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Democratising the Design of Educational Games for Social Change: An Approach Based on Critical Pedagogy

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Abstract: Digital games can be used as educational tools for tackling structural inequalities and promoting social justice. Designing games with these purposes is a complex task that requires a myriad of combined expertise, including games' mechanics, software development, educational game design, pedagogy and knowledge of the educational topic (which can target specific social issues). Democratising the design of educational games is used to increase the agency and participation of diverse and novice groups throughout design processes and can be used to improve the efficiency of such games as it directly leads to the inclusion of broad voices, knowledge, experiences and perspectives. This research adopted a Design-Based Research methodology to create, evaluate and validate 13 design principles to democratise the design of educational games for social change. Three research phases were implemented in turn: a preliminary, prototyping and evaluation phase. The preliminary phase was based on creating these principles by grounding them on fundamentals of Critical Pedagogy, a theory of education which presents pedagogical techniques to accelerate learning, engagement and social change. The prototyping phase was based on conducting semi-structured interviews to assess and improve these principles with educational and game design experts. During the evaluation phase, these principles were applied and evaluated during two weekend-long game design events, called Game Jams. These were open to anyone interested in creating a digital game to raise awareness of gender inequalities, and 13 of the 23 participants (57%) had no previous experience in game design. This research presents theoretical and practical contributions related to how to democratise educational game design for social change. It evidenced the relevance of facilitating design principles that address *what* could be done to trigger learning in games; *why* this learning could be facilitated, from both pedagogical and gaming perspectives; and *how* to implement these principles into educational games.

Keywords: educational game design, democratising game design, social change, inclusion and diversity.

Introduction

About 2.4 billion people globally play video games on a weekly basis (Liao et al., 2020). And an increasing number of games have been adopted as engaging, impactful and motivational tools for digital education (Gee, 2005; Satrio et al., 2021; Wouters & van Oostendorp, 2017). Games can be fun; engaging; they can allow players to explore different environments; to collaborate; to repeatedly practice skills; players can also experiment with consequences of their actions; they can build relationships and communities; and can tell stories in immersive and interactive ways. Games can also be used as a means of raising awareness and promoting change towards social justice and equality[i].

For example, the game Spent[ii] intends to raise awareness about surviving poverty and homelessness. In this game, players are given facts about homelessness and poverty by playing the character of someone facing financial struggles and at risk of losing their home. It was reported that for two years after its release in 2011, the game was getting about 5,000 new plays each day, and a total of more than two million people were playing this game as of the beginning of 2020[iii].

Games are not always designed to trigger learning, awareness or social change. Games are, in fact, often associated with issues related to misrepresenting, discriminating, objectifying and stereotyping women and girls, people of colour, minorities, LGBTQ+, and other groups often facing discrimination (Kafai et al., 2016). A possible explanation is that games often echo the experiences and perspectives of their designers, reflecting the evidenced lack of diversity in the gaming industry and directly within teams involved in games design (Deen et al., 2015; Kennedy, 2018). Enabling the participation of broader audiences in designing games generates new opportunities to share diverse experiences, stories, knowledge and reflections related to social issues, and, in turn, to enhance learning and social change.

Strategies to democratise game design can be used to tackle issues related to misrepresentation, under-representation and discrimination in the design of technologies, as it can lead to increasing the agency and participation of diverse and novice groups throughout design processes (Fleischmann, 2015). The democratisation of educational games design can also directly impact the effectiveness of games, and especially to reach their intended educational outcomes (Deen et al., 2015). It is also evidenced as a process that offers opportunities for learning to broad and novice groups that are involved in designing such games (Myers, 2021).

This paper introduces a set of 13 design principles aimed at enabling novice audiences to understand how to design educational games targeted at improving critical thinking and enhancing learning about social change. Grounded on the fundamentals of Critical Pedagogy (Freire, 1960), these design principles were iteratively created, evaluated and validated following a Design-Based Research methodology (Brown, 1992; Collins 1992). The design principles were studied and applied through semi-structured interviews and during two weekend-long events called Game Jams, which were aimed at designing games in a short period of time (Kultima, 2015) and organised on the theme of gender equality. The Game Jams provided guidance and support for the participants to elaborate on their own ideas and life experiences to create a game that critically questioned power structures and structural inequalities.

Despite the growing interest in the use of digital games for education and social change, the lack of diversity in teams of game designers often leads to the creation of games that promote inequalities and discrimination. One promising solution to tackle this issue, and to design educational games that lead to improved learning outcomes, is the democratisation of game design, where broad and diverse groups are given agency to design games that reflect their ideas, knowledge and experiences. While previous studies have demonstrated the potential benefits of democratising educational game design, there is still limited understanding of how to do this in practice. To the best of our understanding, this research presents the first set of design principles, that use critical pedagogy, to democratise the design of educational games to specifically raise awareness of social issues.

