# Serious Game Rapid Online Co-design to Facilitate Change Within Education

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**Abstract.** Serious games have potential for facilitating change processes but require rigorous, interdisciplinary design to be effective. A novel, rapid online workflow was developed for co-design of games for change with school teachers. Major design challenges included: short timescale; appropriately scaffolding a complex process; remote online interactions; and interdisciplinary communication. The resulting workflow is highly visual, structured, and focused on swift knowledge exchange between pedagogy and game experts, drawing on relevant frameworks. Two workshops used the new method, producing eight co-designed serious games. Analysis suggests the workflow is effective for knowledge exchange for the rapid and rigorous co-design of serious games and has advantages for inclusivity and confidence in the co-design process.

**Keywords:** Serious Games, Education, Online Co-Design, Game Design

## 1 Introduction

Serious games are increasingly benefitting from co-design methods in their conception, design, and production. Co-design is a participatory method that involves all stakeholders and creates shared understanding between them as they participate in equally valuable yet diverse roles [1]. It is crucial to bridging disciplinary boundaries and improving the quality and effectiveness of serious games but there is little practical guidance on how exactly to achieve this goal. We present a new method for 'Serious Game Rapid Online Co-design' (SGROC) with school teachers, applied during the Agents of Change Toolkit (ACT) project [2] to produce eight serious games for change in schools. The workflow and serious games are freely available and represent a contribution to the field of serious games for educational contexts.

## 2 Background

Game-based learning has considerable potential for delivering both knowledge and behavioral outcomes, as is now widely recognized in the literature [3]. However, it is also acknowledged that there are still significant challenges in developing games that

are well situated in practice [4] and where game elements (mechanics, aesthetics, etc.) are appropriately linked with both learning behaviors and intended outcomes [5, 6], not least because of the highly interdisciplinary requirements of serious game design.

The Agents of Change Toolkit (ACT) facilitates teachers and schools to act as agents of change towards the UN Sustainable Development Goals (SDGs) [7] by leveraging serious games. Following recommendations from the literature, co-design with educators and school leaders was identified as the most fruitful approach [8, 9] and embedded throughout the project. Unfortunately, relatively little precise guidance exists to support the all-important linking of pedagogical foundations with game design in co-design methods, which risks ineffective serious games [10] and educators becoming overwhelmed by complexity [6]. Previous research by the authors explicitly addresses these challenges by marrying workflows suitable for game design novices [8, 11] with rigorous matching of learning and game mechanics [12]. However, in the context of COVID19 lockdowns, a need emerged for online co-design (OCD) activities. OCD is increasingly discussed in the literature with examples of general principles for OCD workshops [13, 14] but little related to educational game design. A rare exception presents a hybrid online/physical method for developing minigame prototypes over multiple sessions [15], noting the research gap in OCD for serious games.

## 3 Serious Game Rapid Online Co-Design Method (SGROC)

In the context of the ACT project, the following needs were identified for co-design workshops with school teachers; online delivery; very low time commitment (2 hours); familiar technologies; small collaboration groups; and a strong link between pedagogical outcomes, learning behaviors, and game design. In order to meet these needs and the wider goals of ACT, we adopted a 'lean' methodological approach, i.e. collaborating closely with intended users to produce a minimum viable prototype which could then be further developed. It was necessary to devise a method which combined OCD with rapid prototyping of serious games, with heavily scaffolded game design processes that co-designers could grasp and productively use in a very short time. This was achieved by expanding recommendations in the literature specific to OCD [13–15] and co-design with teachers [e.g. 1] and significantly developing the visual and structural guidance required to achieve such rapid results. In particular, the game design workflow supporting both novices and experts [8] was applied in this context and combined with the robust Learning Mechanic Game Mechanic framework [16] and gameplay loops [17] to achieve rigorous yet feasible prototypes. The Serious Game Rapid Online Co-Design (SGROC) workflow is summarized in **Fig. 1**.

Miro (miro.com) was selected as the most suitable whiteboard interaction platform, used alongside Virtual Classroom and Zoom videoconferencing. To sufficiently scaffold the co-design process [cf. 1] and provide individual attention, workshops were offered to small groups of six educators with three serious game experts facilitating the design of two prototype games each, acknowledged as an ambitious target. Recruitment used the project team's extensive network of educators, school leaders, and educational policymakers and events were shared publicly to increase access. Two

workshops were run, each with a full complement of 6 participants (12 overall). The workshops were also attended by 2 – 3 members of the ACT project team.

In advance of the workshops, participants were asked to define a specific change they wanted to achieve in their school, relevant to one of the SDGs. Prior to the event, desired changes were grouped into complementary pairs and assigned to each game designer to create the most fruitful collaborations.

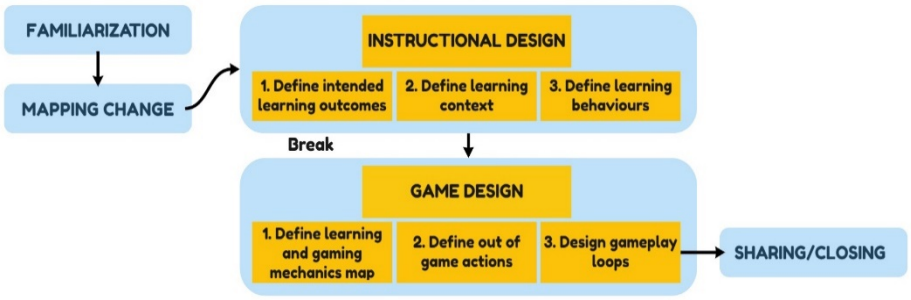


**Fig. 1.** Workshop protocol overview

As with any platform it was important to ensure that participants could concentrate on the content of the workshop rather than struggling with the controls [cf. 13]. To maximize engagement, the familiarization activity was intrinsically integrated with the workshop content; participants constructed a 'monster' representing their previously-defined change and its challenges, and annotated it using virtual sticky notes. To further orient the participants and save time, the whiteboard was meticulously set up for each group, with sticky notes and working areas color-coded and tagged with participants' names. All background and instructional elements were locked in place and clear labels provided for all icons and text that participants would be directly interacting with. This preparation was crucial in streamlining online interactions and keeping participants focused on content. All phases were illustrated with a worked example to provide inspiration, guidance, and continuity throughout the process.

