Merging Real Life Experiences With Technical Knowledge in a Playful Manner – A Case in e-Inclusion

Carolina A. Islas Sedano, Adele Botha, Mario Marais, Erkki Sutinen
Joensuu Yliopiston, Joensuu, Finland
cislas@cs.joensuu.fi, sutinen@joensuu.fi
Meraka Institute, CSIR, Pretoria, South Africa
adele.botha@gmail.com, mmarais@csir.co.za

Abstract: Connectivity to the Information Society does not imply inclusion. Active members of the Information Society (IS) do not just own technology and a connection to the world wide web, they know how to use the technology and inform and express themselves through it. It is therefore not enough just to provide the technology, individuals also need to be able to use it to meet their needs and support their activities. We made use of what we call video games as a potential channel to support the e-inclusion of marginalised members into the information society.

Most interactive video games are designed by and for younger adults from specific cultures and contexts, targeting specific markets. This neglects a vast world wide population with different needs, such as the elderly. They have distinct needs, cognitive abilities and desires that are vastly different from the game design target market. A conceptual framework based on activity theory guided the planning and implementation of a series of game design workshops. Through these workshops it has been possible to observe how a group of seniors learned information and communication technology (ICT) skills through the process of game design. In addition they were able to express themselves in the digital world while their life-experience and creativity captured in their game designs was turned into a digital form under their control.

During the last part of the game-workshop held at a Seniors’ technology club in spring 2007, we developed gaming software, or “digitalized” the games which previously had been conceptualized and developed by the seniors. We used participatory techniques for software development and action research for understanding of the process. By including the seniors actively throughout the design process, games were developed that they enjoyed. Additionally we could observe how through this digitalized game development process, the seniors and developers learned to express and understand each other and to produce a product that can be played and enjoyed by other IS members. Our research suggested that this was an important consideration for the participants. These workshops offered a richer experience than merely observing elderly users with specific applications.

This paper further reflects on the importance that the game-design approach brings in promoting e-inclusion, collaboration, reflection, knowledge exchange, learning and creativity of different individuals by incorporating the life experience of their designers. In addition, this approach, aligned with activity theory, focussed on the games as objects and the elders as the main users being included in the game community leading to an increase in their self-confidence. Thus creating a sustained interest in the e-inclusion process. Case studies of this nature provide valuable insights in e-inclusion activities.

Keywords: e-inclusion, game-design, elderly, activity theory.

1. Introduction and research question
The challenge of overcoming the digital divide reaches far beyond the issues of connectivity – it also needs to address the inclusion of marginalised individuals or groups in the society. The concept of inclusion is often used in the creation of policies and political arguments. Inclusion is an ongoing important theme for incumbent practitioners and the whole process of the World Submit of the Information Society (WSIS) which is seeking change and equality. At the same time we have to understand that “inclusion” is a complex and multi-layered concept.
"The digital divide is a dynamic concept, which evolves over time; There is not a single divide, but multiple divides: for instance, within countries, between men and women, between the young and the elderly, different regions etc." (ITU 2007:23)

The physical access (which directly addresses the issues of connectivity and accessibility to the technology) are the first steps in the fight against digital exclusion. Nevertheless, connectivity alone is not enough to ensure that users be included as active members of the Information Society. It is important to be aware that new users of ICT tools and the virtual environments that those tool offer, need to confidently navigate and understand technology and make it meaningful in addressing their needs, otherwise their adoption will not be successful (Nikolidakis, 2007). In other words, the knowledge acquisition of ICT tools blended with the relevant context, environment and needs of the learners will ultimately support a process of natural evolution and learning. In pursuing this aim, we set our sights on a relevant and very meaningful ambition which is the building of local innovation and the development of human capital.

"Most recent growth in the ICT sector has involved targeted innovation and human capacity-building strategies....The development of an adequate pool of highly-skilled labour is the foundation for the success of national innovation policies." (ITU 2007:78)

Developers and practitioners, who are aware of the inclusion process, should be encouraged to focus and support local social changes through the use of technology. In addition they should understand that a non-skilled person in the IS can be anyone, independently of socioeconomic, demographic or geographic location. As a consequence the needs and previous knowledge of the new user varies considerably from case to case. Therefore our approach towards e-inclusion is that both the learners and practitioners should work together and thus build knowledge jointly. Our target is to understand the community and the context in which the learner is involved and then to support him in choosing and using a tool which addresses his needs. We believe that no digital tool can be successfully taught in isolation from the factors stated before.

