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Concept of Educational Design for Serious Games

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This paper focuses on the challenges related to the development of an educational design for serious games. This paper is based on the project *Serious Games on a Global Market Place* (2007-2010) founded by the Danish Council for Strategic Research, in which an online game-based platform for English, as foreign language in primary school, and a learning game for social science in secondary school are connected. This paper presents an ongoing development of a concept of an educational design for serious games. This educational design integrates theories within learning, didactics, games, play, communication, multimodality and different pedagogical approaches.

Keywords keyword; serious games; educational design; learning, play;

1. Introduction

Research on the use of games in the classroom is new, and we still lack experience in using different forms of IT-based and IT-supported games in different schools and educational contexts. The use of games in the classroom challenges educational design on two levels: 1) it raises essential issues with regard to the design of games, 2) in the use of games in learning contexts in different academic and interdisciplinary contexts, where issues such as planning, teacher and student participation, etc. are on the agenda.

The paper will focus on constructing a concept for educational design of serious games. Based on the project Serious Games on a Global Market Place (2007-2010), which includes two subprojects focusing respectively on teaching English as a foreign language in primary school and social sciences in secondary school, the paper will propose a concept, which includes theories on didactics, learning, games, play, communication and multimodality in addition to different pedagogical approaches.

## 2. Concept of Educational Design – A theoretical Apporch

In the following we present a concept of educational design for developing serious games. The theoretical foundation for the educational design is based on constructivistic and experience-based learning theories, as well as cultural and ethnographic oriented theories on play and games and a semiotic theory on communication and multimodality. Furthermore, the concept also include different educational theoretical approaches such as Computer Supported Collaborative Learning focusing on collaboration processes and the function of language in these in addition to project pedagogy focusing on problem formulation, production and participation.

Using the concept of educational design in relation to serious games implies that the design is directed both towards the construction of the game, i.e. what is built into the game, and towards the educational context, in which the game is going to be used [1].

Educational design is defined as comprising three levels: the practice level, planning level and theoretical reflection level [2]. In a teaching context, the concept of design can be defined as the plan or model for which activities and artifacts are to be included in which type of teaching and learning contexts and when. On this basis, design belongs primarily to the planning level in relation to Dale's three levels, but as both theory and practice constitute the basis for the design process, the three levels are seen as a whole, presupposing and interacting with each other.

The concept is illustrated in the model below:

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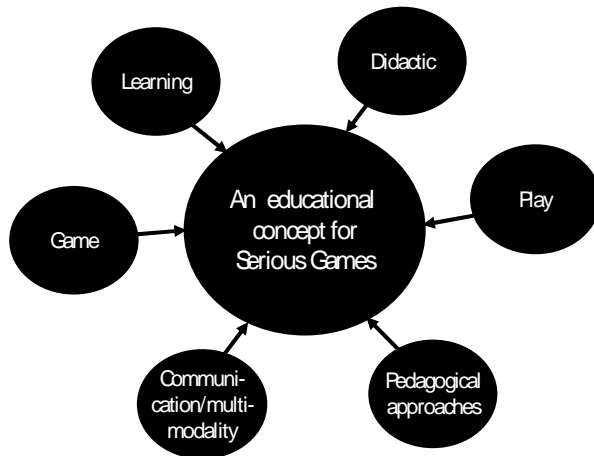
3. Didactic Approach

The development of digital teaching and learning products has focused on didactics. With the educational design concept, we primarily investigate didactics within contemporary Germanic and Scandinavian traditions operating with a broad definition of didactics as theories and reflections on purpose, objective, content, planning, organization and evaluation of teaching and learning [3, 4].

A fundamental potential of change in teaching is digitalization and the Internet, which imply radical changes in the learning and teaching processes. For many decades, the printed book has been the central learning artifact, but, during the last decade, an increasing competition has emerged from digitalized teaching and learning artifacts. As such, it is necessary to have a keen look at the influence of the learning artifacts and the learning potential they possesses, how they are didactically devised, how they could be applied in the classroom and which significance they will have on students' learning.

The book as a learning artifact rests on a long development and research tradition, influenced by changing pedagogical and didactic currents in addition to the developments within learning theory. Games as a learning artifacts represent is a big challenge for the didactic field, as games break away from a large number of teaching and learning approaches in a school context.

