Evolving Playful and Creative Activities When School Children Develop Game-Based Designs

Eva Brooks[1(✉)] and Jeanette Sjöberg[2]

[1] Aalborg University, Kroghstraede 3, Aalborg 9220, Denmark
eb@learning.aau.dk
[2] Halmstad University, Kristian IV:S Väg 3, 302 50 Halmstad, Sweden
Jeanette.Sjoberg@hh.se

Abstract. The presence of digital technologies in classroom settings is relentlessly getting stronger and has shown to have powerful playful qualities. In recent years, digital game-based learning (DGBL) have been introduced in schools. In this paper we investigate an innovative approach to game-based learning, namely to use game design activities as motivators for developing children's creative and social skills as well as other kinds of learning scenarios, e.g. computational. It is based on two cases, where game design activities by means of a narrative approach were applied in both analogue and digital form. The unit of analysis is game design activities. Hence, game design activities with the participating children (3rd graders, 9–10 years of age), creative materials and technologies, and children's actions as well as interactions are analyzed. The research questions posed in this study are: (1) What activities develop when school children design games in two cases, as an analogue activity, and as an activity including technology?; and (2) How do the learning environment, including the artefacts, employed mediate these activities? The outcomes of the study indicate that the game design workshop session which included both creative material and technology unfolded more combinational activities, which indicate that the inclusion of technology facilitated a more critical design decision making. However, the game design workshop session including only creative material exhibited a more thorough knowledge about what the material could do and what the children themselves could do with the material, which seemed to result in more playful interactions between the children.

Keywords: Playfulness · Creativity · Game-based design activities
Learning environment · Learning resources · Primary school children
Exploratory activity · Transformative activity

1 Introduction

The presence of digital technologies in classroom settings is relentlessly getting stronger and has shown to have powerful playful qualities [1]. Research into educational potentials and affordances of digital technologies in designs for learning indicate promising results in facilitating communication [2] and increasing feelings of presence, participation and achievement in teaching and learning processes [3]. This is supported by international research, which has shown that children's skills and comfort should be

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better supplied by a focus on their lifelong, social and personal competencies [4–7]. In recent years, digital game-based learning (DGBL) have been introduced in schools [8]. Based on Van Eck [8], Nousiainen et al. [9] have identified four different approaches for game-based learning, namely: using *educational games*, using *entertainment games*, learning by *making games*, and using game elements in non-game contexts (i.e. *gamification*). The authors explicate that *playfulness* is defined as a mindset and cross-cuts all the four game-based approaches. In this paper we argue that there is another approach to game-based learning that has great educational potential, namely to use game design activities as motivators for developing children's creative and social skills as well as other kinds of learning scenarios, e.g. computational. In keeping with this conceptualization of game-based learning, the present study explores playful game design activities, to unfold collaborative and creative actions and interactions among the participating children (3rd graders, 9–10 years of age).

A way of incorporating creativity in game-based design activities is by using narratives as an interactive approach to learning essential life skills [4, 5] such as collaboration and problem solving, in a meaningful context [10]. Narrative is a form of human thinking [11] that is fundamental in making sense out of a person's social experience and, as such, in a person's cognitive and emotional developments [12, 13]. Thus, a narrative method can be implemented with creative materials and non or varying degrees of technology to create a playful learning environment, where children can explore, experiment, discover and solve problems in imaginative and playful ways and, at the same time, stretch their learning to higher levels [12, 13].

The aim of the present study is to contribute to the contemporary debate on the increased use of digital game-based learning in schools and to relate this to the potential of such a game design approach to game-based learning. It is based on two cases, where game design activities by means of a narrative approach were applied in both analogue and digital form. The unit of analysis is game design activities. Hence, game design activities with the participating children (3rd graders, 9–10 years of age), creative materials and technologies, and children's actions as well as interactions are analyzed. The research questions posed in this study are:

1. What activities develop when school children design games in two cases, as an analogue activity, and as an activity including technology?
2. How do the learning environment, including the artefacts, employed mediate these activities?

The following sections start with a description of the theoretical framing of the project, where creativity in relation to the design activities are conceptualized as a playful learning practice. Next, the methods are outlined, primarily based on video observations and thematic analysis. Based on three identified themes, the paper, then, presents the outcomes of the study: exploratory activities; combinational activities; and transformative activities. Finally, a discussion and conclusions end the paper.

