A Three-Year Long Journey Across the Fields of Participatory Game Design

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Abstract. Primary school contexts pose their own requirements to participatory game design with children, and challenge the engagement of all children in what is often a prolonged and fragmented design process. The challenge led to a three-year long journey, outlined in this paper, which tells: how the challenge led to experiences of participatory game design in primary schools; how experiences led to reflections on how to better engage and motivate children over time in game design at school.

1 Motivations and Rationale

Different design approaches have been devised for eliciting children's ideas concerning interaction design products for them. Participatory Design (PD), in particular, is used for involving children in different (early) design tasks, with diverse generative toolkits or probes, e.g., [1]. Lately, practitioners and researchers alike have also explored gamification of design tasks to playfully engage children so as to elicit their "true ideas" [2–4].

Diverse PD methods assume that intergenerational small teams of children and adults design together outside schools; they may also require a dedicated designer for each group of children, e.g., [5, 6]. The PD literature also counts PD studies with few design experts conducted within school hours and classrooms, e.g., [7–9], in line with the manifesto of [1], which foresaw that "elementary school children [will] learn about designing and co-designing through practical and fun hands-on experiences". This paper moves along such lines. It considers how to bring early Game Design (GD) with PD in primary schools.

School contexts pose their own constraints to GD. Even early GD requires participants to perform diverse and intertwined design tasks, ranging from the so-called high-level conceptualisation of the game to the design of the core mechanics for the rules and progression across game levels [10]. Moreover, GD takes time and hence, due to organizational school constraints (e.g., rigid school timetables), a GD process at school is likely to be split across different weeks, which may work as "wash out periods" for children. The perceived challenge of design tasks as well as their fragmentation over time, when not forming a

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meaningful continuum, can greatly endanger children's engagement in GD over time [11, 12].

Three years ago we faced the challenge of engaging different primary school classes in a Participatory GD (PGD) process, split across several weeks. This workshop paper tells how we tackled the challenge, and how we found whether children were motivated, or not to perform GD together. Specifically, along three years of PGD in the field, in primary schools, we defined and incrementally refined a PGD method for conducting early PGD with primary school children, older than 8 years—GaCoCo. The underlying research question was: *how to engage primary classes in a prolonged PGD experience at school, fragmented over time?* The GaCoCo method was grounded on specific reference theories, and it is briefly presented in the following. It was refined along three-year experiences using an Action Research (AR) approach, as explained next in the paper. The experiences allowed us to repeatedly gather and analyse quantitative and qualitative data related to children's engagement in PGD tasks; considerations related to the results of the data analysis are put forward at the end of the paper.

2 GaCoCo in a Nutshell and Its Reference Theories

GaCoCo places special emphasis on children's engagement in design tasks, treating it as a goal to plan for and an outcome to assess. In order to achieve it, GaCoCo envisions that the design process and its tasks are organised for groups of children at school with gamification and cooperative learning. In order to assess children's engagement in design tasks, GaCoCo relies on qualitative and quantitative data gathering, and specific reference frameworks. The remainder explains them.

2.1 Organisation of Design Tasks

Gamification. Gamification for learning, in this paper, is the usage of GD principles and elements in school contexts so as to engage and motivate PGD participants over time. Self determination theory is the reference theory for gamification in GaCoCo [13]: accordingly, gamification should sustain a sense of progression, control and relatedness through design tasks in order to engage children over time. In GaCoCo, design tasks are thus presented as structured missions with clear goals for children, through ad-hoc generative design toolkits (e.g., prototyping frames) and gamified probes (e.g., paper-based progression maps) for conveying children a tangible sense of progression and a sense of control over design tasks. An example is the progression map in Fig. 1, developed in the third year of the GaCoCo experience in order to orientate children across a design process, fragmented over time; the map is made of paper and wood, and it is enhanced with micro-controllers in order to interact with children and track progression information. GaCoCo also uses gamified probes to convey specific social roles and norms, and hence to sustain a sense of social relatedness through the entire design process. An example is the turn-taking probe for sharing the turn

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in speaking in class that is illustrated in Fig. 1, which was initially developed as a non-technology probe, then as a technology gamified probe [14], and lately turned into interactive prototypes for sustaining different social needs [15, 16]. Such social roles and norms are inherited from cooperative learning and adapted to PGD tasks as explained in the following.