4. Communication and Multimodality

When digital technology is linked to game and play theories in a teaching and learning perspective, one central choice is the combination of systems of expression, interactivity and communication patterns. When associated with the didactic theory, the semiotic theory on communication and modalities is also relevant. In this approach, communication is seen as dynamic processes, where the communication processes take place in a social and cultural constructed world [5,6].

According to Gee, while playing a computer game, you learn to participate in a semiotic domain, i.e. a field or a set of activities, in which you think, act and evaluate in a certain way [7] and when to use one or several semiotic modalities such as verbal language, pictures, symbols, sounds, graphs, artifacts, etc. For instance, when children play SimCity, the semiotic domain includes town planning, design of buildings, roads, etc. and town management, where their actions imply using a range of modalities, which calls for thinking and making decisions.

In school, the different academic themes may be seen as semiotic domains. In the design of serious games, the objective is to match the game's semiotic domain to the semiotic content of a curriculum. This applies to the serious game in the project, Global Conflict: Palestine, where the semiotic domain is the conflict in the Middle East, which matches the curriculum content in history and social sciences.

5. Learning

Regarding educational design for serious games, it is relevant to look at learning as a process that functions in a social field and in a context influenced by social relations. Learning is understood both as a result and as a process. Learning in connection with digital media is understood as an individual and social construction and negotiation process in a context. In definitions of learning, change and difference are central concepts. This applies especially to learning as a result of learning processes, where learning is seen as a difference or change in relation to something that has previously been learnt [8]. Following Knud Illeris learning may also be seen as a cognitive, psychodynamic and social process [9].

Social learning processes may both be seen as something which contributes to the individual learning process, and as a learning process where the individual person contributes to the construction of the common learning process. In this way, the social learning processes reflect what a group of individuals learn in collaboration, and thus it may be seen as common learning shared by a group. However the common learning may not represent individual learning for each individual in the group. Etienne Wenger's theory on learning in communities of practice constitutes a central element in the social approach to learning [10].

If we look at children and young students' learning, it is essential to differentiate between formal and informal learning. In a review paper, Julian Selfton-Green has focussed on different definitions of formal and informal learning often related to the context of learning [11]. Thus, it is not a matter of formal and informal learning, but of formal and informal contexts of learning. In this perspective, the concepts of formal and informal learning are applied on the basis of a play cultural approach. For children and young students, formal learning is connected to the school/educational institution, and learning is a *goal* for the activities taking place. Informal learning is characterized by taking place primarily outside the school/educational institution and is a *means* to acquire an ability and knowledge in connection with activities such as playing a computer game, chatting and making blogs. In order to be able to play, children have to learn something [12]. Thus, learning becomes a prerequisite and integrated part of children and young students' play activities.

In children's leisure culture different informal learning forms function in different contexts, and sometimes they are integrated. Specific learning forms constitute a set of learning strategies, i.e. the approaches children adopt to acquire skills and knowledge. Furthermore, the specific learning forms illustrate the organization forms children construct or establish in order to learn. The informal learning forms include e.g. learning hierarchies, learning network and learning communities.

As informal learning forms are efficient ways of learning not only outside, but also in within school contexts, where they have been applied [13], it will be fruitful to include them in the educational design for serious games, e.g. in the design of the games or in the contextual application of games.

6. Pedagogical Approaches

The concept of didactic design also draws on different pedagogical approaches such as project pedagogy and Computer Supported Collaborative Learning (CSCL). Project pedagogy focuses especially on problem formulation and solution, participation and participant management, as these aspects emphasize the learner's production and active participation. CSCL is a research approach or, as it is often called, a new paradigm that has emerged in connection with IT. This approach is interested in investigating how the organization of the students' collaboration may be productive for learning. Neil Mercer and Rupert Wegrif [14] are studying the relation between learning and collaboration focusing on the dialogue, where especially the explorative dialogue is very important for collaboration and the process and result of learning. In the explorative dialogue, the students propose hypotheses, they explore and discuss, and the progression of their work is based on a common acceptance of the proposals. When games are applied in the classroom, such theories become important, especially for design of dialogues in the game and about the game's academic content. In the dialogue about the game, the teacher becomes an important actor by encouraging the development of the explorative dialogue.