In this paper we present our experiences as practitioners, building knowledge together with senior citizens in Finland. This paper reflects on how the use of participatory design in the digitalization of self-designed video games facilitates e-inclusion? Implying which ICT knowledge they can be learnt along this process Our experience is in the creation of video games focusing on a reflection of the cultural context of the participants. The paper is organized as follows: the background of the seniors and the game workshop, a discussion of the conceptual framework based on the Activity Theory, Action research as methodology, a discussion of the results and in conclusion, an analysis of the project.

2. Background
In the European Community context, it is important to offer access to the Information Society to all its citizens. The emphasis is on policies and initiatives to include the most excluded groups, including the elderly (EU, 2007). Being aware that connectivity is not enough for e-inclusion and with the aim to understand accessibility, usability and technological educational challenges for the elder, the Department of Computer Science and Statistics at the University of Joensuu has facilitated the establishment a Seniors’ Club. In this section we briefly describe the Seniors’ club concept, followed by an outline of the game workshop prepared for them. This workshop was part of a diverse set of activities held within the club. The main aim of the game workshop was to explore and encourage the e-inclusion of the elders’ through an interest in digital games. This included activities ranging from concept creation to the digital completion.

2.1 The concept of Seniors’ club
The Seniors’ club – a technology club for elderly people aged 60-75 – has been operating for three years at the Department of Computer Science and Statistics at the University of Joensuu. It offers meaningful activities with new technologies for the seniors and is a living research laboratory for researchers of educational technology and usability (Eronen et al 2006, Naumanen et al 2007). During
the 2006-07 university year the Seniors’ club consisted of 12 members (six male and six female), who all enrolled voluntarily at the club. The club was facilitated by two researchers and two volunteer tutors. The ages ranged from 61 to 74 years and the member have diverse backgrounds. The level of ICT skills of the participants range from complete novices to proficient users, but all have been equally active members of the society. The club has been running during university semesters, for two hourly weekly sessions at the University of Joensuu Educational Technologies laboratory.

2.2 Game workshop
The concept of a game workshop for the Seniors was developed during the summer of 2006. It is an outcome of experiences gained by the Educational Technologies research group, which forms part of the Department of Computer Science and Statistics at the University of Joensuu. The groups’ interest in game research lies in combining knowledge based on education, technology and games. This offers a unique approach to understand the phenomena of video games.

The game workshop for the Seniors consisted of two phases:

In the first phase, "Workshop-I", the seniors created their game concepts. We addressed the idea of involving seniors as game designers and producers, rather than evaluating a diverse set of games with them. The games were designed based on the interests and life experience of the seniors. This makes the game meaningful for the participating seniors. The city of Joensuu, history, surrounding and cultural ethos was used as a theme. During this process we developed a mutual understanding and practised collaborative game design. The tangible final product of this stage was the game paper prototypes produced by the seniors (Islas Sedano et al 2007).

In the second phase, "Workshop-II", we aimed to develop software games from three different paper game prototypes developed by the seniors in the first phase. At this point the seniors had already tested the playability of each game, and they were already useable game products. Hence the main challenge of this phase was to define how to develop the software version of the games. The coding would be done either by the seniors themselves or by a third person.

Although the seniors were the experts in their games, they were not proficient enough to program them by themselves. Our goal was not to make the seniors programmers and it was felt that this activity would place unnecessary stress on them. Additionally each game was unique and presented specific technological challenges in order to make the game playable via the internet. On the other hand it was a desirable scenario for exploring and understanding how, through the use diverse tools, with a proper division of labour embedded in a community, we could introduce the process of software development to newcomers to the information society. One of the motivations to complete the project was to be able to show their results to other members of the information society. It was envisaged that they would be building bridges of communication through their contribution. They would be gaining experience, vocabulary and skills through their participation.

The decision was made to contract a third party with the necessary proficiencies, to the project. Participatory design techniques would be used to support the expression of the seniors creativity and enable communication between the elders and the contracted party. Through this setup the seniors were empowered to direct the development, look and feel, outlay and other aspects of their games. They were in control of how they would like to have their games came to life the screen, while concurrently being able to follow and direct the “digitalization process” of their own concepts. The researchers and contracted party had the opportunity to appreciate which design elements the seniors considered pertinent to have on screen while the computer concepts that were unclear to the seniors could be explained to them. This interaction and communication process encourages mutual efforts towards e-inclusion by trying to comprehend the needs of each other in a meaningful way and learning from the knowledge of each other.
The understanding of this “digitalization” process through participatory design is framed by a conceptual framework based on Activity theory. In the following sections we describe this Activity theory framework followed by a discussion of the methodology.

