"There Is No Rose Without A Thorn": An Assessment of a Game Design Experience for Children

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ABSTRACT

Game design is recently conducted at school for eliciting children's design ideas about games for them. However, game design is a complex interaction design task, requiring rather mature cognitive skills. This paper reflects on it, reporting a gamified game design experience with groups of children in primary schools.

CCS Concepts

•Human-centered computing → Empirical studies in interaction design;

Keywords

Gamification; game design; participatory design; cooperative learning; engagement; inclusion; children; schools

1. INTRODUCTION

1.1 Motivations and Rationale

Diverse methods allow designers to create interactive products for and possibly with children, with different levels of involvement and product maturity, according to the adopted techniques, e.g., story-boarding, layered elaboration [7, 17]. Informant design methods and participatory design are design methods used with children [20]. In both approaches, children are critically contributing to the design with their ideas, as expert of their experience, but with different levels of involvement. According to the adopted method and its philosophy, designers become full partners, peers, guides or facilitators of children's expression of creativity, and bring in their professional experience of the product under design.

Participatory design methods, informant design methods, or similar others taking children's ideas directly into design are likely to meet children's requirements. However such methods are also demanding on all participants, especially when working at school, e.g., [1, 17]. In case of complex products to design, they also require participants a certain level of commitment to learn, besides rather mature cognitive skills.

Games are the prototypical examples of such complex products to design: even their early design can be complex—also for design experts. Designing games requires not only creativity but also rather mature cognitive abilities, ranging from problem solving to working memory. Despite that, games are the design subject of recent design studies with children, albeit not all experiences are rosy, e.g., see [19].

This paper revolves around a reflection on a game design experience in primary schools, leading to prototypes developed by computer-science students. We aimed at creating an engaging design experience for all children, as well as game design material usable and enjoyable for them. Whereas the importance of usable material for designing is widely documented in human centred computing, the relevance of assessing positive engagement of children in an activity is largely documented in the education literature, which shows a significant correlation between positive engagement and improved activity achievements [8]. Moreover, positive engagement is also one of the potential "educational benefits [for children] of the experience design process" [9], besides a way for improving activity performances. This paper specifies the design activity[1] design (sic), and assesses its results in terms of all children's engagement as well as children's usage and perception of game design material.

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[1]Hereby the terms "activity" and "experience" are regarded as synonyms, albeit we are aware of their different meaning.

1.2 Contributions and Outline

The paper firstly presents the adopted design approach, and then explains the protocol of the game design experience for children. Data hereby reported are mainly qualitative, concerning the daily engagement of children with design work and material, as well as their preferences for this. Instead [2] reports a summative quantitative analysis of the experience in terms of specific children's emotions and work preferences for classmates. A discussion concludes the paper reflecting on: Are all children engaged in game design? Do they encounter issues in game designing? What game design material is usable by children, and what is not? Do children show preferences for material? The discussion section reflects upon such questions in light of the gathered data.

2. RELATED WORK

Different methods have been devised for designing with children. In participatory methods, intergenerational teams are usually created, with children and adult researchers. The study reported in this paper also sees researchers working with children, but it has only one product design expert and one expert of development studies per school class, who acts as observer, like in the studies reported in [25]. Moreover, children and the design expert have different roles in the work hereby reported: the former are realizing design concepts and low-fidelity prototypes in teams, using specific material and tools, whereas the latter scaffolds their work with formative assessment.

The distinction of roles and skills takes the work reported in this paper close to informant design: Scaife does not believe that children have the time, knowledge, or expertise to participate as partners, equal to adults, in the design process [22]. However, contrary than in the work reported in this paper, in the work by Scaife and colleagues, low-tech prototypes are not realized but used by children who then inform their design.

The so-called "children as software designers" is another approach for working with children, developed in [13, 14], related to the work of this paper: it foresees children as software designers, and also as developers. However, the study reported in this paper does not involve children as software developers, but as designers of early prototypes. Moreover, it foresees that the expert designer gives rapid, regular and specific feedback to groups of children on the completion of their work and on its quality, as recommended in [11], alternating the formative evaluation of the expert and the design of children; these design not only individually but also in pair, in group and share their work at the pair, group or class levels using specific strategies of cooperative learning.