The part of the learning process taking place in the context, i.e. about the game, is often of great value for reflection and thus for the learning result. Kurt Squire's studies on the use of Civilization III in classrooms indicate that the games generate dynamic learning opportunities, engaged students and productive classroom discussions by forcing the students to argue and reflect [15].

7. Play Theory

In developmental psychology, which for decades has influenced educational research, play has been regarded as a means in children's development and learning. However, this   perception no longer prevails as culture oriented and anthropological research perceives play as a human form of existence with an independent meaning. According to Johan Huizinga, there is a connection between play and culture. He views play as the

origin of the development of culture, as culture is developed in and as play. He defines play as a voluntary action or operation taking place within certain determined limits in space and time and as such an aim in itself [16]. The playing person plays in order to be in the playing situation, which in itself is the aim of the activity. In Scandinavian research on children and young people, the concept "play culture" has become a central issue as a frame of understanding for children and young people's everyday life [17]. In this approach, learning is seen as a means to developing play competencies. This reversed goal-means relationship has turned out to be constructive for a theoretical understanding of learning processes in relation to computer games and the digital media in general [18], primarily because it establishes an approach that can explore these processes as targeted learning.

Based on this approach, children's everyday life with digital media has been examined in a five-year project Childhood and Youth with Interactive Media – in a Future Perspective to determine what children emphasize across their digital based play activities [19]:

- Action - to do something oneself and to be in control
- Challenge – to face problems that have to be solved
- Reification – to create, produce, experiment
- Sociality – to communicate and be part of communities
- Performance – to receive recognition and command respect
- Self-interpretation – to probe one's identity, including gender
- Enjoyment – to be part of sensual and physically pleasurable situations

The reason why the play dimension has been included in the concept is because play is a pleasurable activity that may be a motivating force in serious games. The above set of concepts shows what children find pleasurable in their play activities, and as such seems essential to the educational design of serious games.

8. Game Theory

Computer games may be viewed from different perspectives, e.g. as media, culture, narrative or experience, which theoretically demand an interdisciplinary approach, also in terms of learning games [20]. The game design for use in classrooms is a genre derived from computer games for entertainment based on the assumption that games have a potential that may be used in a teaching and learning perspective. Therefore, a central question is: which potential are we talking about?

Paul Gee, one of the researchers who has studied the learning potential in computer games, has made a list of characteristic features in computer game design that appear to be of special interest from a learning perspective. Below these features will be listed and briefly described:

- *Interactivity* – Interaction between the player and the interface and between the players
- *Customization* – allows different ways of learning
- *Strong identities* – the identity is connected with a specific virtual character – the identity is clearly associated with the sorts of functions, skills, and goals one has to carry out in the virtual world
- *Well-ordered problems* – problems in a good game is well-ordered – this is a part of good level design
- *Games are pleasantly frustrating* – good games adjust challenges and give feed- back in such a way that the different sort of players feel the game is challenging – they get feed-back about the sort of the progress they are making
- *Cycle of expertise* – good games repeat cycles of extended practice and test mastery of that practice
- *Deep and fair* – a game is deep when the play elements seem simple and easy to learn – and become more and more complex – and fair when it is challenging, but set up in a way that leads to success

[21].

According to Gee, these basic features are included in many computer game designs, and they also seem important for efficient learning [22].

9. Conclusion

The concept of educational design for serious games has been developed concurrently with testing the games included in the project. Context and practice are crucial parameters in an understanding of the obstacles and possibilities faced by serious games. Also, the teacher's role in relation to serious games is important, as he/she develops new functions as a teacher and new positions in relation to the students. A number of studies show that

teachers often fail to take an active position when games are used in the classroom, as they often rely on the students to know what to do or believe that the students appear to be active and engaged. But the studies also show that the teacher's role is imperative to the students' benefits from learning, and often the students criticize the teachers' failure to participate [23,24]. Therefore, the challenge is to design serious games in such a way that not only the student, but also the teacher will be interested in using the games. In other words, the target group is not only the student, but also the teacher, and therefore it is of vital importance to design serious games that teachers will find interesting to use in the classroom.

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