3. Activity theory
We used a conceptual framework based on the Activity theory to support, understand and reflect on our practices. Kaptelinin and Nardi (2006) see the activity theory as a useful framework to negotiate complex structures that include users and their needs as well as technology and its possibilities. Nardi (1996) further describes it as a powerful, clarifying and descriptive tool.

The expanded triangle model of Engeström (1987), shown in Figure 1, attributes human activity to specific needs that individuals have to complete a task. In turn it is understood that the activity of any individual involves the use of “tools” and the activity is reflected in the individual through their own actions as they interact with the environment.

“An activity is undertaken by a human agent (subject) who is motivated toward the solution of a problem or purpose (object), and mediated by tools (artefacts) in collaboration with others (community). The structure of the activity is constrained by cultural factors including conventions (rules) and social strata (division of labour) within the context” (Ryder, 1998: 4)

![Figure 1: Engeström's expanded Triangle model](image)

Although the relationship of the elements involved in the activity theory are explained above, it is important to consider that this model was created when digital technology did not yet exist. Thus, once we start to get involved with digital tools this necessary implies an incorporation of additional components in this model (Figure 2). Botha (2007) mentions that while the activity theory defines technology as a mediating tool, it fails to address the particularities in the interactions between the user and the technology.
A brief description of the framework (Figure 3) is given below:

3.1 Subject component
The user as subject acts with and through technology to achieve an objective. These activities take place through or with the use of tools in a community. In the situation of the games digitalization, the subject studied could be any of the participants: the elder, programmer or the researcher. In this paper the subject component of analysis is the seniors.

3.2 Object component
The object is the motivation that the user has for the activity. It guides and gives intention to the activity. This component might represent different cognitive layers of motivation in the subject triggered by the object. These can be due to personal interest in the subject of games, or interest in the digitalization process, the desire to have their own product or the wish to play with other members of the information society. We are not focusing on the cognitive level of the object, but on the object itself, which is to conceptualized through the interaction and visualization of their games by the seniors (the subject).

3.3 Community component
The community that contextualises the activity is either a virtual environment that is accessed through the technology or is a physical community that surrounds the user and in which the user is embedded. Regarding the e-inclusion focus of the seniors, they are active in their physical community, which they understand clearly. Nevertheless, during the process of participatory design the seniors must decide the extent to which the virtual visitors should interact with their games, and in turn, this decision implies
how can virtuality can ‘leak’ into the physical world of their designed games. Simultaneously, in order to achieve their desires, they must reflect and question themselves about the existing interactions of the actual virtual community. This component is mediated by two relationships:

**Rules**, which are the rule protocols and traditions that are embedded in a community and by which it functions. Often this is knowledge that is taken for granted and difficult to externalise. When a software developer and the target population are separated by an age, gender or disability gap this presents a challenge. By making the target group the designers of the games and the digital interaction of the games, they make explicit this information via at least in two layers of meaning. Firstly, in the game system itself, the seniors make explicit their cultural understanding and description of how the game should be designed and played. Secondly, the senior’s desired interaction between the digital game and the user must be made explicit through the participatory design. Hence, through this participatory design the developers and researchers must listen to the elders, and together develop a common understanding of the rules of the game at different levels.

**Division of labour**, which is the way in which the people in this community divide labour to achieve common objectives. *The cultural and age bias was incorporated in this level as well as the seniors could structure the activities the game involved from their own field of reference.*

### 3.4 Tool component

The tool is an artefact that the subject uses to perform activities. It has no meaning in isolation but is given meaning by incorporation to achieve an objective through an activity. As the seniors had limited or no knowledge of programming they used paper mock-ups, part of the participatory design techniques, were shown what elements should be displayed of their games, which interaction should be represented and how it should look like. The process is interactive, in other words once a digital prototype of the game is developed, the seniors must test it and give feedback to the programmer about the modifications. Hence the senior’s tool in this activity is primarily the paper mock-ups which are slowly being switched to a secondary tool which is the computer. This process itself supports the transition of personalisation and familiarity into e-inclusion. This component is mediated by the following relationships:

**Tool Rules:** This describes the protocols and rules that a subject should be able to navigate to use a tool. They start by using familiar tools such as paper in their mock-ups, and through them the subject starts to conceptualize and visualize the interaction of their digital games with a player. Thus, through a process the subject builds a familiar bridge between the representations of new tool-rules (the computer interaction) through the known tool-rules (the paper mock-ups). Hence, each time they test a digital prototype, they reinforce their reflection and understanding of the new tool-rules of the digital version of their games. In addition, the rules with which they are already familiar, results in an interface that they can navigate and master, and thus creates a positive cycle of experiencing of e-integration

**Tool division of labour:** The tool division of labour refers to the different functionalities that are incorporated in the tool. The functionalities of their games were only as complex as they felt comfortable with, excluding all types of social software capabilities that a younger generation might have felt needed to be included.

