

TEACHERS AS LEARNING GAME DESIGNERS: CAN ELEMENTARY SCHOOL TEACHERS WITH NO BACKGROUND REALLY GAMIFY THEIR OWN TEACHING?

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Abstract

Yes, they can! This presentation gives some examples from a project where ordinary elementary school teacher's design and implement games for their own teaching. Their assignment was simple - develop and implement a pervasive game that can be played in the school and the local community during one school day. The game should be based on the Norwegian national curriculum goals, and should include digital clues, videos, animations and digital games, as well as a well-written story that connected the game to the curriculum and the learning goals. Many of the teachers made the digital games themselves in Kodu (Microsoft) or similar game apps for iOS or Android. Some teachers even made collaboration with other classes in schools thousands of kilometers away. We will show that what the children learn from the game is very cross-disciplinary and can be connected to other topics and learning goal than the main one, including history, language, geography, gymnastics, science (mathematics and physics), digital competence etc.

The project was a collaboration projects between two Norwegian teacher educations in Game Based Learning. It was implemented between 2012 and 2015, and the classes for the teachers were implemented several times during this period. In HUC the course included teacher students are in their 4th educational year as well as experienced teachers that had worked in elementary school for years. The games were implemented and tested in their classes or in their educational practice. The course required no previous knowledge in game design or digital skills.

Keywords: Gamification, Games and Learning, Pervasive games, Digital Games, Concurrent Design.

1 INTRODUCTION

In 2012 we implemented a project in Pervasive gaming for learning in a game production track at Hedmark University of Applied Sciences (HUAS). In this project the students developed a pervasive game for learning, based on competency aims in the Norwegian curriculum related to sustainability. The game goal was to show the children how they could support a long-term ecological balance, and to teach them about ecosystems, pollution, the social aspects of sustainability, and point out how sustainable systems could be used to live wisely. We wanted to apply system thinking, collaboration and problem-based learning (PBL), both in the game development process done by the students, and later when the children was playing the game.

The story of the pervasive game starts with a refugee that had to flee from his country because of famine and war, as consequences of pollution and climate change. The children find his video blog, and are given the task to find out what has happened to the environment in his country, and how the pollution and climate change could be prevented.

The students also developed three digital games as part of the overall pervasive games; one about the refugee situation, one about the ecological balance of an island and one about the soil ecology see from an earthworm perspective. The complete pervasive game played out within the children's school area.

To play the game, the children were divided into teams, and each team received a backpack with a pair of walkie-talkies, riddles and clues, a treasure map, a note with computer passwords and a notebook. They then had to solve clues to find the different locations in the school or in the schoolyard, where they could talk to actors about sustainability-related issues to be able to proceed in the game.

The was also a sum up after the game had been played; a 25-page diary was filled in by the children to sum up and organized their learning experience, and we did a system thinking session to discover

how things they learned about in the game were connected. More details about this project can be found in [1].

To be able to test the game we sent out a request to test the game to a list of schools in the local community. The response was big; within hours we had response from 15 schools that wanted to implement the project on more 1500 children. At the time we only had capacity to implement the project in one of the schools, but we had to promise to come back to the other schools with similar projects.

At the same time we were about to start a project in Game Based Learning together with another Norwegian teacher education - Nord University (NU). Because of the large response to the game track project described above, we decided to also include pervasive games for learning in this project, and to test how capable the teacher students participating in the project was to implement such games for their own education. During this project period (2013-2015) we tested this approach several times. All tests were done by the teacher students, which included both inexperienced young students and older more experienced teachers that had been working in Norwegian schools for years and wanted to refresh their education. The games were implemented and tested in their classes or in their educational practice. The courses required no previous knowledge in game design or digital skills.

The project research goal was then to find out if the teachers were able to implement games for their teaching without a background in game design.