Literature Review

In this section, approaches to design and democratise educational games found in the literature are described and discussed, followed by an introduction to Critical Pedagogy.

Educational Game Design

Three main approaches to design educational games that dominate the literature are based on using educational game attributes associated with game elements, adopting conceptual models and applying design principles. Most of these approaches rely on identifying educational game attributes, which are design features implemented using game elements that could contribute to enhancing learning outcomes in games. Table A in the Appendix summarises the educational game attributes and game elements found in the literature.

From a practical perspective, the first main approach to design educational games, namely using game attributes for educational game design, is mostly used to enable game designers to explore educational game attributes and elements that could be used to facilitate learning in games. This approach does not address the designer's conceptual understanding of educational game design, as it simply enables designers to access ideas to create learning through gaming. To support designers in understanding why certain game attributes and elements could be better than others for a game, approaches that provide access to supporting information and that integrate educational approaches are needed — these are referred to as conceptual models and principles of educational game design.

The second main approach to design educational games, adopting conceptual models, is a game design strategy that explores how to apply educational approaches to the design of educational games. Amory (2007) presented the Game Object Model II, which aims at introducing the connections between games and educational theories through the illustration of the interrelated components and dependencies of game elements. Arnab et al. (2015) presented a model to connect educational theories and game mechanics, which are described as the gaming activities, tools and goals of a game. Building on this study, Carvalho (2017) developed a conceptual model that represents how game elements could be associated with different educational outcomes. Finally, Lameras et al. (2017) created a taxonomy linking learning and game mechanics to guide university teachers in using educational games. These studies present a variety of educational theories and game elements enabling experienced groups to explore and reflect on potential combinations for their game. However, these models can pose risks, especially for groups with little or no expertise in educational game design. Firstly, they do not present how certain educational approaches are better suited to certain educational topics and, secondly, they do not elaborate on why certain combinations of educational approaches and game features could be more appropriate than others. These models are exclusively based on inviting experienced designers to discuss what might be the most suitable combinations of educational approaches and game elements for their games.

The third approach found in the literature is to propose principles to design educational games, which are based on presenting supportive information of how to design educational games. Schrier (2017) proposed 10 design-principle categories to create educational games specifically on the topic of morality. The proposed principles are composed of supportive information and game examples and are introduced as initial principles to consider when creating educational games on the topic of morality. A limitation of these principles is that they do not provide information on why these

principles could be used to trigger learning in games. This information is considered relevant in scenarios where novice groups are involved in designing educational games, as it could be used as supportive information to inform their design decisions.

Gee (2005) proposes an approach based on principles that align educational approaches with game design. More specifically, the work of Gee presents 13 principles of learning in games that explain how and why gaming could be used for learning by building on the literature of gaming and educational theories. For example, the first principle, titled Co-design, is described as "Good learning requires that learners feel like active agents (producers) not just passive recipients (consumers)" and provides supporting information on why this principle is suitable to trigger learning from both gaming and educational perspectives as well as presenting game examples (Gee, 2005, p. 6). These principles are considered suitable for use in conceptualising educational games. However, indications on how to implement a principle into a game rely on introducing two to three game elements as examples, which can be considered insufficient for scenarios where these principles are used with novice groups. In addition, these principles are targeted at providing generic information on educational game design, which suggests that these principles have to be adapted to conceptualise educational games specifically on improving critical thinking and tackling social issues. The following sections introduce and elaborate the concept of Critical Pedagogy to be used together with Gee's (2005) principles.

Critical Pedagogy

Critical Pedagogy is presented as the application of Critical Theory to education and is often attributed to the Brazilian educator and philosopher Paulo Freire. Critical theory was first described by Max Horkheimer in 1937 as a theory targeted at criticising and changing society by reducing injustice and oppression through the development of self-reflective knowledge and critical thinking (Slattery, 2013). Paulo Freire applied this theory by proposing an educational approach to trigger critical thinking, to raise awareness of social issues, and to create democratic engagement in tackling social, political and economic inequalities through literacy education. Critical Pedagogy presents principles to apply this approach into practice, which are introduced below.

Everyday Life Experiences

Critical Pedagogy uses everyday life experiences, where social issues are faced or observed as a starting point for educational interventions. These experiences are described as the educational material that is used to trigger learners to develop broader knowledge, critical reflections and understanding about social and political issues. Using everyday experiences is also described as an opportunity to contextualise learning and to enable learners to relate to educational topics, which in turn can influence their participation in discussions (Darder, 2003).