The second short phase, Mapping Change, allowed the teachers to contextualize their own proposed change and align it with one or more of the SDGs.

The bulk of time was for rapid co-design, broken down into discrete tasks as shown in **Fig. 1**. The first phase, Instructional Design, built on the desired change and challenges from the familiarization phase to inform 1) the definition of brief Intended Learning Outcomes (ILOs); 2) clarify the learning context; and 3) experiment with a range of 'learning qualities' to allow the participants to get a sense of *how* the target audience would engage with the game or playful activity. Participants were offered a choice of learning verbs from Bloom's extended taxonomy [18] (as teachers were likely to already be familiar with this) and/or a Learning Qualities Framework developed specifically for this workshop (drawing on [8]) which supported participants in systematizing learning behaviors using a simple verb + adjective format. The verbs and/or qualities were then used to define a primary intended learning behavior for the game. This rigorously-defined learning behavior formed the basis of Game Design.

With the help of the game designers, participants used their instructional designs to identify and pair learning mechanics (LMs) and game mechanics (GMs) to construct an LM-GM map, following the procedure defined in [12, 16]. LMs were selected and annotated to explain the choice. Appropriate GMs were then linked to relevant LMs and annotated with how the GM would be used within the serious game. LM-GM maps were then used to brainstorm ideas for game prototypes which foregrounded the LM-GM pairings. Where time allowed, LM-GM pairs were formulated into gameplay loops [17]. Game designers used examples of existing games to suggest and inspire. Finally, participants produced a one-sentence description of their prototype game. SGROC workshops closed by sharing the prototypes across the group and a recap.

### 3.1 Eight Games for Facilitating Change Within Education

The ACT SGROC process produced eight finished games for facilitating change processes. After the workshops, games were briefly refined and finalized and content produced for game assets (e.g. question banks, cards, and boards). Where possible this was also via co-design with the educator (5 out of 8 games). Additional assets were produced where necessary (for example card sets, jigsaws, powerpoint) using original or Creative Commons art and crediting all creators. Each finished game document provides 1) a summary of the overall purpose; 2) any assets required; 3) how to play; 4) suggestions for different application areas which could also benefit from a similar LM-GM map and gameplay loop; 5) detail of the instructional design; and 6) gameplay loop annotated with LM-GM mappings [2]. The games are also contextualized in relation to the overall ACT project.

## 4 Discussion

On balance, the SGROC method provided advantages over face-to-face methods. Not requiring travel reduced the time commitment (particularly important for school teachers) and expanded our geographical reach. One participant had to drop out due to poor connectivity – this may have been exacerbated by the ‘image heavy’ familiarization exercise (which was then streamlined for the next event). Despite connectivity barriers, OCD is considered to be more inclusive for those with caring responsibilities or neurodiversity [19]. The care and attention given scaffolding the workflow was crucial to success, as was the choice of technologies appropriate to use from (often restricted) school premises. Acute time pressure provided a way to kick-start the complex process of serious game design, forcing swift collaborative decisions to produce a ‘good enough’ prototype. (The rapid games design approach for complex systems in the context of sustainability is discussed in [11].) Most of the games were further developed and/or tweaked after the workshop (varying between 1 – 4 hours) to improve their gameplay and content. Furthermore, the highly scaffolded workflow was particularly useful when participants were working independently, increasing confidence and productivity. Participants provided very positive feedback at (and after) both workshops: e.g. “I just wanted to say a big thank you for a fascinating,

gruelling but very productive and optimistic event". There was also evidence of considerable knowledge exchange within the interdisciplinary project team itself. Overall, the SGROC method achieved its design outcomes and contributes to OCD methods for serious games, as well as empowering educators as change agents. A formal evaluation of the SGROC workflow would provide deeper insights into user experience (across different roles) and goal attainment.

Unsurprisingly, as each arose from a specific desired change, the games are diverse: three highly structured games with associated assets, two loosely structured games, and three freeform playful and/or creative activities. Limited feedback on the games was gathered anonymously and thematically analyzed. Games were seen as useful, relevant, and understandable; suggested adaptations for (and adaptability of) games to individual contexts was considered very beneficial; games being contextualized within the change process was valuable; and the value of (and need for more) exemplification was noted. The Toolkit was launched in Sept 2021 and is being implemented within schools and teacher education degrees. A larger scale, systematic evaluation with users is needed to validate results and provide further insight (this is in progress).

## 5 Conclusion

The SGROC workflow provides a contribution with ongoing value to those undertaking rapid online games design with educators. Particular advantages of this method are: quick results; inclusivity; knowledge exchange; reduced demand on teacher time; genuine collaboration; and rigor. Main recommendations for successful use of the SGROC method are: use of blended spatiotemporal techniques to increase engagement, commitment, and rigor; meticulous preparation of online platforms; meaningful grouping of participants; meaningful familiarization activities; and a workflow structured to foreground each disciplinary expertise appropriately. This work was funded by the Scottish Universities Insight Institute. All of the games produced by the ACT project are freely available online [2] and the SGROC workshop template can be provided on request.

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