Harnessing the Power of Gaming to Influence Policies Addressing Climate Change

Paul Hollins[1], Paul Watson[2], Anchal Garg[3], Jude Ower[4], Joost Schoor [5], David Griffiths [6], Barbara Kieslinger [7], Katharina Koller [8] and Jane Yau [9]

[1,2,3] University of Bolton, UK
[4,5] Playmob, UK,
[6] UNIR - International University of La Rioja, Spain
[7,8] ZSI, Vienna, Austria
[9] DIPF, Frankfurt, Germany

Pah1@bolton.ac.uk
P.Watson@Bolton.ac.uk
A.Garg@bolton.ac.uk
jude@playmob.com
joost@playmob.com
Daivd.Griffiths@UNIR.net
Kieslinger@zsi.at
KKoller@zsi.at
Yau@DIPF.De

Abstract: In this paper, the authors present the findings of an empirical case study examining the efficacy of the Games Realising Effective & Affective Transformation (GREAT) Case Study design process. The process is underpinned by an established Mixed Methodological Research (MMR) framework for eliciting the preferences of gamers and determining their priorities in climate change policies. Funded by the Horizon Europe programme, the GREAT Project examines the impact and affordances of games for social engagement. The project explores the innovative potential of games as new forms of dialogue between citizens and policy stakeholders. The games are used as tools for players to express their preferences and actively shape policy issues. We present the first case study on this approach, which is one of ten to be undertaken with various partners over the next two years to test and validate the methodology, investigate its potential, and present findings. In partnership with the popular PC & Console game Smite, by the Hi Rez, game development studio. The study involved stakeholders' participation in the co-creation of research questions, designed to influence the prioritisation of future climate policies. The activity was embedded the Smite game playing community via the Playmob platform in January 2024 and engaged over four thousand active players with a completed response rate of 58 %. Quantitative analysis of the data collected during this period will be presented by the authors. In summary, the engagement in and completion rates of the activity were high, validating the initial GREAT project approach. The methodological approach and the substantive data sets produced are of interest to any organisation considering engaging diverse groups active in gaming communities in the political process, including NGOs and policymakers. The project and methodology applied is at the core of this paper.

Keywords: Digital Games, Applied Games, Policy, Climate Change, Data, Games Base Learning, Society

1. Introduction

This paper Reports on the findings of an exploratory case study of a European Commission (EC) and United Kingdom Research and Innovation funded three-year GREAT project. The project involves seven partners across Europe and aims to enhance citizens dialogue with governments and policy agendas relating to actions to mitigate climate emergency, using the medium of gaming to facilitate this. The scope of the paper does not address the sustainability of the digital Games industry per say but how the industry and specifically the associated playful development techniques for player engagement could be meaningfully deployed to address wider societal sustainability challenges. The growth of digital games over the last decade has been a remarkable phenomenon and this raises important questions about the cultural role and meaning of games and the potential for games to be applied for learning or social good over and above their core purpose of entertainment. Collaborative virtual gaming environments can support a variety of pedagogic approaches and can be applied, for example, 'as both constructivist learning environments and as didactic instructional tools' (Whitton & Hollins 2008).

The digital games industry is now a larger economic sector than either of the music or film industries and is estimated to have generated $180.3 billion in the year 2021 (Wijman, 2021). There is no consensus on the positive or negative nature of the impact of games on wider society though much has been written about

specifically children's over exposure to screen time and the negative impact of social media and forms on wellbeing. 'Serious' or 'Applied' games are considered a major emerging technology anticipated to enter mainstream use, in wider society Steiner et al (2015) In parallel, the proportion of (EU) citizens declaring dissatisfaction with functioning democracy in their countries has risen markedly. The deterioration has been especially evident within high-income, consolidated democracies, where the proportion has risen from a third to half of all citizens." (Foa et al., 2020). Similarly, the rise of 'fake' news and distrust of news sources and 'scientific 'information is at an all-time low (United Nations 2021). This dissatisfaction and mistrust correlate with increased scepticism and has occurred in an environment where the volume of data generated through citizens everyday interactions and transactions with media is increasing. Analysis of data has increased to the point that it has significant impact, that social media is contributing to a polarizing society (Vrontis et all 2022). It is in this context that the GREAT project was established aiming to explore these dilemmas through applying games technologies, designed to achieve positive transformation, restore community engagement and satisfaction with democracy and democratic processes. It does this by contributing to the establishment of policy priorities for addressing the challenges presented by climate change and by utilising the opportunities presented by the collection and storage of citizen generated data to bring together communities, in an open, ethical process.