2 Playful Creativity

Playfulness in learning situations are not only connected to individual interests and desires, but also to the material artefacts involved in such situations. In this sense, the artefacts refer to the potential uses of a given medium, based on the perceivable features of this medium [14] and how these affordances are actualized in concrete social practices [15]. Conceptualizing creativity as a playful learning practice entails, among others, the following propositions:

- Creativity and playful learning is mediated by artefacts and results in a transformation of the physical world. Artefacts provide essential resources for children to communicate, store, catalyze, evaluate and reflect on ideas while trying to overcome indeterminate situations. Artefacts, from this perspective, are not mere carriers of information, but enable and constrain a child's actions [16, 17].
- Creativity and playful learning goes along with the generation of new knowledge. As creative practices attempt to act upon a hitherto undetermined situation, the outcomes of this attempt necessarily add to a child's body of knowledge either in that assumptions about the situation are contested or supported. Creative practice hence can be understood as a form of inquiry [18–20].

The focus of this study, how game-based design activities creatively can be used in playful learning situations, hence is based on the assumption that such situations should be deliberately structured and cultivated [17] Already in the 1970s Abt [21] proposed that a game design process should be considered as a crucial learning activity. Our design of the game-based design activities was structured so that the participating children should experience and learn about different creative material and technologies involved in a game-design process where the content creation in the form of a narrative was at the core. In addition, they should also experience the group dynamic and interactions involved in a collaborative and playful activity. In this way and inspired by Abt [21], our approach is not about creating a game per se, rather the interest is related to the design activity, which should allow the children to put ideas and critical thinking into practice. In other words, our concern is to provide conditions for a playful and creative design process that is based on both analogue and digital form allowing the children to create game ideas according to their own imaginations. This requires a stimulating and allowing learning environment in which the children can experience material outcomes of their collaborative design decisions.

3 Method

The study is based on two creativity workshop cases designed to provide a playful and creative atmosphere inspiring children to collaborate to create ideas for new games. The workshops were carried out in two research laboratory settings, where the participants were supplied with a wide range of analogue materials (in both cases) (Fig. 1). One of the cases also included digital technology for creating stop-motion videos of the children's game design solution (Fig. 1 – to the right). The intention was to create a

workshop setting offering an infinitive number of opportunities, inviting the children to feel inspired to explore and 'just go for it'.

Fig. 1. To the left: Case 1 experimenting with different creative materials to represent their game design idea. To the right: Case 2 experimenting with the tablet to record the stop-motion video representing their game design idea.

Case 1 included 28 children from a third grade school in north Jutland, Denmark, north Jutland. The participant were divided between 19 males and 9 females between 9–10 years of age. Case 2 included 22 children from a third grade school in south-west Halland, Sweden. Here, the participants included 16 males and 6 females between 9–10 years of age. The children's teachers participated in the activity, which helped to create a safe learning environment; in Case 1, there were three teachers and in Case 2, there were two teachers. In addition, the two authors of this paper participated in both cases together with three assistants who assisted when the children needed help, kept an eye on the cameras, and supplied the children with water and fruit during the session. Case 1 the workshop session took place in one room (approximately 90 m^2), which created a lively and slightly loud environment. In Case 2, we divided the groups in two rooms, which created a more calm atmosphere compared to the other case.

The two cases were carried out in the form of a design experiment [22] in the sense that it was designed to control some variables emphasizing the availability of resources that the children can draw on and use, as well as allowing for situated interpretations related to the chosen theoretical framing. The authors of this paper designed the set-up of the study and the sessions were conducted by two research assistants to make it possible for the authors to observe the game design activities (the procedure is further elaborated below, Sect. 3.1). The empirical data consist of video observations, observer notes by the two authors. Video recordings offer opportunities to review actions and interactions and to discern minute details that otherwise can be missed out [23]. The teachers had on beforehand divided the children into six groups of approximately five children and each group had their own work station. Each of these work stations was equipped with a video camera, recording the whole game design session; what happened around the table as well as between the group members, other members and material available (Fig. 2). Accordingly, both cases used six cameras, which were

operated by the research assistants, and produced empirical data consisting of 12 video observations (in total 25.8 h).

Fig. 2. A typical workshop environment representing the initial phase of the children's game design idea generation. Video cameras can be seen to the left on the pillar and on the wall (far left)

All teachers and parents were informed about the study in writing and the parents agree to let their child participate by signing informed consent forms. The children were informed that they could withdraw from the game design sessions at any time if they e.g. felt uncomfortable in any way. In line with ethical guidelines, all names of the schools and of the children are anonymized and, thereby, no identifying information is provided.