Dialogue

Guidance on how to use these experiences leads to another aspect of Critical Pedagogy, which is to enable egalitarian participation in learning and teaching using dialogue. This is used to challenge hierarchical positions between students and teachers by identifying everyone involved in educational interventions as egalitarian learners — who can both teach and learn through dialogue (Giroux, 2018).

In this way, dialogue is also intended to enable learners to have agency over their educational pathways (Schugurensky, 2014).

Learners as Agent of Change

Another aspect of applying Critical Pedagogy is to ensure engagement with social and political issues, and to portray learners as agents of change. Critical Pedagogy is presented as a "mode of intervention" (Darder, 2003, p. xii) where reflection needs to be directed toward enabling learners to perceive issues as transformable and to develop ideas on solutions aimed at tackling them.

Praxis

At the centre of Critical Pedagogy lies the idea of 'praxis', which expands on how to trigger learning and develop solutions to tackle issues (Lankshear et al., 1993). In the context of learning, praxis is described as a cyclic process of putting theory into practice and vice versa (Freire, 1970; Ledwith, 2015). Learning is created through performing actions in practice and by reflecting on these actions. These reflections are then used to inform subsequent actions, leading this cycle to be repeated (Ledwith, 2015).

Gee's essay on the empirical relevance of Critical Pedagogy (Freire, 1970) already suggests a connection between Critical Pedagogy and the principles of learning in games (Gee, 2014). The works of Frasca (2001) and Torres (2015) explored potential synergies between Gee's principles of learning in games and Critical Pedagogy. Frasca (2001) used Critical Pedagogy to adapt the game The Sims to stimulate players to think critically about social issues, while Torres (2015) created a game that considers inequalities by following the life of a young black woman in Colombia. This research aims to use Critical Pedagogy as a foundation to democratise educational game design for raising awareness of social issues and intends to boost understanding of practical approaches to democratise the design such games.

Research Questions

The main research question of this study, namely: How to democratise educational game design on social issues? aims to advance understanding of practices needed to democratise educational game design on social issues. This study also explores the following sub-question: What resources can be used to democratise educational game design practices? in order to illustrate ways to apply and adapt educational game design practices to be understood and used by broad audiences, that include novice game designers.

Methods

In this section, the research methodology with the data collection and analysis approaches to design, evaluate and validate the design principles are presented.

Research Methodology

This research adopted Design-Based Research, a methodology within educational research based on elaborating interventions aimed at solving issues related to learning and teaching (Brown, 1992; Collins, 1992). Two aspects of Design-Based Research often highlighted are its collaborative features and the application of iterative processes to create and improve interventions. We adopted Plomp's (2013, p. 15) three phases to implement an iterative process: preliminary research, prototyping and

evaluation. During the preliminary research phase, the complementarity between Critical Pedagogy (Freire, 1970) and Gee's principles of learning in games (Gee, 2005) was used to create an initial version of design principles intended to support novice groups in designing educational games for social change.

During the second phase, the prototyping phase, the initial prototype of the design principles was discussed with James Paul Gee, the author of the principles of learning in games (Gee, 2005) (see section titled Educational Game Design), and John Lockhart, the director of the global Paulo Freire Institute, during semi-structured interviews. The interviews were transcribed, and the data was directly used to improve the list of design principles.

In the last research phase, the evaluation phase, the design principles were assessed during two weekend-long Game Jams. These Game Jams provided guidance and support to the participants and were open to anyone interested in creating a game to raise awareness of gender inequalities. Gender equality was used as a case study for this research and the participants were randomly allocated to groups of five people. The groups were invited to read, discuss and use these design principles to design an educational game aiming at raising awareness of gender inequalities.

The design principles were used as part of a comprehensive framework to support and guide novice groups to design educational games to tackle gender equality[iv]. The framework consisted of a process with structured resources and activities to enhance learning by supporting egalitarian participation and agency. It offered collaborative learning opportunities for groups to engage with the social issue of gender equalities, relying on storytelling, and on the exchange of perspectives and experiences.

Population and Sample

In total, 23 people participated in the Game Jams, and further details of the Game Jams, as well as the games created, can be found in Myers (2021). Ten of the 23 participants (43%) had previous experience in game design and only three participants (13%) had some previous experience in educational game design. In total, five participants (22%) had participated in a Game Jam previously, and four participants (17%) had experience with computer programming. Both Game Jams and each group had diversity in gender, age, ethnicity, sexual orientation and age, for instance, 53% of the participants were from black, Asian or minority ethnic backgrounds, 26% of participants had a sexual orientation other than heterosexual, and their ages varied across adult range categories from 16-to-21 to over 52.