The first case study undertaken by the project is an exploratory study for the United Nations Development Programme (UNDP). The paper provides detail on the methodology applied to the project and how this is elaborated through a research cycle and the steps undertaken in the cycle to examine the problem space this is framed within the context of the overarching research questions to be addressed in the project followed by discussion and interim findings and conclusions of this, the first of a series of, case studies to be undertaken in the project.

2. Methodology

In this section the authors provide detail on the methodological approach adopted and how this is reflected in the selected methodology applied to the study. The challenge facing the project is to apply games not simply to promote learning or social attitudes, but rather to gain insight into the cultural role of games through case studies which establish a new communication channel between citizens and policy makers centred around transparency and actionable insights. The project is oriented to the goal of harnessing the cultural and communicative value of games to provide an opportunity for input and feedback for citizens who may not normally engage in socioeconomic debates, and new sources of insight for policy stakeholders. The games and interventions co-designed and implemented are not one-off solutions acting as research tools that explore the effectiveness of the approach, establishing a method and data sources for future adoption.

Project activities support scalability and adoption from the outset, with case studies which test the concept and apply it in authentic conditions at a scale of genuine value to the policy stakeholders. This undertaking is built on three well-founded assumptions:

1. Games constitute a rich source of data that can reveal a great deal about players' engagement, preferences, and attitudes. However, this is closely guarded by publishers and developers as a competitive advantage in optimising their games. This data constitutes a huge opportunity to draw out insights into social preferences and attitudes at scale, but this requires new methods of gathering, storing and analysing data, and new forms of engagement with stakeholders, together creating an engagement ecosystem.
2. Data analytics developed methods to extrapolate from online interactions to gain insight into citizens real-world experiences. The online interactions of game players generate a similar stream of data, and analytics methods can be adapted to reveal the connections between game-world interactions and players' engagement with and attitudes towards real world experiences and issues.
3. Policy stakeholders require informed insight into citizens preferences and attitudes. Policy stakeholders are open to and will engage with this input. This is supported by the active engagement of policy makers in the project and the participatory Citizen Science approach that engages all stakeholders from the onset.

The methodological approach is situated with an established interdisciplinary framework an adaptation of the Multi Interdisciplinary Research (MIR) (Tobi & Kampen 2018) framework to refine methods and instruments of research based on synthesis of established community intervention/ co design evaluative methods).