3.1 Procedure

To enhance creativity, the game design workshop was structured in an easy to understand manner offering spontaneity. In other words, rather than suppress playfulness and creativity, the structure was there to motivate the participants' minds to exercise the creative game design process (see also [17]). The workshop ran for half a day between 09:00–12:00 h and was divided into two distinct creative periods following the timings and activities depicted in Table 1.

Table 1. Overview of workshop activities and timetable.

Time	Activities undertaken
09:00–09:15	Introduction. Establishing creativity framework and climate
09:15–10:45	Exploratory activity using analogue and digital tools
10:45–11:30	Transformative activity focusing of children's presentations of their narrative game design representations (analogue form [Case 1] and digital form [Case 2])
11:30–12:00	Joint lunch and informal discussions about the activity

In both cases, the research assistant introduced the game-based design activities to the children by telling them that they were going to be game designers and in teams create games based on a specific theme. The above-mentioned controlled variables [22] are grounded in a narrative approach, where the authors, on beforehand, prepared six different themes locating the game design in different settings: Desert; Jungle; Woods; City; Under water; Space (one theme to each of the groups). The narrative as such, i.e. the game design, was developed by the children and, here, we also framed the activity for them. Each group received an A4 sheet of paper where the theme was written together with open space for the children to develop classical narrative content [24, 25], namely the plot, characters involved in the gameplay, and objects/props (Fig. 2, left). The children were then introduced to the creative material (Fig. 3, mid and right), for instance foam clay, modelling clay, crayons, markers, LEGO, cardboard, different kinds of papers, yarn, glue, tape, scissors, and post-its. The Case 2 children were also introduced to the stop motion equipment. The children were told that they were free to explore and use all materials at hand; there were no rights or wrong. This is important in order to establish trust among the participants [26].

Fig. 3. A4 sheet for the Desert gameplay theme and space for the children to specify the plot of the gameplay, characters, and objects and/or props (left). Mid and right pictures show a variety of the creative material available for the children.

The analysis method applied for this study is theme analysis [27, 28]. The transcripts were reviewed of both authors to find patterns in verbal and non-verbal actions and interactions between the children and the analogue and digital game-based design activities. From this analysis we identified three overall themes: (1) Exploratory activities; (2) Combinational activities; and (3) Transformative activities, which are presented in the next section.

4 Results

In the following sub-sections, we present the outcomes of our analysis under three headings following the above-mentioned identified themes.

4.1 Exploratory Activities

The creative material as well as the stop-motion technology used for the analogue and digital activities were familiar to all participants, and as such there was not much basic functionality for the them to discover and interpret, leaving room for playful creativity through lots of exploration of what the children themselves could do with the different materials and technology. Brooks and Petersson [29] make a distinction between exploration and play. Where exploration gave way to playfulness, the emphasis changes from the question of 'what does this object do?' to 'what can I do with this object?'. We argue that this reflects an important openness, which is similar to what happens in play opening up for the participants to take creative risks by experimenting with the material. Both mediums allowed for instances of peer learning, where the children, for example, instructed each other and showed each other how to get sound into the stop motion video (Fig. 4).

Fig. 4. An example of children's exploratory activities, where they are exploring possible game designs (left) and where the girl to the right in the right image is showing her group members how to get sound into the stop motion video.

4.2 Combinational Activities

Combinational activities represent the creation of new ideas from combination and synthesis of children's existing ideas. These combinational activities emerged from the A4 sheets of paper where the children should structure the game design's plot, characters, and other objects, and the more open-ended way of representing these game design ideas through the available creative materials. This activity contributed to the children's elaboration and combination of creative ideas without constraining the creative process. In other words, the children were able to combine ideas together in the

sheet of paper and elaborate the notes by means of the creative material. These combinational activities were characterized by children's imagination and free, often humoristic, associations (Fig. 5). This example is characterized by an improbability and surprise of the combination, where it would have been more probable that the monkey should fail to escape from the tiger.

Fig. 5. An example of children's combinational activity, where a 'game over' scenario was represented by a tiger hunting a monkey (Fig. 5, left), but where the tiger fail to catch the monkey and, thereby, died and caused game over for the player who represented the tiger and victory for the player representing the monkey. The dead tiger is represented by a red spot (Fig. 5, right). (Color figure online)

Another example is when the groups should add musical or sound features to their stop motion video. This was often caused by uncertainty where the children either repeatedly tried out different music or sound combinations or compared the kind of music/sound to their game design solution. Combinational activity was also applied to create new ideas based on the ideas previously generated. This is exemplified by a group of boys who finished their game design quite quickly and when they looked at their design, they found out that they could do better and started a re-design of their original idea.