2 THEORY

Pervasive games are a broad category of games that is mainly played in the real world, but includes clues, hints, texts, pictures, videos or even small digital games in the digital world. The user must use or solve all of these digital hints/clues or games to solve the complete game. Two examples of pervasive games can be Alternate Reality Games where players cooperate to share and understand information presented on the Internet or other digital media, or Urban Adventure Games where the goal for example could be to experience a town in a new way.

Pervasive game development contains creative and immersive processes similar in many ways to game playing. It is about making games out of non-gaming environments, which these days often are labeled as Gamification. Gamification is a broad categorization that has many definitions, for example "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning and solve problems" [2]. As such, game development shares the same basic learning theory fundament as Gamification does. Werback [3] points out how gamification is rooted in cognitive psychology and use points, badges and leaderboards to create intrinsic and extrinsic motivation. Gamification is more than this though; it can be seen as a community of practice where the students can work together towards a common goal in a problem based way, while learning events pops up naturally. At each learning event, players are motivated to solve the task because let them move further in the game, and rarely find it odd to study the theory to solve the task at hand. A community of practice is situated learning [4] [5], and the fact that the students "make a pervasive game" instead of "learning how to make a pervasive game" is experiential learning [6]. The students are "learning by doing" [7] while the learning events pops up naturally "just in time" [8].

We have labeled the creative process that is carried out *before* the actual pervasive game development process the 'pre production' in our documentation. In the pre production, the students work in groups to brainstorm their game ideas. Darsø [9] labels this process the 'preject' and describes how this process is different from the rest of the project in that it should be a process balancing between chaos and structure to make the process creative. She discusses how assignment of roles to participants in such processes (the innovation gardener, jester, conceptualizer and challenger) can help maintain the creative potential in the group, and that creative groups should be put together as heterogeneous as possible, and ideally contain 6-10 people.

3 SCOPE

The scope of this article is to give some examples on pervasive games created by teachers with no gaming background, and to show that teachers are able to make pervasive and digital games for their education.

4 METHOD

For this project we used the same principles as in the student project described in the Introduction. The assignment was simple; make a pervasive game for your own teaching that can be played by the children in one school day. Below we have given a list of the tasks in the game development process:

- 1 The teachers first examine the competence aims in the Norwegian curriculum, and find goals that is aimed at what they want to teach to the students.
- 2 Then they brainstorm to find some good ideas for a game. The brainstorming is a chaotic process where they just note the ideas that pop up. The ideas are then organized and developed before they agree on the one they wanted to proceed with.
- 3 At this point the students have to study some game design to be able to create a game from the game idea. This is done through teaching and self-studies.
- 4 They then make sketches of the game environments, defines characters and makes a storyboard.
- 5 Since they made a pervasive game they also needed to create digital clues, videos, and even digital games to support their game.
- 6 They also needed to find out what kind of actors they needed and what roles they needed to play.
- 7 Last but not least they had to make material to test the children's learning after the game was finished.

The process described above was usually carried using problem-based learning [10]; the students are divided into groups and solve each step by brainstorming, systemizing, studying and summing up [11]. The teachers will guide them through this process.

There was no prerequisite that the students should include digital games in their design but many did anyway, but with simpler development tools than those used by game students. A popular choice of game engine to produce digital games was KODU [12]. Kodu is developed by Microsoft, and is an environment to make digital games visually. The teachers develop the game and the playground using a number of pre made assets and characters. They can then code their game through a visual programming tool. The teachers found this tool both easy and fun to learn and to use. Kodu contains many examples, which makes it easy for the teachers to understand how games are made.

Some of the pervasive games was made using a couple of new digital tools for making treasure hunt games. These tools are called Seppo and Turfhunt.

Seppo is a Finnish tool, which let you make games in a web page using a map to place the game tasks. Each task includes multiple-choice questions, and is creative in that the players can include text, picture, video or sound in their answers. The players (students/children) must also play the game in the web page. After login they are given the map the teachers created with the locations for the tasks, where they solve the challenges or questions using an iPad, a tablet or a smartphone. The teachers, which follows the player's progression, gives points for the answers on the fly. More details on this game development tool is found in [13].