Data Collection and Analysis

The data collection methods applied to assess the design principles included: observation, interviews, and feedback questionnaires. Coaches, who participated in the Game Jams to guide and support participants, were asked to capture observation notes with a template document that provided guidance on what data needed to be reported; these included the questions that participants asked and requests for clarification. Semi-structured group interviews were also used to evaluate the proposed design principles, and the questions used during these interviews included perceptions of the design principles, recommendations to improve them and their potential suitability for use to democratise educational game design. Feedback questionnaires, completed by each participant individually, were completed at the beginning and at the end of both days. The participants were asked to fill out individual questionnaires that comprised open-ended questions and Likert scales, and these included background information, their previous experiences designing games, their perceived

learning about educational game design acquired using the design principles and ideas to improve the design principles. All these resources can be accessed as open-source documents in Myers (2021).

Ethical Clearance

This research followed the ethical standards and processes of the Open University. The research design for each study was approved by the university's Human Research Ethics Committee.

Results and Findings

This section presents the results and finding of this research — it first introduces evaluative data, presenting the results related to using the design principle in practice during two Game Jams. The section then presents the final list of the 13 design principles.

Questionnaires

The questionnaires were used to assess the participants' learning about educational game design during the Game Jam, and their views on the potential relevance and usefulness of the design principles to democratise educational game design.

The first question aimed at capturing participants' perceived learning about educational game design by using the design principles and used a Likert scale ranked from 1 (None) to 5 (A lot) — the responses are presented in Table 1. Three participants (P), namely P5, P17 and P21, reported having some previous experience in the design of educational games. Their responses are marked with an asterisk in the following table.

Table 1: Perceived Learning about Educational Game Design by Discussing the Design Principles

Perceived Learning using Design Principles	Frequency	Participants
1 (None)	*0*	
2 (A little)	*0*	
3 (Some)	*5*	*P4–P5* –P16- P19 – P20*
4 (Very much)	*7*	*P3–P8-P9-P11-P14-P18-P22*
5 (A lot)	*11*	*P1-P2-P6-P7-P10-P12-P13-P15-P17*-P19-P21*

As Table 1 illustrates, all participants reported learning 3 (Some), 4 (Very much) or 5 (A lot), with 11 participants responding 5 (A lot). The responses by the three participants who had previous experience with educational game design were similar to the rest of the participants as two of them reported learning 5 (A lot) and one of them 3 (Some), suggesting that these participants could also learn about educational game design by accessing the design principles. All participants, including the ones with previous experience designing educational games, reported satisfactory levels of perceived learning about educational game design accessing and using the design principles.

Participants were also asked about the usefulness of the design principles to support them with ideas to design educational games. The responses per participant are presented in Table 2.

Table 2: Usefulness of the Design Principles per Participants to Provide Support with Ideas to Design Educational Games

Reported Usefulness	Frequency	Participants
1 (Not at all)	*0*	
2 (A little)	*0*	
3 (Reasonably)	*2*	*P9-P22*
4 (Very)	*11*	*P1-P2-P3-P4-P5*-P6-P8-P9-P14-P17*-P18*
5 (Extremely)	*10*	*P7-P10-P11-P12-P13-P15-P16-P20-P21*-P23*

This table shows that 21 participants reported that the design principles were either 4 (Very) or 5 (Extremely) useful to support them with ideas to design educational games, suggesting that the design principles were appreciated by the majority of the participants as a supporting resource to design educational games for social change.

The participants were also asked to report on how much they would recommend these design principles to people who intend to design educational games. The responses per participant are presented in Table 3.

Table 3: Responses per Participants on how much they would Recommend the Design Principles

Recommendation to Design Educational Games	Frequency	Participants
1 (Not at all)	*0*	
2 (A little)	*1*	*P16*
3 (Reasonably)	*1*	*P8*
4 (Very)	*9*	*P1-P4-P5*-P6-P9-P11-P13-P14-P19*
5 (Extremely)	*12*	*P2-P3-P7-P10-P12-P15-P17*-P18-P20-P21*-P22-P23*

This table shows that in total 21 participants would recommend the design principles either 4 (Very) or 5 (Extremely), which suggests that the design principles were appreciated by the majority of participants as resources to design educational games. An open-ended question asking the participants to justify their response was answered by 16 participants. Ten of the 16 (63%) described

the information presented as valuable, which is exemplified by P7 who expressed "lots of great information communicated in a very understandable way" and P14 who said "they are great to get information and think critically about how to encompass the social issue within an educational game structure". P16, P19 and P20 commented that the amount of information presented for each principle felt like it was too much information when first received. Participant P10 said that they were eye-opening on how complex educational game design is, P16 said that they present patterns to follow to design educational games and P18 expressed that the game elements were inspiring.

Regarding the practical use of the design principles, the main findings are that, first, they were perceived as useful to learn about educational game design and support groups with ideas to design educational games by most participants. Second, that the majority of participants would recommend the design principles to people who intend to design educational games on social issues. And third, recommendations to improve the use of the design principles included reducing the amount of textual information.