It was notable that the Case 2 workshop, including both creative material and stop motion technology, offered more opportunities for combinational activities compared to Case 1, which only included creative material.

4.3 Transformational Activities

During the game-based design activities in groups, we could identify that the children changed their ideas or solutions in a way that things that from the beginning were considered as impossible changed to become possible. This was demonstrated in one of the groups designing a space game, where the group members initially could not agree upon the game content. They were, then, encouraged by the research assistant to start materialize their idea by means of the creative material. They started to map out their idea through making space representations in foam clay and through this

materialization, they changed and extend their initial solution space and knowledge about the material's opportunities (Fig. 6). This is what we conceptualize as a transformational activity.

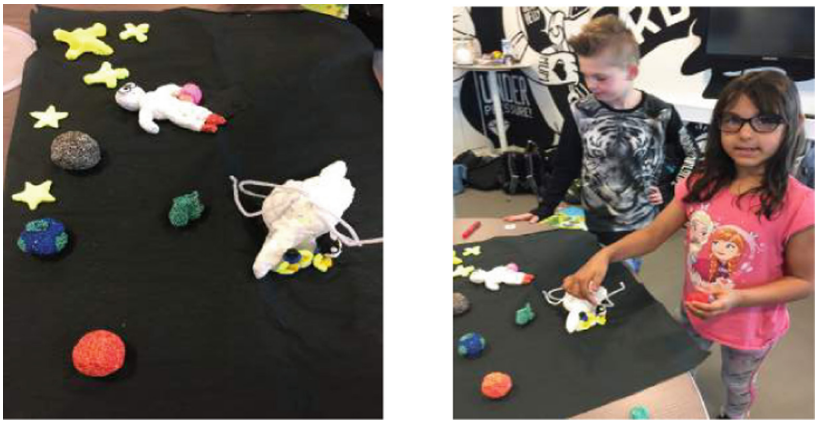

Fig. 6. An example of children's transformative activity, where an impossible solution to a space game through materialization was transformed to a possible game design.

It was notable, particularly in Case 1, that the children's physical ideas generated more structured outputs that aligned with, not only the use of different creative material, but with the knowledge they developed through experimenting with the materials. Furthermore, children's friendship constituted a shortcut to transformative actions. This was visible through the children's way of challenging each other, for example by saying that "this is not possible". This was also seen through the way the children identified each other's strengths and encouraged each other to keep on trying, or allocated work to each other in a supportive manner, which positively determined the interaction between the group members. Finally, we could identify that transformative actions had collaborative dependencies within the team.

5 Discussion and Conclusion

The present study makes a contribution to the discussion about the use of game-based learning activities in school settings. We have investigated what kind of activities develop when school children design games in two cases; as an analogue activity, and as an activity including technology. Furthermore, how learning environments including such artefacts mediate these kind of activities.

In the game-based design activities it was apparent that the children made the creative contribution they wanted to create, with little to no consideration of their own ability to carry out the work – they simply 'went for it'. Their depicted design decisions was clearly inspired by the structure offered by the A4 sheets which detailed the

specific theme and overall features to be included in a game design; plot, characters and objects/props. It was also clear that the participants benefit from the two creativity focuses included in the design of the activities; exploratory and transformative activities. Hence, Biskjaer et al.'s [17] statement about structured creativity was apparent since the children through this structure seemed to experience a framed openness facilitating playful and creative actions and interactions. It was identified that the Case 2, including both creative material and stop motion technology, offered more opportunities for combinational activities compared to Case 1, which only included creative material. However, the Case 1 children's physical ideas generated more structured outputs that aligned with, not only the use of different creative material, but with the knowledge they developed through experimenting with the materials. In this way, both cases reflect Abt's [21] suggestion about conceptualizing a game design process as a learning activity. We argue that it is crucial that this learning activity should include a diversity of material promoting children's creativity and hence offering an environment where playfulness is deliberately cultivated.

It was visible that game-based design activities not only nurture children's creativity, but also collaboration and communication. In both cases, collaboration between the group members was observed to foster children's development of mastery with material and technology as well as of group dynamics. We observed that the children developed a necessary awareness of what different kinds of material and digital tools can do (exploration) and, what the children themselves could do with it (transformation) [29].

In sum, the Case 2 game design workshop session showed more combinational activities, which indicate that the inclusion of technology facilitated a more critical design decision making. On the other hand the Case 1 game design workshop session exhibited a more thorough knowledge about what the material could do and what the children themselves could do with the material, which seemed to result in more playful interactions between the children.

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