3. GAME DESIGN AND CHILDREN

3.1 Introduction

Gamified Co-design with Cooperative Learning (GaCoCo) is rooted in participatory design, and has developed techniques for prototyping games with children at school. Conceived in [5], it was incrementally refined across studies for allowing children to design games at school; an example of a transition from a study to another is reported in [6].

In GaCoCo, children work on the early game design in groups of 3–5. Teachers illustrate the work organization and material to be used, according to the daily design protocol for children. More generally, teachers are in classroom with researchers for managing and explaining the protocol to children. GaCoCo researchers are usually two per class. One is the expert designer, who follows each group for providing rapid feedback during a design session, and for conducting a formative evaluation of each group product at the end of the session, the results of which are made available in the follow-up session for fixing design.

In order to manage social relations and organize work of groups of children, GaCoCo relies on a proven instructional methodology: cooperative learning. Strategies for organizing the work of groups, rules and roles for children are all important contributions that GaCoCo acquires from cooperative learning and adapts to the end of game design, making them tangible via gamified material. GaCoCo uses gamification in order to create material making tangible not only cooperative learning contributions but, more generally, the design protocol for children itself. In such a manner, GaCoCo aims at sustaining children's positive engagement in design, in particular when this is split across different design days. The material for designing is created by the game design expert with experts of child development and pilot-tested, with the aim of being engaging and usable by all.

The remainder of this section delves into the main contributions of cooperative learning and gamification in GaCoCo: strategies, rules and roles from cooperative learning; game design principles and gamified material from gamification.

3.2 Cooperative Learning Contributions

Cooperative learning is an instructional methodology, based on constructivism, for managing group work [24]. How this can be promoted varies according to the chosen cooperative learning models. Hereby we refer to the Complex Instruction model of cooperative learning by Cohen [3].

The model structures class work for small heterogeneous groups, so as to promote the visibility of all, leveraging on the different skills of members. Heterogeneity becomes a growth opportunity for all. In particular, heterogeneity elicits group creativity: learners' early design ideas are triggered by diverse perspectives, which allow group members to build on various alternatives [21]. Cooperative learning strategies for heterogeneous groups, rules and roles are all important contributions that GaCoCo adapts to the end of design.

3.2.1 Strategies

There are a number of strategies for organizing the work of heterogeneous groups in cooperative learning and that GaCoCo picked up [15]. Hereby we focus on those relevant for this paper for groups consisting of 3–5 members. *Brainstorming for groups of children* goes as follows: first the class teacher or domain expert poses a discussion topic; then each group member shares his or her idea with the group, without being judged; finally ideas are collected, organized, subsequently assessed and used by the group. In *think-pair-share*, group members work in pairs as follows: first the class teacher or domain expert poses a question; then each learner thinks individually about a response and hence shares ideas with their partner in an attempt to reach a solution to the problem. Instead, in a *three-step-interview*, children in each group take part in an interview or a discussion divided into three steps, each of c. 2–3 minutes. The domain expert or

teacher introduces the topic and each group member chooses another member as partner. In the first step, partners interview each other by asking clarification questions. Secondly, partners are swapped. In the final third step, groups are recreated and discuss the topic.

3.2.2 Roles

Assigning roles serves to create positive interdependence so that group members perceive to be related to each other for achieving a common goal. In GaCoCo, roles are not fixed but rotate among members, so as to train different skills. The group *ambassador* is an example of a role for children spanning across GaCoCo design activities. Ambassadors ask for clarifications; more generally, they are responsible of exchanging information with the teacher and design expert. The *secretary* is another role recurring in GaCoCo activities: secretaries take notes on project development and group decisions with dedicated material. However it is the *material manager* who is always in charge to collect the right material from the expert when foreseen by the GaCoCo protocol.

