Participatory design and opposing interests in development of educational computer games

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ABSTRACT
In this study we have followed a participatory design process in a class of children aged 11 and 12. The development team, a group of Danish schoolteachers, invited the children to participate in the design of a computer game for mathematics education. The objective of the participatory design process was to have the children create a game close to their own interests, experiences and fantasies, hereby insuring that they would find the game interesting enough to play it in their spare time away from school. Prior to the design workshops, the development team had a discussion with one of their classes, and decided on a game of exploration where the player travels through time and space, and the purpose of the design process described in this paper was to develop this idea further. During this process it became clear that the teachers' ideas in some sense differed from the children's. In the teachers' original concept, the landscape would represent the history of mathematics (e.g. ancient Egypt, Greece, China), whereas the children's ideas, diverse though they were, evolved around a fantasy setting and tourist experiences. In this project there arose a conflict between a pedagogical goal and an attempt to understand the end-users world through research.

Keywords
Participatory Design, Learning Games, Mathematics.

INTRODUCTION
When children are invited to participate in the design of learning games, adult developers will often have their own ideas on the product they want to design even though they want input from the children. Children from the target group of a learning game will often not be able to articulate or even

understand the learning goals that the adult designers have in mind and are therefore less able to engage in the design of the learning activities.

In this article we look at an ongoing participatory design study to try and identify what is happening in cases like this.

Participatory Design

Participatory design is used as an approach to design, develop and evaluate technological and organizational systems, which focuses on the active involvement of the target group. Even though Participatory Design practitioners differ much in backgrounds and perspectives, participatory design is based on some general agreements according to Randy Trigg and Andrew Clement [7]. Central Participatory Design principles for this study are the respect for the users of technology as experts on what they do, and the recognition of workers as a prime source of innovation.

Reflections on participatory design processes have shown that every participant should be seen as an equal element contributing to the development of the design, whether their role are users, developers, teachers or researchers in the participatory design sessions. At the same time that every participant is an expert in what they do in the design process, no one, child nor adult, should have the full responsibility and make all the design decisions [2].

The users should be recognized as a prime source of innovation. It is important in this regarding to focus on the collaboration between the participants in generating ideas and respect the sources of ideas that are generated.

Participatory design used in new technology design projects is not only an opportunity for children to potentially learn, but also an opportunity for developers to make better technologies for children [3]. Many developers and researchers have recognized that they can learn a lot from the user group in by engaging them in the design process [4]. Using children as “experts” is therefore a logical thought when it comes to designing learning computer games. Many children use most of their spare time away from school to play commercial computer games and they become experts on what they like in games, what an interesting game with a good game play (the most basic dynamics or rules in a game) is.

In a lot of studies the participatory design ideas do not work and the usual explanation seems to be that the user and the developers “do not understand each other” [4]. This paper will through a concrete case describe some problems with using participatory design to design learning games.

The process of developing the game

This paper describes an ongoing development process that we take part in. The project was initiated by a group of teachers together with a software house. The basic idea was to develop a computer game that should teach mathematical competencies and “be as fun as normal online computer games”. When we entered the process the idea was to create a travel game where you traveled by some mean of transportation. When you entered a location you would solve some mathematical problems, somehow connected to this location, in order to get fuel or food. This concept was developed by one of the teachers on a session with one of his classes.

In the teachers' original concept, the landscape was traveled in was the history of mathematics (e.g. ancient Egypt, Greece, China), but this idea was at that point merely an inspiration.

We where hired partly to design workshops where children could develop the idea of a travel game further. In order to avoid the problem that these children where unable to design leaning activities and describe learning goals it was decided that the focus of the children's work was on designing the mean of transportation, good travel experiences, and to some extend the game play of the game.

The workshops

The research group had two sessions with a class of children and their mathematics teacher, who also was a member of the development group. To begin with the children were told that the game that was to be developed was a traveling game that should teach mathematics. The children were not told what kind of math this game should include, nor what kind of pedagogical goals the game should have.

The first session, a brainstorm, was throwing lights on interesting subjects to include in a traveling game. Then the children were asked to draw the ideas that they liked from this brainstorm on to paper and try to connect these ideas with math. The second session the children were working on these ideas in groups in order to develop them from the first session.

Four boys as game designers

The following section describes how four children interacted and in cooperation created a game. The activities took place in the second session the children was asked to draw their ideas from the first session on to a large paper. The children were divided in four groups with each four or five children in the group. One of the groups, a group of four boys (Lars, Anders, Per and Søren), inspired the development group.

They started out with drawing a cross that divided the paper in four squares. The idea was to travel across different ages and each square should represent an age.

