THE NEED FOR SPECIAL GAMES FOR GAMERS WITH SPECIAL NEEDS

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Abstract: People with intellectual disabilities are a part of our society, but unfortunately, they are often excluded. Their assistance includes everything they need in their lives. The work in the various workshops for people with disabilities often gives them the feeling that they are needed, but few can find access to an independent life by further developing and training of themselves. The pleasure of (digital) game playing and learning with a game is not yet considered a standard constituent of leisure time activities in sheltered workshops for people with an intellectual disability. Qualitative studies with off-the-shelf digital games have demonstrated enormous potentials of game playing for the assistance of people with an intellectual disability. However, conventional off-the-shelf digital games have severe limitations. The authors' qualitative studies lead (i) to a requirement specification and (ii) to the design and implementation of a completely new digital game meeting essential needs of people with an intellectual disability. The present publication surveys the results of the qualitative observations and leads to the recently completed game design.

1 INTRODUCTION

The authors' main motivation is to contribute to the quality of the life of people with intellectual disabilities, who work regularly in sheltered workshops.

An intellectual disability is impaired if cognitive and partially physical abilities are permanently limited and when help is needed to participate in everyday life and work. The intellectual disability and the intended help by others should not lead into negative consequences concerning the personality, family and the attendance in public life (World Health Organization, 2001), (Bundesregierung, 2004), (Cloerkes, 1988).

Contributions to the peoples' life quality may become part of a systematic assistance. The present work focuses on the usage of digital games.

Which role do digital games play in the current assistance of people with an intellectual disability, in general, and in their supervised leisure time, in particular? In case game playing is not just fun, which other effects (maybe educational, e.g.) may be observed? What about the potentials of off-the-shelf commercial games? Do we need ad hoc game designs and implementations?

Beyond the contribution to those peoples' quality of life, the authors are focussing training and learning. It is the authors' strong belief that people with an intellectual disability do need more support in daily life, in particularly in playful learning and training.

The authors want to clarify that the issue of accessibility is certainly one of the main requirements of the special education. In the case of games, the following study indicated that there are some special needs which can be supported individually and personalized by 'special games'. Technology-enhanced approaches are probably quite promising, but seem to be much underrepresented in the scientific discourse, in general, and on leading conferences such as CSEDU, in particular, at least for adults with intellectual disabilities.

2 LITERATURE REVIEW

An enormous number of authors have investigated the challenge of getting computer systems engaged for educational purposes including the special needs of persons with an intellectual disability. An overwhelming majority of publications ranging from (Gresham and Elliott, 1987) to (McCray, Vaughn

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and Neal, 2001), (Sullivan, Lautz and Zirkel, 2000), (Deeney, Wolf and O'Rourke, 2001), (Weiss and Lloyd, 2003), (Frederickson and Turner, 2003), (Fuchs and Fuchs, 2005), and (Graham and Harris, 2005), are focusing children and school problems. In contrast, the present approach is addressing the needs of adults.

Furthermore it is stated as an important target of special education to support the computer literacy, because the use of computers became central in everyday life and the employment market (Sonderschul-net.de, 1997). Usability and regular feedbacks were stated as main requirements of software programs for people with special needs. In a majority of publications such as (Cosden et al., 1987), (MacArthur et al., 1986), (Rieth et al., 1988), authors have complemented the potentials by varying hints to the limitations of information and communication technologies.

It is only natural that a larger number of authors' response is the dedicated ad hoc development of special purpose approaches as surveyed in (Riva, 1997). There is the particularly important aspect that "any educational innovation is filtered through teachers as they modify instructional activities to fit their beliefs and the instructional and management routines in their classrooms" (MacArthur and Malouf, 1991).

Corresponding to the results of the literature review on the game market we mainly found games for children with intellectual and physical disabilities. Most recent games offer a training of single cognitive skills and tasks, like counting. Some representatives for the development of specific hardware and software for children with disabilities are "World of Genesis" (Genesis, 2008), "LifeTool" (Clevy, 2008), "Läramera" (LäraMera Program AB, 2009) and "Inclusive Technology" (Inclusive Technology, 2008). The dedicated hardware can be used by adults, while the software has been developed almost exclusively for children with disabilities.

The conducted study deals with the question **which learning effect can be achieved by people with intellectual disabilities while playing educational games**. In addition to this question it should be clarified to what extent playing and learning can be useful to this target group.

3 METHOD

As empirical method we choose a case study, because we wanted to analyse how digital games could be integrated into the daily life of the sheltered workshops and how they affect the people working there.