3.2.3 Rules

Besides strategies and roles, and in support of them, cooperative learning considers a set of rules necessary for working in group and including all. Rules are concerned with social skills, such as reciprocal listening and respect of different views. Examples of cooperative learning rules that GaCoCo employs across design activities are: *rule for turns:* taking turns in voicing opinions; *rule for reconciliation:* reconciling different views, e.g., concerning game design documents or prototypes.

As outlined below, GaCoCo has gamified material for making tangible strategies, roles and rules for relating to others.

3.3 Gamification Contributions

Game design, from mechanics to aesthetics, is behind the broad area of gamification [12]. In its most common acceptation, gamification means: properly using game-based elements, such as story lines and progression bars, for a non-game goal and in a non-game context in order to positively engage people regarded as players, e.g., see [16].

Diverse motivation theories are invoked to explain why gamification can trigger positive engagement [16]. In general, gamification should nourish a sense of social relatedness, as well as competence and progression, control and autonomy, and have a powerful feedback system. Let us see how that is designed for in GaCoCo.

3.3.1 Relatedness

Relatedness needs are important components of games, and are supported in GaCoCo via cooperative learning, as explained above. Gamified material can help in making tangible cooperative learning for connecting with others. Examples of such material are signaling disks and scepters for sharing with others, illustrated in Fig. 3 and used in the 2014 study. A signaling disk is used for sharing and voting ideas in groups, reconciling different views (rule for reconciliation of cooperative learning): children can draw smileys or write their feedback, positive or not, on their signaling disks in relation to the voting task. A scepter is used for sharing and organizing the turn to speak among group members (rule for turns of cooperative learning).

3.3.2 Competence and Progression

Figure 1: A progression map across design challenges (vertical), divided per group (horizontal)

GaCoCo organizes and presents design sessions as missions, with a goal valuable for all. All children should experience a sense of progression through missions, so as to feel more and more competent. To this end, according to their complexity, missions can be chunked into small progressive challenges, disclosed when needed with clear rules, of which the first challenge should be easy to take up by all learners. Progression maps help GaCoCo in tangibly conveying the idea of growth through missions and challenges. An example of a progression map used in the reported study is in Fig. 1.

3.3.3 Feedback System and Control

Rewards in GaCoCo can be tangible or not and they are part of the so-called feedback system [18]. The gamification literature debates on the benefits of rewards. For instance, in the study reported in [10], using rewards contributed to undermining motivations of students interested in the work per se and to increasing competition. Such findings are in line with cognitive evaluation theory, which predicts that a reward can cause people to feel less competent and in control, which decreases intrinsic motivation, when the reward is seen as controlling or not valuable to their work. Thus GaCoCo considers only rewards contingent to the design work, so as to be valuable for it, and customized or customizable, achievable on completion of a mission or challenge by all children. Examples of completion-contingent rewards are the objects in the shop in Fig. 2. They can be chosen by groups on completion of a mission, independently of who concludes first so as not to increase competition. They serve for prototyping games, so that children perceive that rewards can have a tangible effect on their design work.

4. STUDY GOALS AND PARTICIPANTS

4.1 Goals

The aim of the study was to qualitatively assess the GaCoCo game design experience with primary school children, in terms of the design protocol and its material. This lead us to set the following measurable goals for the study.

4.1.1 Goal 1: Engagement in Activity

The first goal was to assess children's engagement in groups' activities in terms of three constructs: concentration, interest and enjoyment (e.g., curiosity) in line with [23].

Figure 2: The shop for buying game design objects

Figure 3: Signaling disk (black and brown) and scepter (yellow) usage

4.1.2 *Goal 2: Performance with Material*

Another goal was to assess performances of the class with material: whether the functionalities of material for designing were clear or not considering issues children had in using it, e.g., which material required several explanation pieces and which did not; whether specific material was used differently than expected, and the usage was (not) distracting children from their design challenges.

4.1.3 *Goal 3: Preferences for Material*

The third goal was to assess children's preferences for gamified material for designing (explained in Sect. 3.2) besides their usage of such material, which is part of the second goal.