Group Interviews

The group interviews were used to evaluate the application of the design principles into games and gather a general impression about their potential suitability to learn about educational game design. The transcripts of the interviews on educational game design were coded and categorised into *the use of the design principles* and *feedback on the design principles.*

Concerning the use of the design principles, all groups mentioned that the information presented was either 'useful' or 'helpful' to design their educational games. This is exemplified by P7 who said, "I think that they are really useful resources. Without them I wouldn't know how to do it, how to design a game that creates learning" and P9 who said, "To define the interactional model of the games these [design principles] are very useful, they help us define a structure – to define how to reach the learning outcome of our game." Another group mentioned that it was difficult to use them at first and suggested that a presentation illustrating how to use them with examples would have improved their understanding. Regarding the collected feedback on the design principles, two groups suggested reducing the amount of text to improve the design principles' layout.

Observation Notes

The observation notes were used to identify potential issues when groups used the design principles. The data reported that all groups needed clarification on how to use the design principles when they first received them. In response to this, the lead researcher supported the participants with information related to the objectives of the design principles, and why these were used as part of the Game Jam and used examples to support instructions. This enabled all the groups to discuss each of the principles and select the ones to be used in their games. Based on the data collected, the following section introduces the design principles as an outcome of this research.

Design Principles

This section now introduces the final list of the 13 design principles, validated during the evaluative study. As presented, the objective of the design principles is to democratise the design of educational games to facilitate critical thinking and learning about social issues by supporting novice groups in exploring, understanding and implementing practices of educational game design on the topic of

social change. Each principle is composed of a short description, together with insights on why it could be used to tackle social issues and examples of how it could be applied in games. These principles were presented in a *flash card* format, and the final set of 13 cards are published online and shared using open access policies[v]. The final list of the 13 design principles is presented in Table 5. The game elements could not be introduced in this table but can be found directly on the cards for each principle introduced above.

Table 5: 13 Design Principles

Design Principle and Subtitle	Example	Use to Create Social Change	Use to Design Games	Game Example
1. IDENTITY - *People's sense of identity changes as they learn*	*Studying engineering helps people develop their identity as engineers*	*Learning about inequalities can change the way people perceive life experiences*	*Players develop an identity through their characters experiences*	*The Sims is a simulation game that allows players to project their identity through their characters. It also invites players to explore different identities by playing multiple characters.*
2. CUSTOMISATION - *People have different preferences about how they process and remember information*	*Some people learn better from visual representations than from text*	*Flexibility over how to learn about a topic helps people discover ways of learning that suit their skills and abilities*	*Games can offer a range of different learning and playing styles*	*In the football game FIFA, players can customise the level of difficulty and competition within their games.*
3. CO-DESIGN - *Learning as an active process involving interaction with other people*	*Asking questions and discussing topics helps people develop their own understanding and learning*	*Social interaction enables people to learn from one another*	*Players' actions with characters or other players shapes their gaming experience*	*The game Nanocrafter is a scientific discovery game that invites players to explore biology and develop research ideas in an online community of experts and other players.*

Design Principle and Subtitle	Example	Use to Create Social Change	Use to Design Games	Game Example
4. MANIPULATION AND DISTRIBUTED KNOWLEDGE - *Manipulating things in an environment supports immersion and facilitates learning through exploration*	*Understanding cultures can be enhanced by visiting countries as well as reading about them*	*Critically engaging with other people and objects in different contexts enables people to question and extend their knowledge*	*Controlling characters and objects helps a player to become immersed in the game*	*In Quandary players lead a new human colony where they need to make ethical decisions based on the testimonials of characters they meet.*
5. WELL-ORDERED PROBLEMS - *Solving problems in an increasing order of difficulty enhances learning*	*Learning dance steps before performing a dance*	*Starting by reflecting on inequalities in one's own life helps understand larger social issues*	*The first levels of games help players acquire skills that are needed later in the game*	*In Dragonbox Algebra 5+ players learn to solve complex calculations. They start with very simple sums before solving more complex equations.*
6. PLEASANTLY FRUSTRATING - *Creating challenges that feel hard but achievable enhance learning*	*Playing sports against people at a similar level makes the competition pleasantly frustrating*	*People feeling empowered to learn and act is essential for social change*	*Games adjust the level of difficulty of challenges and give feedback to players*	*Just Dance is a dancing game with increasingly complex moves.*
7. CYCLE OF EXPERTISE - *Developing expertise through practice*	*Musicians progress through their grades by practising and performing set pieces of music*	*Learning through cycles of reflection (theory) and action (practice) helps people understand social issues*	*Games create cycles of expertise through levels where players develop expertise at solving challenges*	*CodeCombat is a game where players learn how to program. Every line of code written has a direct consequence in the game that the players observe.*