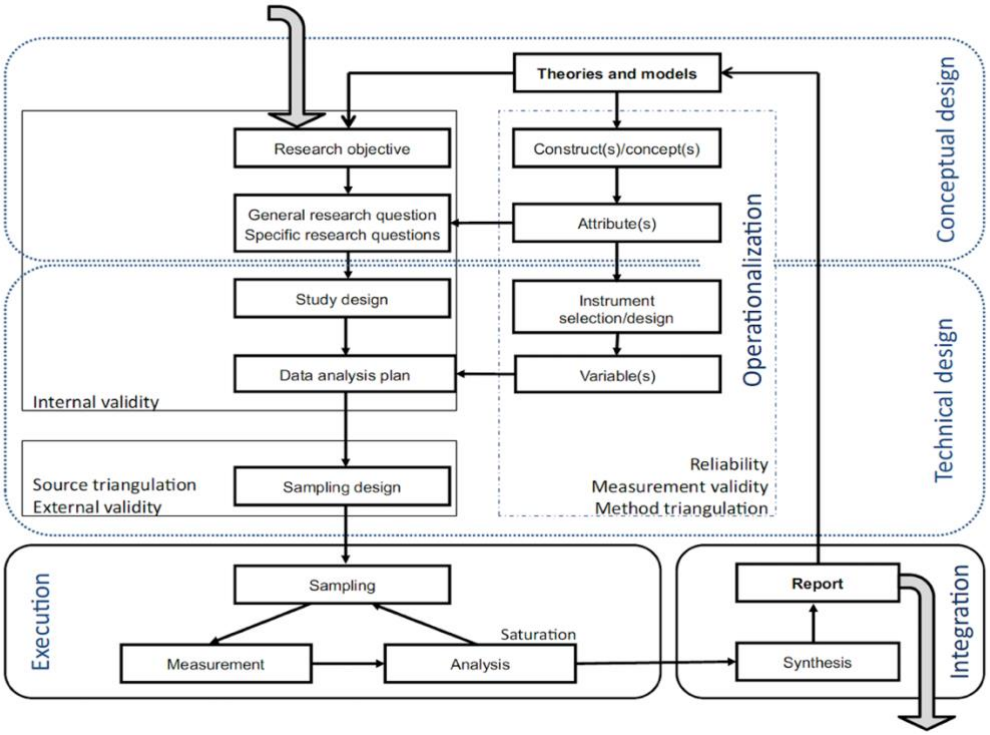

Figure 1: An adaptation of the MIR Framework (Tobi and Kampen 2018)

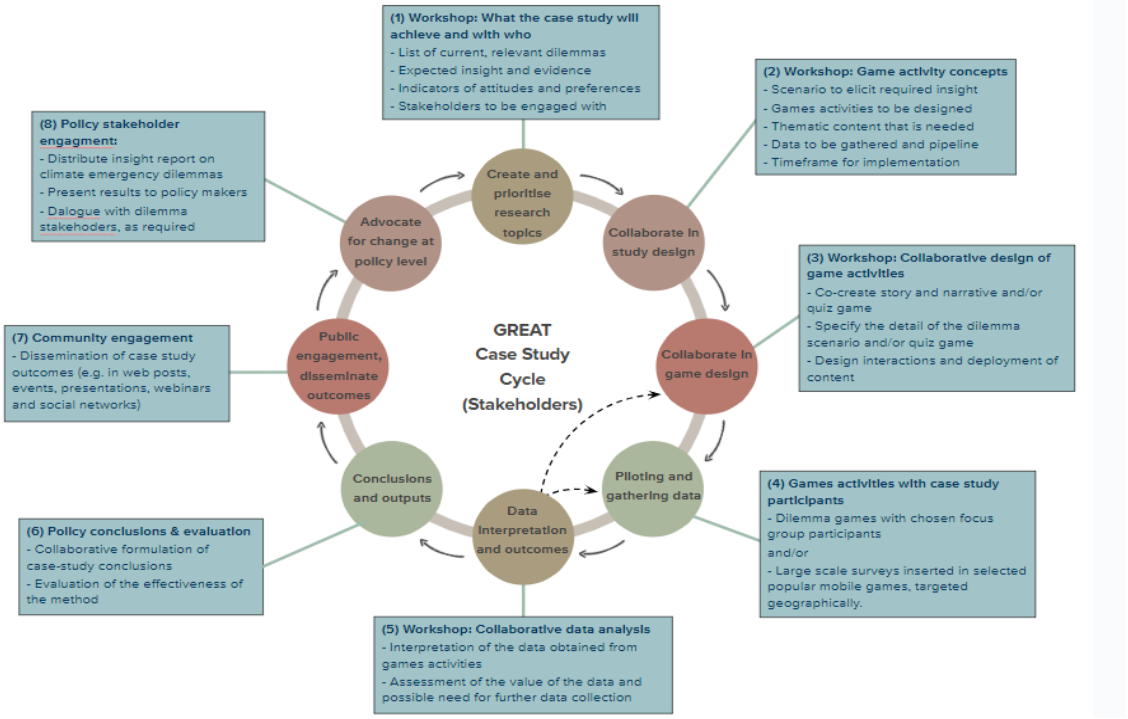

Figure 2: GREAT Case Study Cycle

The research question underpinning the initial steps of the case study displayed in this paper is: *How effective are games-based activities in eliciting, representing and communicating citizens' views on social dilemmas?*

This study utilizes the GREAT case study methodology [Figure 1 and Figure 2] which implements processes involving both policy stakeholders (UNDP) and citizens (Players). Thus, this methodology provides a link between policy and the public.

