced over time. However, further preparation of introductory teaching guides will be essential to provide an appropriate level of support for novice users. In a society where there is a growing need for products and services for vulnerable generations, and accordingly a growing need for education within this area, outcomes of the DEVICE project offer an important contribution to support for designers and for advancing inclusive social innovations.

7   Conclusion

In this paper, the objectives, methods and final results of the DEVICE project have been presented. The project focused on vulnerable generations, and aimed to extend current design curricula to include design for these user groups. Based on interviews and other review activities, nine educational modules were developed and evaluated, and will be made openly accessible for designers and trainers worldwide. Preliminary analyses of the modules showed an increase in participants' level of knowledge and skills needed to design for vulnerable generations. The work presented in this paper is intended to raise the awareness, interest and knowledge about VG in design teaching.

8   References

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