So the study was conducted in a sheltered workshop (Germany/Thuringia) for adults with intellectual disabilities who have completed their compulsory education. The workshop is divided into different areas, including the five workspaces wood, metal, installation, kitchen and vocational training.

The study used a mixed-method-design and integrates qualitative as well as quantitative methods. The quantitative approach was needed to answer certain predefined research questions and to follow the duration of the analysed game, which consists of 28 game units. The qualitative approach was used to clarify the key dimensions of how learning was enhanced by digital games and to reach an in-depth understanding of these processes.

Therefore a longitudinal participant observation (10/2008-01/2009) was chosen as main research instrument. Within the observation a protocol was used which integrated open plus well-structured criteria to realise the qualitative and the quantitative approaches. The structured, quantitative elements in the protocol used scales ranging from 1 to 5 (Likert-Scale).

Because in Germany there are no digital games for adults with intellectual disabilities available, we used the preschool games "Janosch – meine große Vorschulbox", "Lauras Vorschule" and "Die Mini-Mäuse" as test objects. With these serious games the main research questions could be analysed, because they provide the requirements the supervisors of the sheltered workshop defined and reach the target group.

The sampling is characterised by the qualitative approach taking very different people and their varying computer literacy into account. The chosen persons A (Age 40, female), B (Age 28, female) and D (Age 25, female) have only a slight computer literacy. Person C (Age 21, male) has basic knowledge about using the computer.

These games were played over a period of 14 weeks with 2 game units per week, each lasting 45 Minutes. The structure of the participant observation was to set up a scenario in which the participants were asked to play the game while the observer sits aside.

The results of the empirical study will be outlined as requirements in chapter 4 and should serve as guidelines for designing and programming a digital learning game (see chapter 5).

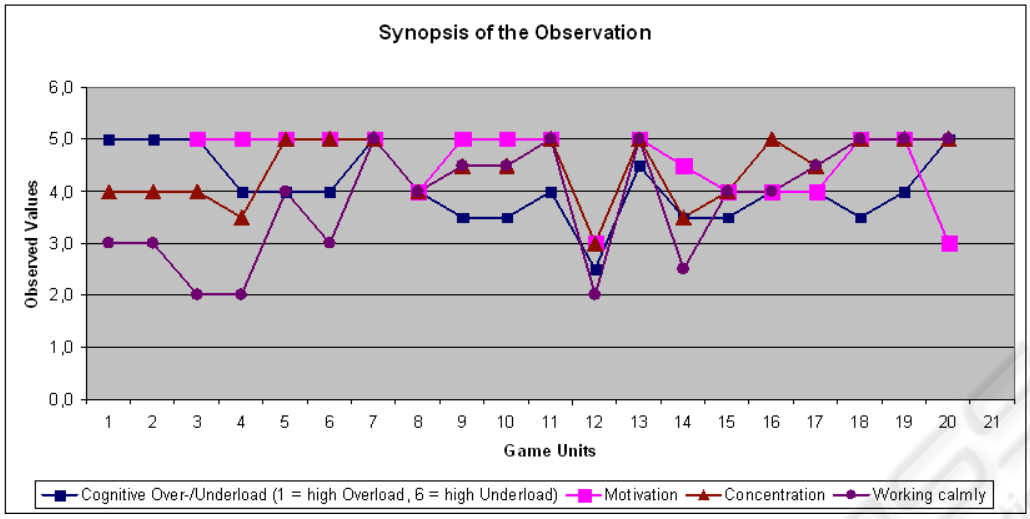

Figure 1: Selected results of participant C concerning the quantitative part of the observation.

4 RESULTS

The results showed both positive effects on learning and negative aspects of game usage.

The main **positive effects** on the learning process are characterised by improvements concerning the computer literacy, for example handling the input devices. The observation protocols indicated increasing concentration, perseverance and patience as well as an improvement in working very calmly and precisely concerning playing the game and solving the tasks. Figure 1 shows a clear correlation between an adequate difficulty and a high motivation (game units 9-10).

An increase of competences and knowledge regarding the daily-life topics was ascertained, e.g. nutrition, traffic rules, and dealing with money. Regarding the motor skills while handling the computer we found an improvement in the ability to react, the eye-hand-coordination and the orientation in virtual rooms.

Also some **negative aspects** of game usage were analysed. The learning topics within the chosen games do not concern aspects of the reality of the participants. All tested games communicate the instructions and explanations either through an acoustic or a written mode, which was problematic for those, who are not able to read.