Table 1: UNDP exploratory Case Study Research Cycle Steps

Step 1: *What the case study will achieve and with who*	Participating stakeholders will participate in a workshop or equivalent activities to identify and prioritize the research topics.
Step 2: *Game activity concepts*	Participating stakeholders will join a workshop or equivalent activities to generate ideas for the game activity.
Step 3: *Collaborative design of game activities*	Participating stakeholders will engage in activities to co-create research questions based on strategic requirements
Step 4: *Games activities with case study participants*	Playmob quizzes embedded within the SMITE online game analysis of two methods 'paid for' (where links to the games are provided by paid advertising) and 'Non Paid' (where the quizzes are embedded directly in the gameplay).
Step 5: *Collaborative data analysis*	Data analysis undertaken using the collected data.
Step 6: *Policy conclusions & evaluation*	Formulate the conclusions that can be drawn from the results of Step 5.(outside the scope of this paper)
Step 7: *Community engagement*	Promote community engagement activities that are impacted by the policy dilemma and identify dissemination opportunities. (Outside the scope of this paper)
Step 8: *Policy stakeholder engagement*	Close the cycle by engaging with policy stakeholders, and in particular the policymakers who identified the dilemma addressed by the case study. (Outside the scope of this paper)

The GREAT case study methodology follows an eight-step process, each stage providing details for co-design and implementation. The work presented in this paper focuses on step 4, the remaining steps of the case study which are beyond the scope of this paper will inevitably close the loop on the cycle in future research, through detailed policy insights, policy stakeholder dissemination and the presentation of results directly to policy makers, the purpose of each step is listed in Table 1.

The project objectives and steps in the cycle determine the types of activities and participants to be involved in the co-design processes, i.e. citizens, domain experts, policy stakeholders and policymakers etc. The following section outlines the steps of the methodology in relation to the UNDP exploratory case study.

3. The Research Cycle Implementation

In this section we discuss the GREAT research cycle and how this was applied to the UNDP exploratory study.

3.1 Create and Prioritise Research Topics. (Step 1)

The research topics in the exploratory case study were developed by the United Nations Development Programme to address key themes identified in their organisation policy documents.

3.2 Collaborate in Study Design. (Step 2)

UNDP collaborated with the GREAT researchers to developing a set of questions to engage players in the climate change debate. The questions were a refined and improved version of questions previously developed in consultation by UNDP with key stakeholders for the Peoples Climate Change Vote and the University of Oxford using a polling method. The questions were refined by the GREAT team with input from partners ZSI and UoB.

The following research questions were developed to be embedded within the selected digital game (SMITE).

- What should the world do about climate change?
- To address the climate crisis, how should your country improve transport?
- To address the climate crisis, what should your country do about energy?
- To address the climate crisis, what do you think your country should do about nature?
- To address the climate crisis, what should governments do about farms and food?
- To address the climate crisis, what should governments do about the economy?
- How can your country better protect people from extreme storms, flooding, droughts, forest fires and other climate impacts?
- Do you think games can contribute to resolving climate change?
- In your view How do you think games could best help tackle climate change?
- What climate topics do you think games can best cover?

- Age.
- Gender.
- Level of Education.

3.3 Collaborate in Design of Games-based Activities. (Step 3)

In collaboration with UNDP stakeholders the game studio partner selected to be a collaborative partner for the UNDP GREAT case study was SMITE which provided free access to the game.

Smite was selected as the game had a high number of active users whilst not being of a scale that could present difficulties in terms of data management for this exploratory study. It was recognised the game had predominantly male players and future case studies aims to address gender balance in a more effective way.

SMITE is a game originally published in 2014 a free to play third person Multiplayer Online Battle Arena (MOBA) digital game developed and published by the Hi-Rez studios for multi platforms including the Microsoft X Box, Sony PlayStation 4, Nintendo Switch and Amazon Luna. In the game players control a 'god' 'goddess' or other mythological figures to participate in team-based combat activities using their tactics, approaches and ability to engage with other players and non-player characters (NPC) 'minions'. The game has multiple modes and supports an active e-sports community that participate in multiple global tournaments and currently has over ten million global players. The Case study explored two discreet approaches to embedding content in the online game SMITE. The first approach involved exploring the use of paid for advertising using 'google ads' embedded within the game. The second involved directly embedding the research questions into game playing experience.