These relationships and components highlight the multitude of complex interactions that need to be considered when designing technology to facilitate the activities of a user or group of users. When the programmer and developers seek to guess by themselves the needs of the excluded people for e-inclusion, it becomes difficult to incorporate explicitly elements that correlate to specific tacit needs. In order to not take for granted a wide set of requirements to involve actively excluded groups, we support the excluded members to design their own digital interaction through an application that is meaningful for them, and through this process support e-inclusion.
4. Methodology

In order to successfully accomplish the digitalization of games developed by non experts and newcomers to ICT activities, it is necessary to have a specific action plan and working techniques to achieve this goal. The basic technique we used for the digitalization of these games was Participatory Design (Newell et al 2002, Schuler et al 1993). Because each game presents different specific challenges and needs, seniors, programmer and researchers should be ready to resolve conceptual and technical problems together for a successful implementation of the games according to the senior’s design. Hence, the researcher used an interventionist method together with action research, gaining theoretical and practical knowledge about this process while supporting the communication and understanding between the stakeholders.

Each game was treated independently and carefully related to the specifications of its creators. In the first meeting of the digitalization phase we started with a general session, which was the only session in which all the members concentrated on this topic only. In this first meeting we made it clear that the designers (seniors) and the programmer are of equal importance in this project. Each one of them has their own expertise, the programmer has his skills and the designers have their knowledge, and they needed to collaborate in order to make the final products.

In the digitalization process, based on participatory design techniques, each team made their own paper mock-ups. In other words, through the paper they should express how they wanted to see their games on screen, which functionalities should be present according to their game’s system and which functionalities should be related to their own interaction with the computer. We encouraged them to be as explicit as possible and to not limit themselves in any aspect. To conclude this session we explained that the rest of the process would be a series of iterative meetings between the game team and the programmer until the designers were satisfied with the game. In addition the programmer’s focus will be on one game at a time.

For each game digitalization, the first meeting of the game team and the programmer consisted of the seniors explaining to the programmer their mock-up and their game rules. The seniors were as explicit as possible and the programmer tried to understand all the elements needed for his work. After this meeting weekly meetings of 30 min were held before their regular club activities. In this meeting the programmer showed the game-team his progress. During the meetings doubts were resolved reciprocally while testing the game (in its current phase). This process took approximately four weeks per game. The order in which the games were digitalized was chosen by agreement from the whole group.

At the end of the whole digitalization process the three games are running on the internet. The evaluation of the results involved presenting each of the games to the other member of the club in a final meeting where all of us reflected of the whole digitalization process. Figure 4 represents graphically the timeline of this research process.
5. Results and analysis
In this section we report the outcome of the workshop and some analysis of it in order to move towards resolving our research question.

Game A (Figure 5), Joensuu Koodi, is a strategic game for one player about the knowledge of Joensuu’s history. Among the digitalization conceptual challenges that were present in this game was how to represent the navigation of the pictures in order to answer the game question. This presented a double difficulty because two piles of pictures were used (one with a higher difficulty level than the other one) and so the pile the player is using needs to be confirmed, and then the creation of how to navigate inside this pile takes place. Determining the calculation of the points along the game, and the way in which the time should be represented in the game was challenging in the digital design. Feedback of the game actions to the player required careful thought.

Game B (Figure 6), the Joensuu Lottery game, is based on the historical architecture of Joensuu. Among the challenges presented was how to keep its multiplayer nature. Our programmer had not enough knowledge of client server applications, nor how to implement play by multiple players on one machine. However the challenge was suitably sorted out by the seniors, and it was left as a multiplayer format within one computer, while allowing periods of time for each player to take a turn. Another challenge to be resolved in this game was the design of the settings of the game and also clarification of the navigation of the game. It was important to have a feature where it was possible to see the pictures whether the users were playing or not.
**Figure 6:** Game: Joensuu lottery

Game C (Figure 7), is a story telling game with poems. Among the challenges was providing proper feedback to the users on how to identify the matching of poems and pictures correctly.