As mentioned earlier the concentration decreases if the game levels are either too easy or too complicated (see figure 1, e.g. game units 11-13). In the tested games there were only a few possibilities to modify the navigation tools. Only one game offered the option of printing out a certificate about the achieved score, a detail which was very much appreciated by all participants of the study.

Because of the fixed order of the given answers, the participants recognised response patterns, which were often experienced as negative.

Summarising, the results of the study show a strong interest and motivation in playing digital games across all participants, e.g. participant B said: “That’s why I’m here: to learn something, finally!” (“Dafür bin ich ja da, um was zu lernen, endlich!”); participant D claimed: „Please, remember me that we train calculation next week!” (“Erinner’ mich nächste Woche daran, dass wir Rechnen üben!“).

Moreover, they affirmed that playing digital games challenged them in a positive manner and varied their daily life routines within the sheltered workshop. During the study this interest decreased a little, especially when the participants felt unchallenged by the game. Participant C showed this significantly: “Today, I have no passion to play this game, it is always the same.” (“Darauf habe ich heute keine Lust, das ist ja immer wieder das Gleiche”). This perceived cognitive underload differed from person to person, depending on their knowledge, motivation and computer skills. As a main intervening variable on learning processes the ever-changing disposition and concentration were analysed. One of the most striking results is the huge interest in computer-related knowledge, e.g. to get to know how a computer works. However, only a few changes in the social behaviour of the participants have been observed, e.g. one participant became more outgoing, as the supervisors told us.

Even more, the supervisors reported that the game showed the participant's skills more detailed than they expected.

5 REQUIREMENT ANALYSIS

Based on these empirical results a requirement analysis was outlined. The requirement analysis provides a first step to encourage the development of „special games" for adults. The main concept to realise the requirements through a digital game is adaptivity, which affects several requirements.

5.1 Basic Framework Requirements

One of the major requirements is drawn from the literature (see chapter 2) and claims to stage the game **closely to the reality of the players**, e.g. using symbols (words, pictures) which are well understandable and commonly known. The content should display the every-day life of the participants so that the lessons learned during the game can **be easily transferred and put into practice**. Therefore the game designers should clarify beforehand which learning areas should be enhanced. We suggest using **mini-games** with single delimitable steps to avoid a cognitive overload and to allow individual interruptions without loosing the game. Regarding the **instructions** we argue for using all possible perceptional modes (oral, written,...) at the same time, so that the user (or their supervisors) can choose how the instructions should be communicated. Thereby a wide range of intellectual disabilities are taken into account. The possibility of an **individual key assignment** is considered as very helpful. Furthermore the possibility of choosing and combining different input devices, like the mouse and keyboard, should be given. This demand is caused in disabilities, which do not allow writing or reading. Since some users are not able to insert a CD-ROM into the drive due to their limited physical abilities, the game **should be playable without a CD-ROM** or other additional preparations. In general it should be possible to play the game autonomously so that the need of permanent assistance can be avoided. Hence an excellent and invisible **help function** is needed. It should be prevented to give **monotone answers and feedback patterns**, because this seems to be exhausting, especially for people with intellectual disabilities. A **simple graphic design** with high-contrast colours will encourage the visual perception and support the orientation within the game. The **menu's structure** should be as simple as possible, so that the main functionalities like saving the game are easy to find. The menu should also integrate a button to print documents, like the certificate with the reached high score. For supervisors as well as for parents it is helpful to have a **game protocol**, which should be as well available though the menu.

5.2 Didactical Requirements

One of the major didactical principles is to support and **to challenge the learner individually**. So there is a need for a well-adjusted balance (Mortimore, 1999). Thereby a cognitive overload as well as a cognitive underload should be avoided. To impede an overload of the participants, e.g. the possibility to repeat tasks and levels is needed. To impede underload new stimuli can be given through regular updates of certain tasks, levels or mini-games.

Additionally a motivating, friendly and varying **feedback** will create a supporting learning environment. For the supervisors it would be a benefit to be able to assess the skills and knowledge of new participants by the digital game.

It would be an engaging tool to create a competitive atmosphere for those players, who seek for some challenges. This can be reached by offering a game level with a high score.

5.3 Adaptivity as Main Requirement

Adaptivity is a key feature of modern information and communication systems offering added value to literally all users or customers through the system's ability to adapt to individual needs and desires.

A certain system's adaptivity, naturally, requires the system "to know" something about the user for being able to offer varying services to different users (Popescu et al., 2007). Therefore, adaptivity requires user modelling, a key issue not to be discussed here in more depth.