Two alternative visual approaches were developed by Playmob to engage players. The visual approaches were designed in collaboration by the Playmob and Smite design team. The visual approaches were designed using themes from the game in which the activity would be embedded and to appeal to the SMITE community

3.4 Games Activities with Participants (Step 4)

The game participants were invited to respond to a series of questions relating to climate change.

3.5 Data Interpretation and Outcomes. (Step 5)

The responses to each of the research questions is provided herein:

Question 1 What should the world do about climate change?

2365 Responses 93.8% Engagements

Do everything necessary, urgently (1328) 56.2%

Act slowly whilst we learn more about what to do (835). 35.3%

Do nothing (210) 8.9%

Question 2 To address the climate crisis, how should your country improve transport?

2297 Responses 91.1 Engagements

Use more clean electric cars, busses or bicycles (1367) 59.5%

Transport goods on planes, ships, trains and trucks that run on clean energy (1101) 47.9%

Improve the design and planning of cities and rural communities (1463) 63.7%

None of the above (226) 9.8%

Question 3 To address the climate crisis, what should your country do about energy?

2255 Responses 89.4% Engagements

Use solar, wind and renewable power (1710) 75.8%

Waste less energy in homes, buildings and factories (1077) 47.8%

Stop burning fuels that pollute (1215) 53.9%

None of the above (231) 10.2%

Question 4 To address the climate crisis, what do you think your country should do about nature?

2221 responses 88.1% Engagements

Keep the Oceans and waterways healthy (1852) 83.4%

Conserve forests and land (1744) 78.5%

Support local communities, indigenous peoples and women that are environmental stewards (1104) 49.5%

None of the above (127) 5.7%

Question 5 To address the climate crisis, what should governments do about farms and food?

2205 responses 87.5% engagements

Use climate friendly farming techniques (1630) 73.9%

Reduce food waste (1639) 74.3%

Promote plant-based diets (691) 31.3%

None of the above (207) 9.4%

Question 6 To address the climate crisis, what should governments do about the economy?

2185 responses 86.7% engagements

Invest more money in green business and jobs (1439) 65.9%

Require more information on how products are made (1272) 58.2%

Make companies pay for their pollution (1520) 69.6%

None of the above (195) 8.9%

Question 7 How can your country better protect people from extreme storms, flooding, droughts, forest fires and other climate impacts?

2165 responses 85.8% engagements

Install more early warning systems for disaster (1436) 66.3%

Provide good affordable insurance (1233) 57%

Build infrastructure and conserve nature to protect lives and livelihoods (1607) 74.2%

None of the above (157) 7.3%

Question 8 Do you think games can contribute to resolving climate change?

2164 responses 85.8% engagements

Yes (1244) 57.5%

No (380) 17.6%

Don't Know (542) 25%

Question 9 In your view How do you think games could best help tackle climate change?

2153 responses 85.4 engagements

Raise awareness of climate change (1509) 70.1%

Educate players on what we can do to take action (1305) 60.6%

Raise money for green projects (1435) 66.7%

Enable players to speak up on climate change (1009) 46.9%

None of the above (263) 12.2%

Question 10 What climate topics do you think games can best cover?

2151 response 85.3% engagements

Transport (379) 17.6%

Energy (670) 31.3%

Nature (615) 28.6%

Food and Farms ((408) 19%

The economy (421) 19.6%

Protecting people (335) 15.6%

All of the above (924) 43%

None of the above (227) 10.6%

Question 11 Age.

2147 response 85.2% engagements

Under 18 (102) 4.8%

18 – 35 (1822) 84.9%

36 -59 (224) 10.4%

60 plus (34) 1.6%

Question 12 Gender.

2147 responses 85.2% engagements

Male (1830) 85.2%

Female (191) 8.9%

X (161) 7.5%

Question 13 How old were you when you left education

2120 responses 84.1% engagements

Under 12 (20) 0.9%

12- 16 (83) 3.9%

17-19 (657) 31%

20 or over (803) 37.9%

Still in education (528) 24.9%

Never went to school (29) 1.4%

3.6 Conclusions and Outputs. (Step 6)

The analysis, conclusions and outputs from this study are currently being worked on and outside the scope of this paper which focusseds on the process and methodology applied.

3.7 Public Engagement and Disseminate Outcomes. (Step 7)

Outcomes of the UNDP exploratory case study will be disseminated through established academic publishing channels.