Fig. 1. Progression map and taking-turns-in-speaking cup; in the map, each group is related to a fruit; each fruit is divided into layers, one per design mission; each layer shows design tasks related to its mission

Cooperative learning. GaCoCo also adopts cooperative learning as reference theoretical framework, and specifically its social norms and roles for participants, children and adults alike. In fact, in view of our own experience and of similar concerns raised by other PD researchers, e.g. [17], participatory designers need guidelines for managing social interactions with children, especially in school contexts. Therein different voices are present and affect the design process also in unpredicted manners if not properly planned for and regulated through shared social roles and norms [9]. An example of a crucial social norm for groups of children is that group members should all take a turn in designing, which GaCoCo tangibly conveys through specific gamified probes, such as the one in Fig. 1. Assigning specific roles for children can also aid in promoting that norm and similar norms; an example is the role of participation controller, who is in charge of ensuring fair participation, and of ambassador, who manages the communication with adults on behalf of the group.

2.2 Data Gathering in Design Tasks

Finally, for assessing children's engagement in design tasks, GaCoCo recommends that researchers use quantitative and qualitative methods.

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To this end, [18] offer a tested protocol for field observations with various indicators of engagement that can be adapted to the specific learning context, for instance, specific on-task or off-tasks behaviours (e.g., if a child is on-task working alone, on-task but participating in conversation, or off-task) and affect indicators (e.g., confused facial expressions). Observers base their judgment of a child's engagement on the context, actions, utterances, facial expressions, body language, and interactions with adults or peers, using multiple cues for maximum accuracy rather than attempting to select individual cues.

Moreover, research in traditional learning domains has documented explicit links between engagement and emotions, emerging in competence relevant tasks, e.g., [19]. Pekrun's *control-theory* [20, 21] offers a valuable reference theoretical framework. In the control-theory, emotions related to engagement in tasks are distinguished by *valence* (positive, negative) and *activation* (activating, deactivating). In relation to engagement in tasks, the theory posits that enjoyment is positive and activating, relaxation is positive and deactivating, boredom is negative and deactivating, whereas anxiety is negative and activating. The available evidence in traditional learning domains supports the theory and also stresses the relevance of contextual factors, such as the domain tasks and goals, which motivate participants to engage as well as the standard against which they reflect on their own success in tasks [22]. Therefore the investigation of emotions for engagement in the GD domain is not only relevant for the PD community but also a novel topic for education research. Different surveys are available for gathering data concerning intensity of emotions in tasks. An example is the GR-AES for Italian school contexts, which is a standardised verbal-pictorial survey for children [23]. Note that the focus of GR-AES is on investigating children's emotions in a process with tasks for children, which is different than assessing their perception or preferences for games or other technology solutions, and for which specific instruments are available in the child-centred design literature [24], e.g., the Fun Toolkit [25].

3 GaCoCo along the Journey: an AR Approach Based on Mixed Data

AR is based under the principle that complex social processes can be studied best by introducing changes into these processes and observing the effects of these changes in their natural context. In view of this, Baskerville observes that an ideal AR domain is given by new or adapted technology development methods for complex social contexts [26]. Thereby, for developing the GaCoCo method and the associated guidelines for primary school contexts, we adopted an AR mind-frame and approach, yet we grounded AR on empirical data. Our data were concerned with children's engagement across a GD process and its design tasks. Guided by the research question of concern for researchers and "clients" (how to engage primary classes in a fragmented GD process, in our case), AR interleaved actions in the natural context of clients (PGD experiences at school) and research reflections (driven by the collected engagement data) for produc-

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ing scholarly knowledge (the GaCoCo method and guidelines) and benefits for "clients" (children's engagement) [27, 28].

AR with empirical data allowed us to tackle our research question and deepen it by investigating, from multiple sources, what GD tasks were (dis)engaging for children, over time. Specifically, the GaCoCo PGD studies gathered data related to engagement in the PGD process by means of a protocol for observations of behaviours and through the GR-AES self-report instrument for emotions, both described above. According to the gathered quantitative and qualitative data, overall children were engaged in the GD experiences, conducted across the years, which speaks positively of the organisation of the GD process with GaCoCo, and suggest the presence of a state of wellbeing in children's perceptions of their experience.

However, results also pinpoint areas critical for participatory GD with children. Crucially, disengagement was tracked when children were asked to conceptualise their game level idea, by starting from a storyline and with specific generative toolkits. Then positive emotions decreased in intensity and negative emotions increased in intensity, and significantly so. Such results were found across the years and were backed up by observation data, which report that children seemed to perceive the task as over-challenging. In the future, this and similar conceptualisation tasks will require further considerations and research in PGD with children. For instance, PGD researchers may consider to support such conceptualisation tasks with additional scaffolding opportunities, e.g., by alternating the conceptualisation work with the sharing of preliminary game level ideas at the class level. Further considerations are discussed in [29].

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