4.2 Participants

The study involved two classes from two different primary schools in North-Eastern Italy. Children were, in total, 36 (59% females), coming from a variety of socio-economic backgrounds. Classes were of different ages and sizes: the younger class was of $n = 15$ children, in grade 3, with mean age = 8.85 years, SD = .44; the older class was of $n = 21$ children, in grade 4, with mean age = 9.72 years, SD =.47. All children participated on a voluntary basis, and their parents authorized their participation through a written consent form. The study also involved 2 researchers and 2 teachers.

5. STUDY PROTOCOL AND MATERIAL

5.1 Introduction

The game design activity in each school took a total of five sessions. Each session was organized in a different day of different weeks, and lasted circa two hours and a half. The entire game design activity was organized and conducted in line with GaCoCo (Sect. 3.2).

Group work was organized with cooperative learning. Strategies for small heterogeneous groups were set in the GaCoCo protocol. Different cooperative learning roles, such as that of ambassador, were assigned by teachers to learners in every design day, according to the protocol, and rotated across missions. Rules for managing group work were explained to the class by their teacher during the first day and recalled at the start of every other design day.

Each design day was organized as a gamified mission with a specific goal, using tangible gamified material for conveying a sense of progression, control and relatedness to children. Missions followed a recurring pattern, using the same gamified material. However, each mission challenges had: their own goal, that is, product to release; its specific design material; its cooperative learning strategies. In the remainder, we explain firstly what was common across missions and then what was specific of each one, mission per mission.

5.2 Missions

At the start of a mission, the teacher recapped what children had produced at the end of the previous mission (if any) and outlined the goal of the daily mission. The mission continued with its specific challenges: except for the first mission, which mainly served to discover the material and rules besides to create the identity of groups, each of the other missions had challenges asking each group to design and release a specific game product, consisting of a design document and of a prototype, which complemented each other eliciting multi-modal communication of children's design ideas, in line with what recently done also in [4]. At the conclusion of every mission, however, the teacher and researchers always gathered feedback data from children, concerning the preferred challenge of the day and learners' emotions during the mission.

The gamified material described in Sect. 3.2 and others were used across missions as follows.

Each design group had their own badge, with the group logo printed on, to move across design challenges in the progression map in Fig. 1. This was hung on the classroom wall, always in the same central position. Each challenge in the map had a tangible reward in the form of a removable coin, made of wood. When a group grabbed their coin, on completion of a challenge, they found a positive feedback behind it. Those coins work as completion-contingent rewards, that is, a group can earn a coin only after completing a challenge.

In the progression map, the end of a mission is represented with a door hiding other completion-contingent personal rewards: stickers to place in another map for assembling trees, metaphorically showing groups' progression in designing across missions. Each group had their spot in the map for placing their stickers. Firstly each group had to plant the seed into the soil, secondly to water the seed and then to grow their tree, piece by piece across missions. See Fig. 4.

At the end of a mission, groups could use their coins found in the map for challenges. Coins served to buy objects useful for their game design. Groups had to move to the shopping

Figure 4: A progression map across missions, showing that each group had grown their tree, a metaphor of the growth of their game prototype

point in the classroom, where they found the wood fabric shop with jute pockets, containing objects for prototyping. See Fig. 2. Groups could then buy objects gained in a mission by inserting their coin into the shop fissure.

Each group had a single scepter for regulating the turn to speak. Each child had their own signalling disk for reconciling views. See Fig. 3.

5.3 First Mission

Goal. In the first mission, children had to create their own group and identity.

Procedure. Firstly, their teacher explained children the relevant cooperative learning rules and roles. The expert designer explained them how game design would proceed using metaphors: each game would have its roots in a game idea (seeds), would build on a mechanics (trunk) and would flourish with aesthetics (leaves and fruit).