Advocate for Change at Policy Level. (Step 8)

Advocacy and policy interventions are subject to planning with UNDP and outside the scope of this paper.

4. Geographical Context for the Delivery of the Game

This exploratory Case Study was undertaken in a global, international geographical context specified for the delivery of the game. The data collected provides detail of the geographic location of the individual sessions undertaken by players in the game. Players of the SMITE game play on servers predominantly in the United States of America and this has served to highlight that in future studies, where distinct geographical focus may be required, targeted approaches will be taken by the project.

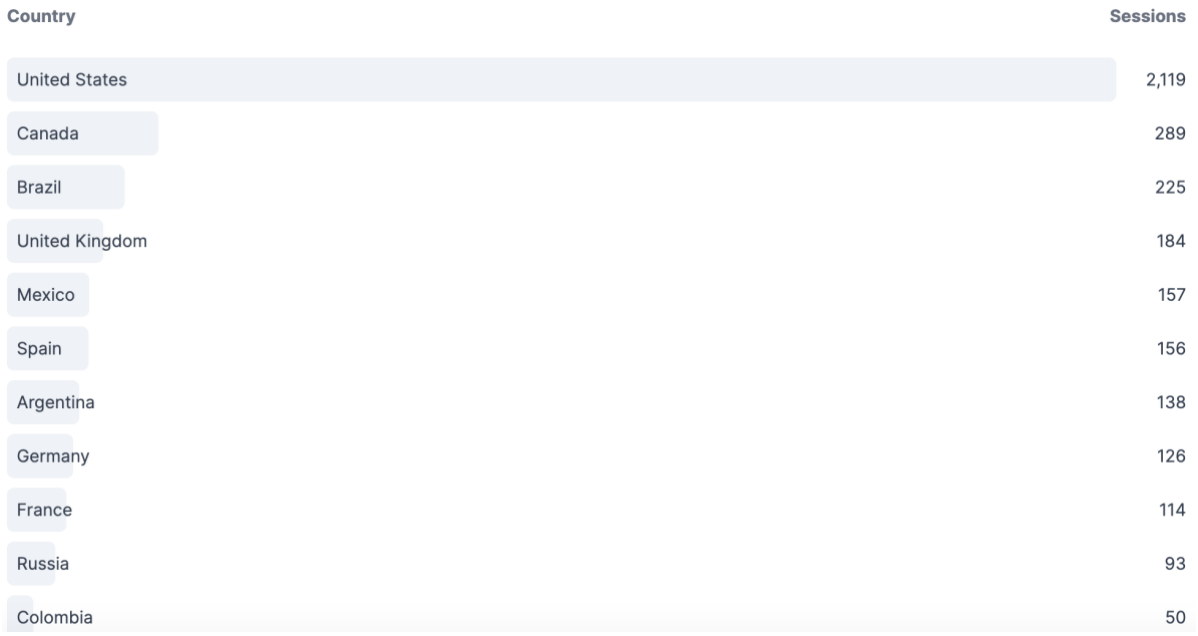

Figure 4: Geographical location

GREAT Project Research Questions.

The overarching research questions of the project were directly mapped to the UNDP exploratory case study activities to ensure alignment with the GREAT project objectives and are detailed in Table 2 below. This ensures that the project research questions are addressed within the case study.

Table 2: Mapping of Project Research Questions to the UNDP exploratory Case Study

GCS 1 United Nations Development Programme (UNDP) Mapping of the Case Study focus and contribution to the GREAT project research questions as proposed.	
Objective 1. Establish ways in which games can be designed to provide a link between citizens and policymakers.	
RQ 1.1: Which methods in digital games can be used to create an information exchange between attitudes and preferences of citizens on societal challenges (e.g., climate change) and policy makers working on these challenges?	Yes
RQ 1.2: How effective and efficient is the use of games in creating an information exchange between attitudes and preferences of citizens on societal challenges (e.g. climate change) and policy makers?	No
RQ 1.3: How can games be used to foster dialogue and collaboration on societal challenges (e.g. climate change)?	Yes
Objective 2. Understand the actual and potential impact that games can have on citizens' engagement in social issues and challenges, and on policy stakeholders' awareness of citizens' attitudes and preferences.	
RQ 2.1: What are the affordances of games in developing citizens' engagement with challenges and dilemmas arising from societal challenges like climate crisis?	No
RQ 2.2: What are the affordances of games in informing policy on the societal challenges like climate crisis?	?
RQ 2.3: What is the value to policy stakeholder groups of the information on citizens' attitudes and preferences generated through games-based activities?	No
RQ 2.4: What is the value to citizens of enabling them to engage in policy discourse through the design of and engagement in games-based activities?	No