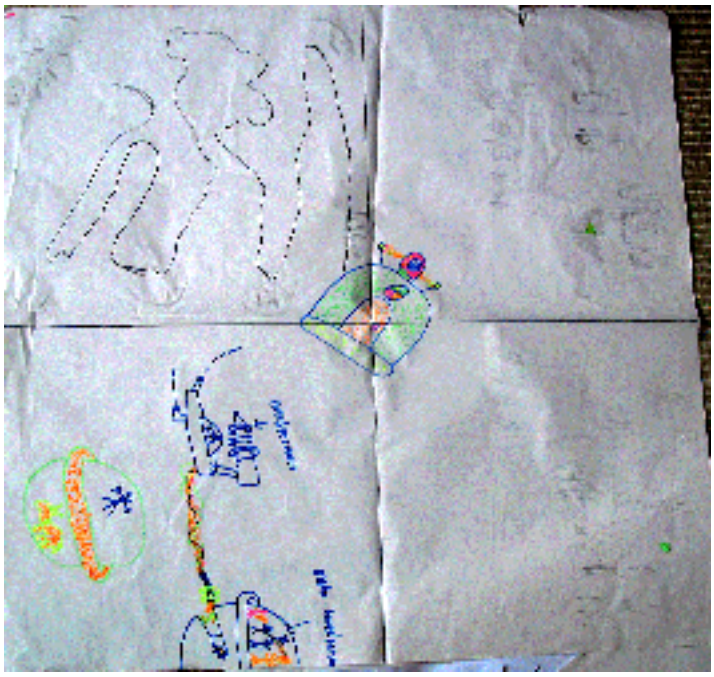
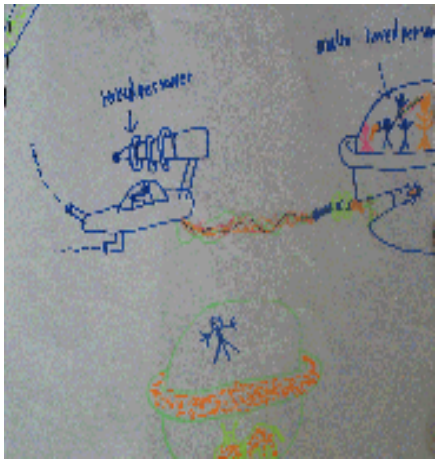
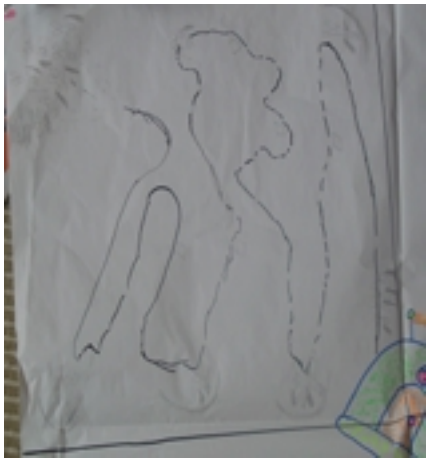


Figure 1: The Time machine-game.

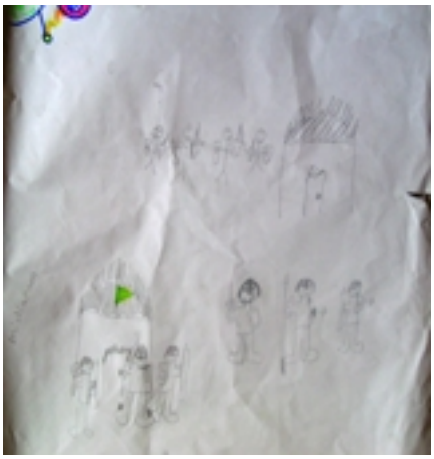
Each boy was then to draw a story from an age. The four ages were: "Future", "Middle Age", "Western Age", and "Caveman age". The plot in this game was that the players travel around across the ages in a time machine. In every age the players are to find a piece of a "time-clock". In order to finish the game, the players should collect all the four pieces of the clock and to put these pieces together. Then the players can travel to the present in order to finish the game.



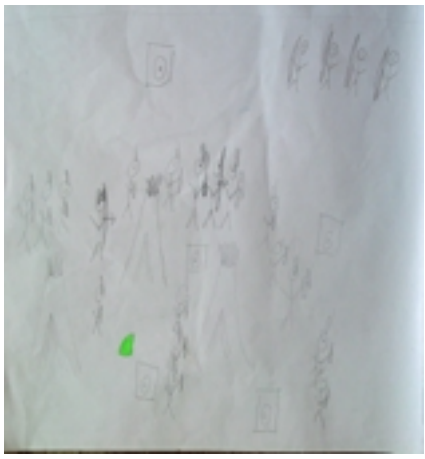
The Future



The Western Age



The Medieval Age



The Cave Man Age

Figure 2: Close up of the four ages

Teamwork is an important factor in this game. Every move in the game requires cooperative skills by the players because the players needs to work together in order to solve the game. Each player can also benefit to the cooperation with acting individually. As an example the player can talk to persons in the game to get knowledge that is to be used to solving the game.