Then the only mission challenge started for creating the *group name and badge*. Groups were created and each worked on their identity. They had a form to fill in for choosing the name of the group. In order to share their ideas, children did group brainstorming and then registered their choices in the form as follows. In turn each group member gave his or her opinion when the child holds the group scepter for signalling his or her turn to speak. The secretary reported the choice in the pertinent field of the form. Once all children had given one or more opinions within the allotted time, the group had to converge on a single choice. In order to that, each group member voted the proposal of others group members using signalling disk. Children drew smileys or write with chalk on their signalling disks in relation to the voting task. In case of a tie, a coin was used for randomly choosing the top-rated opinions. At the end, the group name was written on the progression map for challenges in Fig. 1. Finally, each group created their own badge, which served to track their progression on the map across challenges.

5.4 Second Mission

Goal. In the second mission, each group released the so-called high-level concept document of their game, containing their game idea, and their character prototypes.

Procedure. The second mission foresaw three challenges. The first challenge is named *the high-level concept of the game*: starting from a common story read in class, concerning a land without thorns[2], each group specified their game idea for continuing the story by filling in the high-level concept form. The group filled in the form as follows: the secretary read aloud what should go in a form field; in turn, each member shared his or her own ideas with the group until converging towards a single choice; the secretary reported the choice in the pertinent field of the form and the group moved to filling in the next field, if required.

In the second challenge, named *game main character*, each group member worked individually on his or her main character for the game and related personal objects, using a specific template for drawing and specifying features of their characters. See Fig. 5.

Finally, in the third challenge named *sharing character details*, groups were reunited to share their prototypes and refine them, if necessary, with the feedback of group members. This challenge was organized with a variant of the following cooperative learning strategies explained in Sect. 3.2: think-pair-share and three-step-interview. Each group was divided in two pairs for the discussion (interview). Each child presented the other the designed character, and then they enriched their characters together, verbally or graphically, according to their skills. Groups were recomposed to share information gathered during interviews in pairs: each child with the role of pair-speaker described the designed characters, whereas the child with the role of checker reported if the pair-speaker had forgotten anything.

Figure 5: The character form

5.5 Third and Fourth Mission

Goal. Starting from the high-level concept document and character prototypes, each group conceptualized two game levels, releasing the chore mechanics document and prototypes of their levels.

Procedure. Groups worked in pairs in the first challenge named *level document*, and shared results in group in the second challenge named *level prototype*, proceeding like in the second challenge. The document for the first challenge was again structured as a form and was filled in as in the second mission. Using what released in the second mission, each pair prototyped one of the levels. To this end, children had at their disposal an A3 tablet-shaped frame, colors, pens,

[2]For the curios reader, the land had roses without thorns, a fact that contributed to the title of this paper.

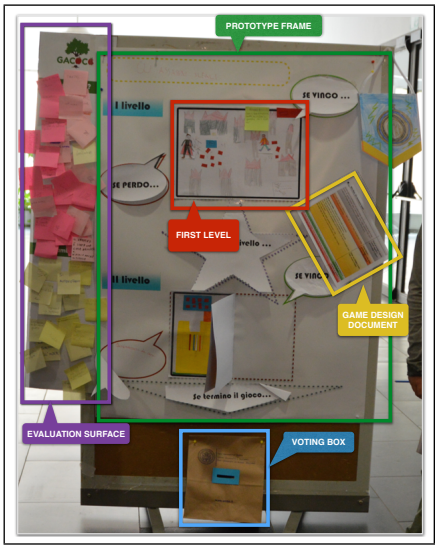

Figure 6: A game prototype

scissors, glue, transparencies, paper and other material.

Moreover, in the third challenge named *sharing level*, each pair shared their results in group using a variant of think-pair-share: each pair-speaker described and explained the other group members the prototyped level and, using the forms, the child acting as checker controlled whether the pair-speaker had given all the necessary level details.

5.6 Fifth Mission

Goal. Each group finalized their game design document with passage conditions between levels, and included them in their prototype, presenting their work to the entire class. *Procedure.* The fifth mission foresaw four challenges. In the first challenge named *progression*, groups of children conceptualized the passage conditions between levels, filling in the related form, referred to as progression document, proceeding as in the second mission. In the second and third challenges groups assembled their level prototypes into a single game, using an ad-hoc frame, and chose the title for their game. The frame is an A0 poster with coloured shapes for inserting specific game elements for their paper-based prototype. See Fig. 6. In the fourth challenge named *game presentation*, each group presented their game to the entire class, playtesting it so as to gather feedback from peers. In particular, each group showed the interaction with their game using the frame: how the game characters and other objects interact in the level; the winning and losing conditions, e.g., what appears when the player wins or loses.