GCS 1 United Nations Development Programme (UNDP) Mapping of the Case Study focus and contribution to the GREAT project research questions as proposed.	
RQ 2.5: How generalisable are the GREAT methods to other global challenges or other fields of research and innovation?	No
Objective 3. Provide practical guidance for games developers and policy stakeholders.	
RQ 3.1: Which are the key interventions in the GREAT method which lead to its effectiveness and efficiency?	No
RQ 3.2: Which variables need to be taken into consideration when adapting the method to new contexts?	Yes
RQ 3.3: What documentation and/or training is required for games developers, policy stakeholder groups?	Yes
Objective 4. Assess the benefits and risks to individuals and society of using games to promote engagement with societal challenges.	
RQ 4.1: What are the benefits and risks experienced by citizen participants, policy stakeholders, games designers and providers, as well as policy makers and organizations, when they participate in the GREAT method?	No

5. Discussion

Earlier project pilots carried out in the summer of 2023 and the design of the case study cycle steps made a start on addressing this question. If the method/methods as defined in RQ1.1 are characterised by the step cycle, then case study addresses this, though the early steps were not conducted exclusively by the GREAT project which developed the approaches and questions of earlier UNDP validated activities. The application of the Playmob approach using established digital games tested the method confirming an information an indication of preferences to policy makers was supported by the methods deployed in the case study.

The case study provides substantive quantitative data on those that were engaged and players that have completed surveys. The data provided in this paper suggests that the method is 'effective' though more detailed evaluative comparative study would be required to validate the method as being 'efficient'.

The UNDP exploratory case study does not provide any qualitative response to the research question.

In this case study the focus was on the use of games to foster dialogue and collaboration. There were two business models applied to foster dialogue and collaboration the first, Google Ads, being the purchase of advertising space (using google ads) the second, in-game rollout, engaging directly with games development studios to embed the approach within gameplay.

Table 3: Comparative engagement response rates Google Ads and In-game rollout

	Google Ads	**In-Game Roll out**
Reach/First page load	7,257	4,352
Engagement	398 (5%)	2,539 (58%)
Completion	179 (45%)	2,148 (84%)
Community Sign Up	18 (10%)	282 (13%)

The data relating to engagement and completion suggests that direct engagement in this case was more effective in fostering and supporting this dialogue. The data further suggests that games can be used as a medium for supporting dialogue. At least anecdotally the study does serve to identify affordances but does not provide substantiated evidence to support these, whilst the quantitative data generated is not compelling.

Data was generated that relates to citizens' engagement, however:

1. There is insufficient data to substantiate player engagement.

2. The case study question is not clear about the meaning of 'affordances', and if indeed this is a useful word to guide our inquiry.
3. There is a potential overlap with RQs 1.1, 1.2, & 1.3.

The Case Study involved discussion with stakeholders, though in this example most of the consultation occurred in earlier activities not managed by the GREAT project. The consultation with UNDP as sponsor of the activity provides limited evidence of sponsor engagement. In future Case studies, where practical and possible questions could be posed to UNDP on what 'value' in a qualitative sense they apply to the information provided to them via this activity and specifically examination of how this games-based activity data generated is used by them.The Case Study does not directly identify key interventions though game interventions within the GREAT method are, at least, implicitly identified in this Case Study access to large volumes of players for example could be construed as an effective characteristic of the intervention. Consultation and co-creation of engaging question sets could be considered likewise as could association with large scale successful commercial games. It will be possible to undertake a comparative study as part of the full UNDP Case study later in 2024 involving future refinements and improvements informed by this Case Study could be incorporated into the research cycle where applicable to ongoing activities with the GREAT Case study sponsors.