It was clear that the process in the group was controlled by one of the boys that took the role as the leader of the group. This situation was quite unsatisfying for the three other boys, and the boys expressed this unsatisfactory situation to the researchers. The researcher group had a talk

with the group of boys and afterwards the dominating boy let the other boys participate more in developing the idea of the game set.

After all, this internal conflict in the group benefited the group with positive results in the end. At the presentation where all the groups in the class presented their ideas, this group was the one that had come furthest in designing a game. It is interesting that the boys (controlled by Lars) immediately define the frames to work within. After solving the conflict, the boys were able to open up and work in more widely defined frames than the other groups that didn't define frames to work within. It could be worth considering whether researchers should define frames, the participators could work within or get the participators to define their own frames they will work within.

The four boys almost "remade" the game play proposed by the development group, and the boys even developed these ideas further. Elements as multiplayer options and solving mysteries in order to go further in the levels of the game were elements that the boys designed into their ideas of a game play. With these three elements the four boys contributed to the development of the game play design.

Over all the workshops gave some interesting results, and some ideas as the idea of a multi player part and the idea of the creation of an own character were taken in by the development team.

In general the idea of a travel game seemed appealing to the children whereas the idea of situating the game in ancient history was less appealing. A lot of alternatives where offered but obviously none of those alternatives had the form of a full developed game idea. The development group chose to go ahead with the history of mathematics idea because it was the most developed idea and they had only little time to finish the game concept.

Why change a good idea?

So why were there so few fundamental changes from the initial version of the concept to the final model when the expressed goal of the development group was to incorporate the ideas gained at the workshops with the users into the game concept?

There can be different explanations to this. One can be that no interesting ideas came up viewed from the development group's perspective. The group had from the beginning a full concept that could hold different learning content ideas they had planed for the game. This is not the same as saying that they did not want to be open towards changing this concept, but for some reason this did not happen.

The time-travel game concept was the perfect frame for the adult developers idea that more or less was to connect the educational content to interesting narratives through the ancient history of mathematics. This idea was in the beginning thought as an example of how the basic game play could work, there could be many other such themes or landscapes. But in the end it was chosen to proceed with the ancient history of mathematics.

The basic claim in this paper is that this happened for two reasons; one that the first idea was good seen from the developers perspective, and hence that most alternatives or modifications only would make the initial idea less good. The second reason that we propose was that the organization of the working process was unfortunate in the sense that all the implicit knowledge [5] that

the workshop generated was collected by the group of researchers (us) that then attempted to communicate this knowledge to the development group.

The recommendations that the workshop generated namely a feeling that the ancient theme was not very appealing to the children, was then very difficult to follow for the developers, and the concrete ideas and wishes from the children about traveling in present time in tourist and fantasy settings could not immediately fit the developer's educational content ideas. The developers thus would have had to let the good content idea go if the student ideas should have been fully incorporated into the game. Here the educational content ideas came to control the game development process. Seen from the educational point of view this was the only thing to do. Furthermore since the developers did not take part in the workshops with children they had no access to the large amount of implicit knowledge that was generated there but only to number of guidelines that was difficult or impossible to incorporate in their existing design.

Relevance of Participatory Design to educational games

It is obvious that an understanding of how the world looks from the perspective of children is important when designing all sorts of educational material – especially when designing educational games. And our data shows that children can act as designers. Despite the little time that was used for the participatory design sessions the example of the four boys developing the time-machine game shows that children can design complicated game plays for the development group to go further with.

The data also shows that the children's ideas had only little effect on the designers work. Now why is that and why does it matter: The most obvious reason is that children are unable to fully understand the educational goal and hence create educational material on their own. But why does this prevent children from contributing to the process of creating material? Obviously we cannot say that children cannot contribute to the process, but it happened only little in this case and the paper has searched for reasons for this. We have proposed that an early introduction of a good idea has been a central reason for this. Furthermore we have proposed that this means that the children in order to have any impact on the design had to pose a full flown alternative to the ideas from the design group.

This study suggests that Participatory Design projects like the present with a set of game concept and educational content ideas need clear definitions on the role of the different participants and how they can contribute to the development of specific idea. This would maybe give a more fruitful result in the present case. But narrow frames set but designers from the educational world could also keep out ideas that would bring the end product closer to the interests of the end-user.

Many Participatory Design researchers have suggested a close team work in the design process between users, teachers, developers and researchers. In this project the research group's workshops were actuated without the development group, and the researchers were to hand over the data obtained in the sessions to the development group. An explanation on why the end result in the gameplay differed from the children's ideas could also be the lack of contact between developers and users.

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