Turfhunt is an Icelandic produced App where you make the games by downloading a map of the game area and the game locations. Together with the download map you also include the multiple-choice questions that the players should answer in each task/location. The game is played by downloading the App to a smartphone, iPad or tablet. When you log on to the game you get the map and tasks. Their location is always monitored by the GPS and shown on the player's map. When the game is started, the location of the first challenge pops up on their map, and they have to move close to it to get the first task. When the first task is solved they can move on to the next. More details on this game development tool is found in [14].

The teacher students in the project had a thorough background in pedagogy and teaching, but no knowledge about game development or pervasive games, so we had to teach them how to do this. This was either done before the development process started or during the process as a part of the PBL process.

To teach the teachers more about game design and implementation, some game projects added a second session that included game students; third year bachelor student from the games track was asked to improve on the teacher's games. In this session the teacher students worked as facilitators.

This was done through a brainstorming session; the game 'students were organized into groups of six students, and the groups were put together as heterogeneous as possible to make them as creative as possible [9].

Research methods and data collection

In the projects the researchers and the students worked together to design the game, solve the challenges and implement the game ideas. This kind of research is classified as ethnographic design[15].

Some of the projects were done as case studies [16], and some was taken further into problem based learning [10][11]; the development process for the games was divided into several cases and then presented to the students as problems. Each case started with a discussion where the students clarified the problem and found out what to study to be able to solve the case. They then have an individual study period where they studied theory and solve their part of the case. Then the group meets again to sum up and to implement the results from the study period into the game.

The game development process was documented through notes, meeting resumes, pictures, reports, web pages and blogs written by the students during the project. In most cases the research process could be described as action research [17], where the sum up phase was used to improve the next case. Further, each project gave experience and influenced the design of the next project, which also is action research.

In some projects the students collected data and observations from the implementation, and then reflected on the learning outcome in their reports. In other projects, like the "The mystery of Agatha Hansen" (see below), data were collected during both the development phase and the playing both by the teacher students, the game students, and the researchers in form of notes and reports.

5 RESULTS AND EXAMPLES

Most of the games the teachers made were tested in school environments and proved to be very popular. Below are some examples:

Operation Overload - an expanded treasure hunt

This game was developed by two students, which after school was finished ended in different parts of Norway (1000 km apart). The game was implemented after they finished their education as a distant cooperation project between their schools. The game was developed as a pervasive game - a treasure hunt.

The game was played as follows - while the children is watching a boring school video, the video is suddenly interrupted by a message - OPERATION OVERLOAD - that tells they have to meet in the football field outside the school right away.

There the class is divided into 3 teams named BRAVO, CHARLIE, FOXTROT (the names are connected to the task they will solve) and each team is assigned a teacher as a guide. They first find a coffin that is locked with a padlock with a number code. It is possible to solve the number code by solving a case on a sheet of paper beside the coffin. When they unlock the coffin they find a Skype address and a set of coordinates. They have to go back to the base and log into Internet to find where the coordinates are, and then log into Skype to find out who is in the other end. In the other end there is a class 1000 km away. They are solving another game, and the coordinates the children were given has to be used by the other class to find the next game challenge. In a similar way the other class has some coordinates for this class. Both classes then need to go to the place the coordinates indicate, solve a task, and then get new information they will have to discuss with the other class to find the next challenge. Later on in the game they get both QR codes and maps they will have to discuss with the other class to get further in the game. In the last coffin they get a paper with applications to fill in to get money to travel and see the other class. This is the reward for the game.

The Aftermath: After the game the teachers had made a Kahoot quiz [18] that summed up the learning in the game. This quiz will also function as a log for the children as well as sum up for the teachers to improve the game next time.

The game was based on competence aims in mathematics, natural science, gymnastics, Norwegian, English and Social science but they also learned other things like digital skills, cooperation etc. The theoretical learning was put in the tasks they had to solve and discuss with the other class.