Design Principle and Subtitle	Example	Use to Create Social Change	Use to Design Games	Game Example
8. INFORMATION - *Providing information when needed enhances learning (e.g., information just-in-time or on-demand)*	*Road signs are examples of just-in-time information (information used directly) and websearch is an example of on-demand information (access more information when desired/needed)*	*Encouraging curiosity and reflection helps people make use of available information*	*The rules of the game are available on-demand as a manual or just-in time as instructions*	*Spent is a game about surviving poverty and homelessness. Players are given facts about homelessness and poverty to inform their decisions in the game.*
9. FISHTANKS - *Fishtanks are used to manage complex problems by controlling separate elements of the problem*	*Scientists study river ecosystems by analysing fish in a fishtank and gradually adding more elements from the river environment*	*Discussing acts of institutional discrimination helps people understand the causes of social inequalities*	*Games use fishtanks to avoid overwhelming players*	*1979 Revolution is a game about the Iranian revolution. Players take the role of a photojournalist to explore the moral dilemmas of increasing complex situations.*
10. SANDBOXES - *Sanboxes are realistic learning spaces where risks are managed to encourage discovery*	*Architects create models of houses before building them*	*Discussing different perspectives encourages people to explore social issues and learn without fearing failure*	*Games offer sandbox levels where players can explore the game without risks*	*Bury Me, My Love is a game where a Syrian couple communicates by phone message. The player messages his wife to help her while she flees to Europe as a refugee.*
11. SKILLS AS STRATEGIES - *People learn and practice skills better when they understand them as strategies for accomplishing their goals*	*Understanding the importance of practice and training everyday helps athletes win competitions*	*People learn and practice ways of treating people fairly as a strategy to reduce social inequalities*	*A player learns and practices specific skills as a strategy to win the game*	*In the Citizen Science game, players learn about responsible actions to save a lake from pollution.*

Design Principle and Subtitle	Example	Use to Create Social Change	Use to Design Games	Game Example
12. SYSTEMS THINKING - *Understanding how skills, strategies and ideas fit into the big picture help people learn*	*Understanding climate change helps people explain the importance of recycling*	*Understanding the shape of society helps people explain everyday inequalities*	*Knowing the objective of the game helps players to understand how to play it*	*Parable of the Polygons is a segregation simulator used to explore the interaction between social group size and proximity. The players move four types of polygons to form happy groups.*
13. MEANING AS ACTION - *Concepts and words are more meaningful when they are tied to personal experiences*	*People's understanding of pollution is based on their own experiences of it*	*Using examples from everyday life experiences helps people understand inequalities*	*Games enable concepts and words to be understood through the player's experiences*	*Depression Quest lets people play the role of someone living with depression. The game raises awareness of depression and suicide prevention.*

Discussion

This paper introduces an approach to democratise educational game design addressing a topic that stands as a social issue. This approach is grounded on Critical Pedagogy to propose design principles for supporting the inclusive participation of novice and diverse groups in educational game design processes. This paper focuses on the design principles only, although the Game Jams needed resources to support participants in other aspects, such as the ideation phase and developing the educational games (Myers, 2021).

This research illustrates the relevance of adopting the principles proposed by Gee (2005) as a foundation to democratise educational game design, and to explicitly connect them with Critical Pedagogy to tackle social issues. The synergies between the principles of Gee (2005) and the principles of Critical Pedagogy were revealed with the recognition that the ideas they presented were based on related educational pedagogies and were targeted at similar educational outcomes. It was also identified that these principles were complementary, given that the principles of Gee (2005) presented insights on how to trigger learning in games, while Critical Pedagogy presented pedagogical techniques to improve critical thinking and learning as well as to raise awareness of social issues. This research argues that aligning Gee's (2005) principle with Critical Pedagogy by considering their similarities and complementarities contributed toward selecting, structuring and presenting information in an adequate way to democratise knowledge of educational game design on social issues.

This research evidences the suitability of the proposed design principles from theoretical and practical perspectives. The theoretical perspective was validated by James Paul Gee and John Lockhart

regarding foundational relevance of the proposed principles. The format and content of the design principles were confirmed as suitable to both support learning about educational games and to design them in practical terms during the Game Jams and the analysis of their outcomes.