6. DATA GATHERING

The goals of the study were three: group engagement in daily missions, performances with material and preferences among gamified material.

Engagement was tracked by the passive observer in class, taking notes in her diary concerning concentration, interest and enjoyment of the mission challenges. Moreover, her observations in class were compared and complemented with those by another researcher who analyzed videos at the end of the daily mission.

Such observations were also complemented with children's self-reports in the form of a class interview run at the end of each daily mission; then the game design expert asked the class what challenges they liked best and how they perceived their work was; the teacher asked children to reflect on whether all group members were engaged in the group work, so as to self-reflect on the group cooperation.

Performance with material was assessed by means of the passive observer notes and video analysis. Children's preferences for gamified material recurring in every mission were investigated via self-report surveys. Each child was administered the form shown in Fig. 7: children had to rank pictures of the material, also described with captions, by sticking them in the form. The teacher administered the survey at the end of the game design activity.

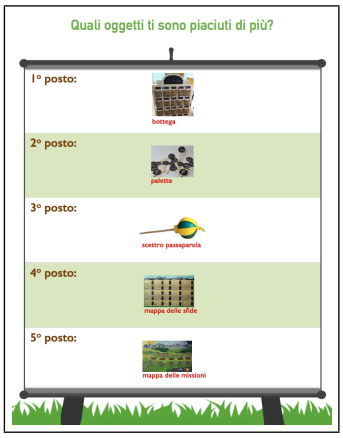

Figure 7: The preference survey filled in by a child

7. RESULTS

7.1 Engagement in Missions

Group 1, older. The group had a child with autism and a cochlear implant, to whom we give the fictitious name of Johanne. In the first and second missions, the group was overall concentrated over their challenges: they helped each other sharing tasks, involving also Johanne. In the third mission, when the group was split in pairs, the pair with Johanne had several problems in sharing tasks and taking decisions, and such difficulties created at points lack of concentration and delays in concluding the challenge, requiring the help of the teacher or expert for assisting Johanne. In the last mission the group is re-created and all children are concentrated.

Group 2, older. The group was generally interested in their work and concentrated, curious to discover and use material, until the fourth mission. Then lack of concentration is observed: children walked among tables, and delivered complete but careless products.

Group 3, older. In the first two missions, two member actively participated whereas the others did not and were not on tasks. In the third and fourth missions, the strategies for making children work in pairs were used. Active children were paired with the non-engaged children. After some initial difficulties, both pairs worked well together and were concentrated on challenges, and this continued in the subsequent missions with some lack of concentration in the fourth one.

Group 4, older. The group was missing concentration. They tended to play with material; although they had terminated all challenges, their products denoted superficial work.

Group 5, older. The group was overall interested and concentrated, enjoying work, except in the fifth mission in which they showed less concentration. A child, who was less involved in the first two missions, got engaged from the third mission onwards after working in pairs.

Group 6, younger. The group was overall engaged, concentrated and joyfully interested in design challenges. A lack of concentration was experienced in the fourth mission.

Group 7, younger. The group had a child diagnosed with an *attention deficit hyperactivity disorder* (ADHD), to whom we refer with the fictitious name of Ada, and a dominant child (according to the teacher), to whom we refer as Bart. The group was not engaged in the first mission only. In the third mission the pair with Ada worked well and was more concentrated than the other pair with Bart.

Group 8, younger. The group had a child diagnosed with ADHD, who distracted others from tasks particularly in the second mission. Overall, the group members were interested and enjoying their design challenges.

Group 9, younger. The group members were chaotic in their work and often showed lack of concentration. The division in pairs in the third mission had clear benefits on the involvement of all in the design work.