Each future case study undertaken by the project could produce a theory about the context (the characteristics of the participants, the circumstances) and identify the characteristics of project intervention that made it work or not work (i.e. an explanatory mechanism). These insights could be accumulated to suggest "use it, but when you do, be aware of these decisions you have to make". Further important insight could be attained through internal evaluation by the GREAT team and or supplemented by the documented reflections of stakeholders and sponsors Useful input could be obtained through the combination of citizen science approaches adopted in dilemma-based activities in the project with the Playmob method to produce rich quantitative data to supplement the large data sets produced through this method.

6. Conclusion

The UNDP exploratory case study detailed has provided valuable insight into the methodology and the research cycle to be applied in further case studies as they are undertaken in the GREAT project. The case study is focussed on a methodology to apply digital games to engage players in discussions focussed on climate change. Addressing the primary research objectives of the project the number of players responding directly to the intervention provides limited early indication of evidence of the efficacy of the approach. The response data is provided directly to the UN to help inform policy development.

The case study provided an opportunity to test two distinct approaches to working with games studios on a large scale. The case study provided evidence that working directly with the studios and embedding the activity within play is more effective in engaging players with the activity than using 'paid for' adverts within games.

Opportunity was provided to test the Playmob approach from a technical perspective, of server functionality and in the management of raw data. The case study did expose a deficiencies in the data in terms of its use for detailed analysis, this is being addressed by the GREAT data teams, reuse, interoperability of the data as it is currently formatted requires further work and standardisation, if the data sets are to be examined and used in other contexts or if the data sets are to be provided directly to the sponsoring stakeholder group for the activity.

The case study has been used in discussion with UNDP to inform the development of a future much larger scale implementation in partnership with several games and studios scheduled for late 2024. It is anticipated that recommended changes both to the methodology and technical improvements will be incorporated in this future activity.

Acknowledgements

No Artificial Intelligence Tools were used in preparing this paper.

Co-funded by the European Union

UK Research and Innovation

References

Foa, R.S., Klassen, A., Slade, M., Rand, A. and R. Collins. 2020. The Global Satisfaction with Democracy Report 2020. Cambridge, United Kingdom: Centre for the Future of Democracy. IAP2 2022. Public Participation Pillars, accessed2ndApril2022: https://cdn.ymaws.com/www.iap2.org/resource/resmgr/Communications/A3_P2_Pillars_brochure.pdf

Hollins et al 2018 D7.6 – [RAGE Asset-based business case] European Union Deliverable, Open University of Netherlands accessed April 2023.
https://research.ou.nl/en/publications/d76-rage-asset-based-business-case/fingerprints/

Rooney-Varga JN, Sterman JD, Fracassi E, Franck T, Kapmeier F, Kurker V, et al. 2018 Combining role-play with interactive simulation to motivate informed climate action: Evidence from the World Climate simulation. PLoS ONE 13(8): e0202877. https://doi.org/10.1371/journal.pone.0202877

Steiner, C., Hollins, P., Kluijfhout, E., Dascalu, M., Albert, D., Westera, W., & Nussbaumer, A. 2015. Evaluationof Serious Games: A Holistic Approach. In L. Gómez Chova, A. López Martínez, & I. Candel Torres (Eds.),ICERI 2015 Proceedings: 8th International Conference of Education, Research and Innovation Seville, Spain.18-20 November, 2015. (pp. 4334-4342). IATED Academy. ICERI Proceedingshttps://library.iated.org/view/STEINER2015EVA United Nations. 2021. Trust in public institutions: Trends and implications for economic security (Policy Brief 108).

Tobi, H., Kampen, 2018 J.K. Research design: the methodology for interdisciplinary research framework. *Qual Quant* **52**, 1209–1225 (2018). https://doi.org/10.1007/s11135-017-0513-8

Vrontis, D., Siachou, E., Sakka, G., Chatterjee, S., Chaudhuri, R., & Ghosh, A. 2022. Societal effects of social media in organizations: Reflective points deriving from a systematic literature review and a bibliometric meta-analysis. European Management Journal, February 2022.

Whitton N & Hollins P 2008 Collaborative virtual gaming worlds in higher education , ALT-J, Research in Learning Technology Vol. 16, No. 3, September 2008, 221–229

Wijman, T. 2021. The Games Market and Beyond in 2021: The Year in Numbers. Newzoo, available at https://newzoo.com/insights/articles/the-games-market-in-2021-the-year-in-numbers-esports-cloudgaming/