For the purpose of answering the research questions stated earlier in this paper the following data is analysed: the comments available on the web blog, the answers from the last questionnaire and research observations.
After the digitalization workshop, the participants filled in a questionnaire resolving the following questions: what did you like from the Second Game workshop and digitalized games (thought and feelings)? And what is your actual opinion about video games and why?. The analysis is done by identifying, naming, categorizing and describing relevant phenomena found in the text.

From the feedback given by the seniors, a constant element of their answers is their surprise toward the digitalization of their games.

- Positive surprise.
  - The programmer understood. Totally happy.
  - New and wonderful things.
  - The games came better than he expected to be.

We hold that participatory design supports the communication between the developers and elders. In addition, this technique supports knowledge creation by the parties involved while promoting the self-reflection on how we want to do the things and being able to express them to others. Hence, as the seniors highlight in their comments, collaboration is a fundamental element:

- Challenging.
- Digitalizing was interesting.
- It has been interesting to be part of it.
- Give her pleasure doing it.
- She didn't understand what the programmer did, but it was interesting to see the process.
- We made different changes with help of everybody. Each one had their own opinion. Good collaboration for the end.
- Collaboration was positive.
Last, but not least, we also suggest that through this process, the inclusion process towards the specific topic of video games has started, while people who discover this world find which type of games they are willing to try.

She didn’t have idea of video games at first,
It is possible to create smart games with computers
It should be smart games

From this observation it is possible to generalize (and it must be studied further) that researchers might take for granted that different users present some basic amount of knowledge that might be “obvious”, but that actually it is not present in the users per se. Examples of this are how the “click” of the mouse should be presented or designed in the flow of their game, how a down counter should display its information, which extra information is needed to make explicit, among others. The development of proper usability of the User Interface is presents a more difficult challenge.

Seeking to answer the research question: how does the use of participatory design in the digitalization of self-design video games facilitate e-inclusion? And which ICT knowledge can be acquired along this process

From the results of this workshop there is a need to further explore this phenomenon. However, according to the results obtained we suggest that the use of participatory design in self-design application facilitates e-inclusion. In addition it supports the understanding and communication of knowledge that might be implicit for the programmers but it is unknown for non-expert users in computers. Example of this is on how the interaction will be more suitable in the screen, activity that non-computer designers might not have thought about it until they are facing this phase of development. Hence this approach also offers enough space and information for newcomers to reflect on how it is more intuitive for them to interact with the computer in order to get the results that they would like to have. This is facilitated if the application is meaningful to them. The process to test the game prototypes weekly with the programmer supports a space for this knowledge creation.

The activity of elders and a programmer towards the concretization of the idea with some degree of freedom, supported their determination and increased their self-esteem in this area. This created a positive atmosphere, which at the same time was transmitted to the programmer, tutors and researchers. It is worth highlighting that this creative environment brought a positive experience to the programmer, who after being unemployed for a long time, as according to the reports given by the City of Joensuu, showed a change of attitude in his persona. From our observation and data, we can affirm that he worked diligently to accomplish all the wishes of the seniors each week according to his knowledge.

6. Conclusions
This is a small-scale approach towards e-inclusion and learning process between computer scientist and non-computer experts. It is clear this experience presents a dependency in a contexts of which we are talking. Nevertheless through this process we realized that it is important to create an openness towards video gaming, furthermore to create trust between people and the use of the technology. It is through the confidence built through this trust process, when non-experts involve by themselves more into the use of technology while including their own visions in specific applications. In addition it is also important to use prior knowledge that might positively influence users interactions with ICT and also enhance the possibilities of expression. Further research in this area will offers more information on how activities as this one can be applied in different marginalized groups into ICT. Which activities are more focus into the development of skills while perhaps others is in the knowledge exchange, or in the combination of both. Nevertheless, if we want to involve illiterate and non-expert users of ICT in playing with us, we have to listen to what they find interesting and understand what are the impediments that are keeping them from joining us. Those challenges can only be resolved through communication and understanding between the individuals.
The authors of this paper would like to express their deep appreciation to the seniors club at the Joensuu University, Minna Naumanen for all her support along all the process. Also our gratitude goes to our tutors Minna Hiltunen, Janne Krohns We would also like to mention Prof Erkki Sutinen and Prof. Markku Tukiainen who initiated the Seniors Club and has given enthusiastic support and valuable guidance

7. References