7.2 Performance with Material

Mission 1. Children showed curiosity, interest and enthusiasm towards all material. For instance, all children with the role of material responsible queued up before being called for fetching material. Signalling disks got soon very popular and were also used creatively for tasks designers had not planned, e.g., for showing an example logo to other groups.

Mission 2. In the first challenge for creating the game idea several children played with signalling disks when not foreseen in the protocol. The usage of scepters for the taking-turn rule of cooperative learning (see Sect. 3.2) was not immediate and required some training. In the second challenge for creating characters, all children were concentrated on the individual task. All children showed enthusiasm for the shop for acquiring objects for prototyping. In this mission, objects tended to be chosen for their aesthetic appeal and not so much for their functionality in the game. The maps were also great source of curiosity for finding out rewards.

Missions 3 and 4. At the start of both missions, children asked for their signalling disk. In the challenge for prototyping levels they showed enthusiasm for material, e.g., tablet frames and transparencies. Once more the shop was source of strong interest, however objects got chosen according to their functionality in the game; discussions were observed in front of the shop concerning the usage of objects in games.

Mission 5. Albeit the A0 frame for assembling levels created curiosity and enthusiasm, matching it against the passage document required effort on the side of younger learners.

7.3 Preferences for Material

The ranking of gamified material, done with the form in Fig. 7, gave the following preferences. As for younger learners, 12 out of 15 completed the survey. At the first place of the survey, 50% of them chose the shop, and 34% chose the signalling disk. Moreover, 33% of them chose the signalling disk as second. The progression map for challenges was third for 42% of younger learners.

As for the older learners, 19 out of 21 completed the survey. At the first place of the survey, 37% chose the shop, and circa 32% chose the progression map for missions. Moreover, 32% of them chose the progression map for challenges as second, 50% chose the signalling disk as second or third, and 21% chose the scepter as third.

8. DISCUSSION

This section assesses what worked smoothly and what will require a re-design of the protocol or material for engaging all children in game design at school.

Globally, children showed engagement with the game design activity. A peak of lack of concentration was observed during the fourth mission. This was concerned with the finalization of the level prototypes and the expert had to validate the final design choices of all groups. Such a situation suggests a redesign of the fourth mission for avoiding a bottleneck of requests for the single game design expert in classroom.

The child with autism and a cochlear implant was generally engaged in group work but required her group mates more effort for explaining her challenges. An adult for the group, explaining challenges step-by-step, would have facilitated their work. It was also observed that children who were not engaged in group work got instead engaged after being paired with an engaged child. Strategies such as think-pair-share and three-step-interview should then be used in situations for which engagement of all in design work is critical so as to involve all group members.

Material was generally received with curiosity and properly used, albeit scepters for taking turns in speaking and frames for prototyping passage conditions required more explanation than other material. Such a situation can be interpreted as follows: the cooperative learning rule of taking turns in speaking requires per se more training, and the object for stirring it should be less intrusive, intuitive and yet visible; maintaining consistency across game design documents and prototypes was cognitively demanding, above all for younger learners, and requires the guidance of the expert.

Signalling disks were often creatively used albeit their usage flexibility was also source of distraction at points.

All children showed a marked preference for the shop for buying objects for customizing their games. As second or third choices, children tended to place signalling disks or progression maps: younger learners tended to prefer signalling disks, whereas older learners tended to prefer maps.

9. CONCLUSIONS

This paper reported a game design experience with primary school classes, merging gamification and cooperative learning. The collected data, considering researchers' and children's viewpoints, stirred a reflection on the daily engagement of children in the activity as well as on their usage of the game design material and preferences for this. The reflection shows researchers that the conducted game design activity was a rose but, as every rose, it had (still) its thorns: children were generally engaged; less engaged children benefitted from working in pairs; gamified material was enjoyed and generally used appropriately; more flexible

gamified material such as signalling-disks, designed for reconciliating views, were creatively used for varied purposes but, at points, also became source of distraction. The assessment of the experience in this paper could be useful to other interaction designers willing to bring game design and gamified material for designing into school, engaging all children.

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