Two pervasive history games based on Kodu.

Both games combine the digital game Kodu with a pervasive game.

The overall game goal of the first game is to find a word that will be a result from questions and puzzles from the game. In this game the children start with Kodu. The Kodu game has 3 levels and in each level the children has to solve several tasks to get a code that leads them to some place in the real world, where they have to solve the next task. After solving the real world task, they get a code for the next level i Kodu. All in all there are 7 levels in the game, 3 in Kodu, 3 in the real world, and one boss level at the end.

In the first Kodu level the children has to collect a number of things to get the code, in the second level they have to win a racing game to get the code, while the third level they need to win an air-hockey/pong kind of game to get the code. In the real world they have to solve tasks in gymnastics, orientation, coordination, and memory recognition. However, they also get questions in history and social science throughout the game and they all need to be researched to find the final puzzle word.

The game is founded on learning goals for Greek roman societies (history), social science and gymnastics, but also here they will learn cooperation, digital skills, competition etc.

The other game is somewhat similar, the children have to find knowledge capsules (they pop up as an instruction when bumped into) in an open Kodu world and then solve them. There are 6 such capsules in 3 topics; Norwegian, English and Mathematics. The overall story is that the Kodus (the avatar the children play in the KODU game) is from outer space and has landed on earth to collect information about the humans. The children will help the Kodus to collect information, and when done they get the key to a boos game level where they can find a spaceship to travel to the Kodus planet.

“The mystery of Agatha Hanssen” - Urban Adventure Game

The goals of this game is to introduce the players to Namsos town during the Second World War, to teach the players war history, and to let them feel how it was to live in a bombed and burned out city. The local museum served as the base for the game, and the museum curator introduced the game by presenting documents written by Agatha Hanssen. These documents revealed that she had secretly hidden something from the Germans in several locations in the town. These things had to be found for the players to solve the puzzle.

The players were divided into groups, and each group was given an Ipad and a web site address where they could report their findings.

The overall game goal was to explore and discover what have happened to Agatha Hanssen in those locations in Namsos by reading her letters, her diary and by using the city maps and hints from the game. The time frame for the game was one school day.

After the teachers had designed the game it was presented to game students that were asked to improve upon the game design. The students were introduced to the original game concept of Agatha Hanssen, and then given some time to brainstorm the project for new ideas. During that process the students took on different roles such as Game designers, Producer, Programmers, Visual artists, Quality Assurance, Work estimation/economy etc. All ideas from each group were recorded in a shared Google document. After the brainstorming session each group analyzed their document to find the best ideas that was possible to implement in time. A final session was then done with all the students and teachers to select the final ideas. The results are presented in the result section below.

We found that the game students were less afraid to use digital tools to vary the game play. This is possibly because the teachers are not “digital natives” and a bit scared of the digital domain. We think this will change in new generations of teachers. Form the sessions with the game designers the students suggested, among other things, that the game could use a digital game board or map on the iPad where they used GPS tracking to see other players, and that the players could collect points and puzzle pieces and thereby give a digital view of the others players level, or scores in the game. They also suggested that the teachers expanded letters into puzzle games and used QR codes to get data from the locations in the game. All in all the game students saw more things the iPad could be used for that the teacher had not discovered. In addition to this, some of the groups had ideas for how to improve the gameplay in general. However, the teacher's story were good and was not improved upon much.

Keiser Resir - Alternative Reality Game

The learning goal of this game is to teach the children about recycling of waste like paper, bottles, plastic and general waste. The game is made for children in K4-5. The introduction of the game is a video with Keiser Resir, who threatens the dean to take down the green environment flag in the school, followed by another video where the dean asks the children to help to save the flag by doing recycling tasks. The children are then divided into groups with 4-5 children in each group. They start by inspecting trash baskets, where they will find trash that doesn't belong in the basket. This has to be reported to the teacher and corrected. In the next tasks they are introduced to QR-codes at different places at the school, which links to digital games and videos with recycling issues. The children then have to play these games or watch these videos to get to the next task in the game. The last task is to make Christmas decorations using old light bulbs. When that is done the game is concluded with a short celebration; they have saved the green environment flag in their school!