The findings of this research must be seen in the light of some limitations. The first limitation concerns the evaluation of the learning acquired by the participants of the Game Jams. The analysis of learning was conducted using responses based on the participants' perceptions. Therefore, the results can only be used as indicative measures and not as an objective evaluation of learning. Perceptions of learning were considered relevant for this research, since the proposed design principles were developed to make participants feel empowered to learn and able to create educational games on social issues. Another limitation is related to the number of participants, as the design principles were evaluated by 23 people and in London. Arguably, applying the proposed design principles by participants in different contexts could reveal additional issues that would need to be considered to adapt the use of the design principles. These could include translation needs, validation and/or contributions to their content by local or regional groups and redefining the game examples to align them with regional experiences and popular games. Lastly, the design principles were validated in Game Jam scenarios. Using these design principles in other settings could present additional opportunities and challenges, such as exploring their potential relevance to be used to design educational games that could be launched in the gaming industry, and how (if at all) they could contribute to improving players' learning outcomes about social issues.

Conclusion

Emerging evidence shows that diversity, for instance in age, ethnicity, race, sexual orientation, and gender, within groups of designers plays a crucial role in improving the efficiency and inclusivity of educational games. Educational games have also been widely used as immersive, fun and impactful tools to raise awareness of social issues. Democratising the design of educational game design on the topic of social issues by enabling broad audiences to create such games, stands as an opportunity to enable anyone to improve learning outcomes through gaming by sharing diverse and inclusive experiences, knowledge and perspectives.

This study explored ways to apply and adapt educational game design practices and pedagogical techniques to be accessible and used by broad audiences, that include novice and diverse groups. This research contributes to the literature on educational game design by presenting insights on how and what kind of resources are needed to democratise knowledge of educational game design on social issues. It is argued that this information should address *what* could be done to trigger learning in games by presenting principles of educational game design; *why* this learning could be facilitated, from both educational and gaming perspectives and; *how* to implement these principles into a game. These design principles can support groups, particularly those that are novice and diverse, in owning and participating in educational game design processes by enabling them to access, apply and reflect upon specialised knowledge related to pedagogy, educational game design and social issues. In addition, the design principles can also be used to directly design educational games for social change and can contribute toward capacitating the potential of educational games to facilitate awareness of a social issue, critical thinking and potentially triggering a social change.

Future investigation is necessary to evaluate the relevance of the participants' suggestions to improve the design principles application. These include evaluating additional guidance with examples illustrating how to use the design principles. The design principles could also be applied to tackle social issues other than gender inequalities, such as racism, discrimination against the LGBTQ+ communities, and religious discrimination, and their potential relevance could be rigorously evaluated. This research validated the use of the proposed design principle to support Game Jam participants in learning about educational game design and implementing such principles in their games. Future investigation could build on these findings and explore the use of design principles to support groups in fully developing the games, perhaps in a context different from a Game Jam, where the games are more likely to be fully completed and implemented into the gaming industry.

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Notes

[i] E.g., Game for changes (www.gamesforchange.org), which is a label, proposed by a non-profit organisation, that encompasses games that have educational components and that intends to create social change.
[ii] https://playspent.org/
[iii] See statistics: https://www.whitenoiselab.com/interactive/spent
[iv] This framework can be accessed here: https://ordo.open.ac.uk/articles/presentation/Framework_to_democratise_educational_game_design_on_social_issues/12458285/1
[v] The cards can be found online at the following URL: https://figshare.com/articles/figure/Educational_Game_Design_Cards/7466879

Appendix

Table A: Educational Game Attributes, Educational Game Elements and References

Educational Game Attributes	Educational Game Elements (ideas for implementing educational game's attributes)	References
Access to Educational Information	*• Integration of voices • Text • Verbal communication • Photographic content • Link to external webpage • Information about the game • Information on characters • Educational purpose • Signs • Reminders • Indications • Hints*	*Schrier (2019); Beetham (2008); Gee (2005); Laurillard (2013); Prensky (2008)*
Assessment and Feedback	*• Scoring • Ranking • Tracking performance • Numerical score • Sensory stimuli (e.g. explosion as indication of result) • Gaining/losing lives • Progress bar • Dashboards • Virtual currencies • Progress tree • Rewards • Feedback as motivation and information on performance • Opportunity to learn from mistakes • Feedback given by the game, characters or objects • Self-evaluation feedback • One way to finish the game • More than one way to finish the game • Incomplete or unresolved endings • Hints on available actions • Encouraging actions by a reward or penalty • Tutorials levels with no consequences • Repeat task or level when player loses • Re-entry level*	*Schrier (2019); Lameras et al. (2017); van Staalduinen (2011); Wilson et al. (2009); Carvalho (2017); Elverdam and Aarseth (2007); Kiili (2005); Michael and Chen (2005); Dempsey et al. (2002)*
Customisable Game Features	*• Customisable feedback • Customisable pace • Customisable solution parameters (access to hints, etc) • Multiple player options (e.g. collaborative or competitive) • Customisable level of pressure • Different types of rewards • Customisable appearances of character • Personalised character names • Time adjustment • Increase or reduce the number of hints • Tracking performance • Customisable playing styles e.g. achievers (winning points), socializers (social interactions), explorer (discovering areas) or fighters (competition) • Customisable learning styles e.g. visual learners (visualising information), auditory learners (hearing information), reading or writing learners (using text), kinesthetic learners (hands-on experiences)*	*Schrier (2019); Carvalho (2017); Flanagan (2009); Gee (2005); Lindley (2003)*
Designers' Intentions	*• Text or verbal recording on character design (cloths, gender, ect) • Text or verbal recording on game environment (research, historical background, etc) • Presentation of designers' values • Introduction of designers*	*Schrier (2019); van Staalduinen (2011); Flanagan (2009); Gee (2005); Lindley (2003)*
Game Objectives and Rules	*• Description of rules • Access to instructions • Game instruction • Questions and answers • System rules • Procedural Rules • Imported Rules • Descriptions of character's goals • Tutorials about character's goals • Pop-up information and reminders • Illustrations of the consequences of player's actions • Irreversible consequences • Replay opportunities • Cut scenes to recap and set goals*	*Lameras et al. (2017); Wilson et al. (2009); O'Connor & Menaker (2008); Blunt (2007); Amory (2007); Kiili (2005)*