To many people, adaptivity is a nice feature that makes products and services more attractive and, perhaps, more useful. To producers and service providers, adaptivity is a nice feature that helps to gain advantage over competitors.

To people with intellectual disabilities, the adaptivity of the given system is not only nice to have, but a feature of decisive relevance. The authors' results (see section 4.2 above) exhibit that people with intellectual disabilities are not very much tolerant to deviations from their needs and requirements. If a system such as a game does not closely enough fit their individual needs, it is very

likely to fail in general.

Research into the adaptivity of digital games is a current field of endeavours. Although there are recent results of great interest (Charles et al., 2005), (Torrente et al., 2008), these recent research activities do not take into account the special needs of people with intellectual disabilities.

Further work will have to weight the requirements and to structure them regarding the production process.

6 PROTOTYPING & OUTLOOK

Based on the requirements mentioned above the authors are in the process of developing a game as prototype for people with intellectual disabilities. The prototype implements the most of the requirements displayed in chapter 5.

To develop a realistic game environment, we basically created a virtual copy of the sheltered workshop, in which the study was conducted. The images below show the main corridor of that institution.

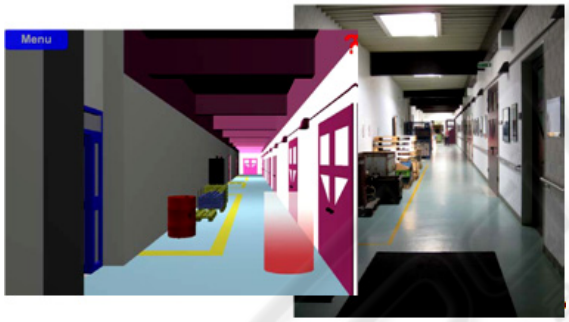

Figure 2: The virtual and the real sheltered workshop.

But because the game should not be exclusively created for one single workshop, we decided to design a **holistic framework**, in which different ground plans of different sheltered workshops can be depicted and staged as basic virtual game environment (see figure 3).

As a side effect the content of the game as well as the learning tasks are very comparable to the **real-life sheltered workshop** so that possibilities of knowledge transfer are given. It is even conceivable that this has a positive impact on the individual working performance.

Another learning objective is the expansion of existing knowledge, as well as daily life oriented skills, such as learning to read the clock and to use money. Apart from this learning effect, people with intellectual disabilities can hereby be encouraged playfully to reach a more **independent lifestyle**.

The creation of a system that imparts learning content playfully is one of the central objectives of designing a computer game for people with intellectual disabilities.

As an additional side effect, the target group is engaged to use the **computer as a learning medium** and instrument even for other contexts than games. An anxiety-free use of new technologies on the one hand and with the computer in particular is striven here. Computer competences improve the chances to be integrated into the employment market.

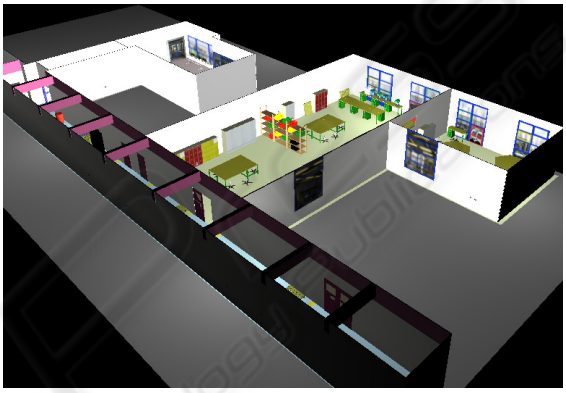

Figure 3: Ground plan of the virtual workshop.

The game will also provide the training of various skills, such as the responsiveness, concentration, endurance and patience. At least the game should be funny and motivating.

For those reasons we chose **mini-games,** especially to train certain skills selectively and for doing this in an entertaining way. At the present moment four mini-games are directly available through the game environment and already implemented. They train the visual perception, orientation in rooms, handling of input devices, counting, spelling and reading the time.

A main focus of the prototype is to implement the **adaptivity**. This will be realised by an incorporating user model. Within this user model all relevant data about the individual users will be stored. Because of this information the system knows to what extent help and assistance are needed.

After finishing the prototype an **evaluation** will be conducted. Using a similar research setting in the same institution will make the results of the other tested games comparable with the results of the prototype. Moreover, we can analyse whether positive learning effects and an entertaining experience will occur and if these learning effects are transferable to the daily-life reality of the participants. The empirical research should as well

extend the evidence base concerning the usability in general and especially in navigation. The results of the empirical study will influence the redesign of the prototype.

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