The Liberation of the language teacher - A treasure hunt game

The purpose of the game is to work with different assignments in "Nynorsk" (a secondary variant of the Norwegian language) through digital tools, and to win the race to free their kidnapped teacher. The game starts when detective Kambestad enters the classroom and shows the students a video with their kidnapped teacher. In this video their teacher is begging the students to solve several assignments from the kidnapper to free him. The video also introduces them to the first task.

Detective Kambestad then presents the game, divides the students into groups, and gives the children the necessary digital equipment and tools, such as a flash drive, smart phones with Internet connection, PC's and a code lock. The groups have to write a short report in 'nynorsk' to detective Kambestad after they have finished a task and want to go on to the next one. Detective Kambestad also helps the children to find the clues, provided that all questions and dialog is done in 'Nynorsk'.

The Briefcase Mystery and The Biscuit Thief - two treasure hunts games in Turfhunt

The purpose of the briefcase mystery is to introduce digital maps and work with mathematical challenges for children in K5. The class had 20 students that were divided into five groups. The game started by giving the group leaders an envelope with the assignment and the key to the premade Turfhunt game. The game has six different tasks, each with a multiple-choice questionnaire. A correct answer to this gives 10 points, while 5 points is given for each GPS-location they visit at the map. When all but one task is solved, the students have to use their previous answers to solve a code to open a briefcase given to them in the last task. The group score must be at least 70 points before they are given the briefcase task. Some of the groups might have to do extra tasks to reach this 70 points limit. This game is scheduled to take about two hours, and the content of the briefcase is case candy for each group that are able to find the code.

The biscuit thief game is a treasure hunt to learn about the local village. In the game the players use digital maps and groupwise problem solving. The target group is children in K5-K7. The class is divided into groups with 3-4 children. The game starts with a plenum introducing for all groups to a secret mission. The story is about an accounting company in the neighbor building, which is frequently visited by a biscuit thief. Unfortunately the surveillance camera is stolen, but it is possible to find some clues by playing the Turfhunt game. The young "detectives" find messages at the local store, the newest house in the village and by visiting an old inhabitant. Some clues and hidden messages are also hidden in origami sculptures. The key issue is to identify a specific link to a YouTube video from the surveillance camera where the thief presents herself and solve the problem. The prize for the "detectives" is of course biscuits, and the moral of this story is to change habits from eating biscuits to eating fruit. The game plan is estimated to take a school day.

6 DISCUSSION

The examples above were a small selection from more than 40 games the teachers have produced over the two year period. The examples clearly show that teachers are able to implement their own games for teaching.

Also, in all implementations the children/players had fun.

To be able to say something clearer about the learning outcome, the research material will have to be studied in more detail. This certainly will be done sometimes in the near future, and presented in new articles. However, some thoughts about the game projects are given below.

An important advantage of pervasive games is that we don't need special equipment; the teachers can use what the school already own. The game can also be played inside the school or in the existing campus without many modifications.

Pervasive games are also relatively fast and easy to make, and the teachers can make the assignments, clues and applications themselves. They can use available digital films, letters, diaries, digital maps, videos, email, smartphones, tablets, laptops, Smartboards, QR-codes/scanner and GPS, walkie-talkies etc.

In both schools involved in the projects the teachers (and game students, when involved) also did the acting and prepared all the scenery and locations before the game started.

Most children also have smartphones these days. They are computers and can be used for digital game playing, gogging, visiting forums or groups etc. A good idea could be to group the children so that at least one smartphone is an asset of each group.

We can, based on the examples seen here highly recommend that teachers try out games for learning in their teaching.

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