Educational Game Attributes	Educational Game Elements (ideas for implementing educational game's attributes)	References
Gaming Atmosphere	*• Fantasy adventure • Trusting environment • Realistic atmosphere • Everyday interactions • Authentic speech and dialogue • Letters from characters • Photos from the past*	*Schrier (2019); Wilson et al. (2009); Habgood et al. (2005); Owen (2004)*
Gaming Environment	*• Description of boundaries within the games • Definition of time • Definition of game scope • Theme of game • Genre of game • Different contexts in the game*	*Schrier (2019); van Staalduinen (2011); Wilson et al. (2009); Elverdam & Aarseth (2007)*
Goals	*• Definition of gaming goals • Definition of educational goals • Short-term goals • Long-term goals • Missions within the game • Map of the game • Overview of strategy • Description of characters' duties • Illustration of progress in game • Illustration of character's progress • Descriptions of character's goals • Tutorials about character's goals • Pop-up information and reminders*	*Wilson et al. (2009); O'Connor & Menaker (2008); Carvalho (2017); Amory (2007); Kiili (2005); Gee (2005); Garris et al. (2002)*
Interactions	*• Dialogue between characters • Friendships between characters • Listening to other characters/objects • Non-verbal communication • Physical interaction between characters • Use of communicative symbol • Romantic interactions between characters • Dialogue between players • Listening/speaking to other players • Multiplayer features • Community building activities between players • Integration with social media platforms*	*Schrier (2019); van Staalduinen (2011); Carvalho (2017); Wilson et al. (2009); O'Connor & Menaker (2008); Amory (2007); Dempsey et al. (2002); Prensky (2008)*
Learning Activities	*• Reflective opportunities • Creative writing • Memorising activities • Labelling diagrams and concepts • Incomplete statement • Web-quest • Scientific experiments • Brainstorming activities • Open discussions • Guided discussions • Debates • Calculation • Question-asking activities • Citation reading • Creative expression • Deliberation • Persuasion/negotiation activities • Reading activities • Test skills in the game • Access to explanations and training • Mentoring by other characters*	*Schrier (2019); Lameras et al. (2017); Carvalho (2017); Beetham (2008); Laurillard (2013)*
Players' Curiosity	*• Unusual analogies • Unusual situations • Surprises • Mysterious scenes • Vivid visual • Vivid auditory • Mysterious characters • Unexpected skills or abilities of character • Counter-stereotype characters • Unpredictable character personalities • Character's secrets*	*van Staalduinen (2011); Wilson et al. (2009); Amory (2007); Garris et al. (2002)*
Problem-Solving Activities	*• Game levels • Tutorials • Increasing levels of difficulty • Use of acquired skills or knowledge • Structured problems • Overview of the problem • Problems provided by the player, other characters or game events • Multiple ways to solve a problem • Problems presented as conflicts • Decomposition of problems • Repeat challenges • Interviews with characters*	*Schrier (2019); van Staalduinen (2011); Carvalho (2017); Amory (2007); Dempsey et al. (2002); Prensky (2008)*

Educational Game Attributes	Educational Game Elements (ideas for implementing educational game's attributes)	References
Story and Narrative	*• Story presented through character interactions • Story presented through environment exploration • Introduction of a protagonist • Introduction of the story • Story plot (e.g. conflict, implications and resolutions) • Perspective of storyteller • Skip scenes • Emotional stories • Dramatic scenes • Story premise • Atmospheric music • Sound effects • Characters' voices*	*Schrier (2019); Lameras et al. (2017); Wilson et al. (2009); O'Connor & Menaker (2008); Lindley (2003)*