

ByMaker Game: Empowering Young Minds for Sustainable Cities

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ABSTRACT

The research is focused on how serious games can be used to bridge the gap between citizens and municipalities in urban development, thereby improving social sustainability. Previous research on public participation shows that citizens cannot effectively participate in the planning process unless they understand the language being used. Likewise, their contribution will not be taken into consideration by planners if it only serves private interests rather than collective ones. As such, our research has sought to develop an artifact to solve this problem by utilizing serious games to improve children's understanding of and participation in sustainable urban development. Results of our user tests show positive outcomes in terms of improving understanding and motivation to learn. Our work contributes to the growing field of serious games for public participation, demonstrating the potential to transform the way we engage citizens in urban planning and decision-making processes.

KEYWORDS

Serious games, UX, empower children, smart and sustainable cities, children participation, technology for the future, web-based solutions

Introduction

By 2050, 70% of the world population will be living in cities, engaging citizens in the sustainable transformation of the built environment is therefore crucial [4]. Moreover, children and youth will be the ones to face the long-term consequences of the decisions made by today's adults. The active participation of children and youth is enshrined in the Norwegian Planning and Building Act and all municipalities are legally obliged to facilitate their participation in any planning proposal, regardless of whether it be carried by public or private actors [5]. Gamification of processes is one way the public authorities have explored to engage younger publics in the co-creation of urban spaces.

Serious games are games that have a purpose beyond entertainment, such as education or training [6]. In the context of smart cities, serious games can be used to engage citizens in urban planning and decision-making processes [1,9,10]. This can help to increase transparency and accountability, and improve the quality of life in cities. They can also help citizens to better understand

complex urban issues, and provide a means for them to express their preferences and concerns [1,2] Additionally, serious games have the potential to reduce the power imbalance between citizens and government, and promote more collaborative decision-making processes [3]. Wagner and Gałuszka (2020), conducted an extensive study on the role of serious games in energy transition, in which they explored the concept of sociotechnical imaginaries and their relationship to "serious gaming". They found that energy imaginaries presented in the games comforted the established "socio-technical regimes and its gradual evolution, rather than supporting a radical change in the energy socio-technical system" [8]. Findings from this study are important to consider in the development of a serious game for smart and sustainable urban development. Even more so when developing a game that is targeting children, if we want to avoid fostering the same "old socio-technical systems" but rather encourage them to explore new possibilities and shape alternative futures.

Method

Our research bridges academia and municipality by using a Design Science Research (DSR) method to develop an artifact to solve the problems identified in the literature and in practice. This method is particularly well-suited for action innovation research in the context of academic-industry partnerships. We addressed the challenge of engaging children in sustainable urban development by designing a web-based game called "ByMaker" to give them the knowledge and skills they need to co-create the city. To design the prototype, we used the LEAGUE Toolkit (Learning, Environment, Affective-cognitive reactions, Game factors, Usability, usEr) [7], which includes characteristics to define when developing the area of Game-based Learning (GBL).

The following points make the core dimensions identified by Tahir and Wang (2020) in the LEAGUE Framework research, each of them representing one specific aspect of GBL:

- *Learning* (Decide the learning domain of the game),
- *Environment* (Decide the technological environment for the game),
- *Reaction* (Reactions you want to generate through the game),
- *Game* (Decide the game genre),
- *Usability* (Decide the usability goal of the game),
- *User* (Decide the target players of the game)

Table 1. Characteristics of the game according following the LEAGUE Framework.

LEAGUE	ByMaker
Dimensions	
Learning	Smart city (Sustainable city)
Environment	Web game (using Unity and WebGL), supported on desktop computers and mobile devices
Reaction	Cognitive and Behavioral
Game	Simulation
Usability	Ease of use and Efficiency
User	Children (ages 10 to 12), parents, and teachers

The development team, consisting of five women and three men, brings a unique perspective to the project, with a deep understanding of the challenges faced by women and girls in the field of sustainable urban development. The game is built in Unity based on 3D maps provided by the municipality and uses familiar landmarks and friendly historical character modelled and rendered in Blender.

Results

ByMaker was developed to immerse the players in a familiar environment and increase their sense of responsibility towards their local community. ByMaker requires no prior knowledge in sustainable urban development and uses a simple and intuitive interface for a quick understanding of the gameplay.

On the ByMaker journey, the players are invited to experiment multiple combination of choices within different aspects of urban development: road and transportation, urban nature, residential and public space. The impact of their decisions on the overall sustainability of their city is displayed as visual feedback, providing children and youth with a tangible understanding of the interplay between social, environmental, and economic factors (Fig. 1).

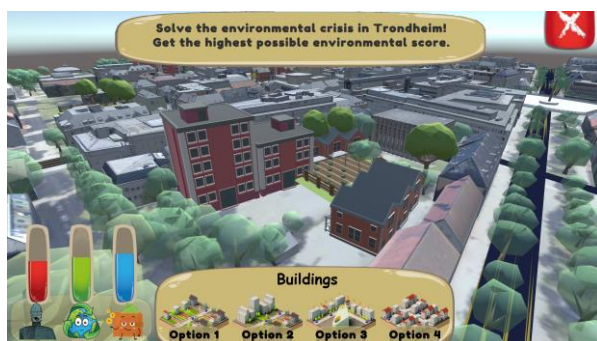


Figure 1: ByMaker interface

Using a game in participatory processes allows municipalities to provide a more comprehensive understanding of the big picture and showcase the long-term vision for the development of their city, by including potential future scenarios.

The game was tested during supervised sessions in schools in Trondheim, Norway with over 100 pupils between 8 and 10 years old. Results of our tests show a positive response to the game concept and the added value of playing with their own city. In all sessions the average values for user experience and motivation score above median. This reflects a certain level of satisfaction

from the pupils. The highest values are found in session 3 which might be explained by a greater engagement of the teacher in the classroom who had prepared the pupils in advance and actively helped the researchers to supervise the session. The teacher also mentioned that she would use this as a kickstarter for a learning cycle on sustainability in general. The pupils were therefore more responsive and engaged when playing the game.

Conclusion

The use of serious games for public participation is a fast-developing field, ByMaker innovates in its use of pre-existing resources to create a realistic environment, providing a tangible reality and focusing on the development of children's critical-thinking to make well-informed choices. ByMaker also seeks to stimulate creativity and critical thinking by introducing futuristic scenarios to children and inspiring them to consider all aspects of sustainability to make informed choices. Some limitations were identified in terms of visualization and the possibility to design their own ideas directly in the game. Further research and development will focus on improving the visualization and developing new functions to allow free expression. Our work contributes to the growing field of serious games for public participation and has the potential to transform the way we engage citizens in urban planning and decision-making processes.

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