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Urban Living Lab Enhanced by a Mobile Application as a New Way to Educate Towards Green and Inclusive Cities

Ewa DUDA[a*], Łukasz GONTAR[b], Maksymilian KOCHAŃSKI[b] & Mari Hanssen KORSBREKKE[c]
[a] *Institute of Education, Maria Grzegorzewska University, Poland*
[b] *Research and Innovation Centre Pro-Akademia, Poland*
[C] *Western Norway Research Institute, Norway*
*eduda@aps.edu.pl

Abstract: Amidst rapid technological advancements and escalating environmental crises, there is a pressing need for innovative educational approaches addressing these challenges. This study introduces the Urban Living Lab (ULL) concept as an educational environment to engage households in sustainable food production enhanced by a mobile application. Leveraging a learning-by-doing approach and new technologies, the study focuses on the "SmartFood" project, which aims to reduce the environmental footprint by promoting self-produced food and fostering pro-environmental behaviors in urban communities. The research employs co-design workshops with future ULL participants to understand their needs and expectations. Utilizing thematic analysis, the study identifies both enablers and barriers to the project's implementation. The SmartFood mobile app emerged as a pivotal tool, providing users with valuable information on plant growth conditions and facilitating communication among participants. The study reveals that ULL enhanced by mobile application can serve as effective platform for educating households on sustainability. It also highlights the need for more frequent and detailed educational sessions to maximize the sustainability impacts. Overall, the study contributes to the limited body of research on ULLs as educational environments beyond higher education and offers practical insights for the co-design of sustainable urban food systems.

Keywords: Environmental Education, Urban Living Lab, Sustainable Food Production, Co-Design Workshops, Mobile Application, Pro-Environmental Behaviors

1. Introduction

With the rapid advancement of technology, as a society we are faced with many new challenges. Firstly, the negative impact of human activity on the environment is giving rise to ever new crises, for which we must begin to prepare effectively on the one hand, and which we must begin to counteract on the other. Secondly, the development of new technologies means that we should look for new tools to educate and engage the public, better adapted to their changing needs. The study presented here is an attempt to introduce the increasingly popular educational environment of the Urban Living Lab concept, supported by new technologies, which is based on a learning-by-doing approach.

2. Urban Living Lab Concept

2.1 Related Works

Urban Living Labs (ULL) are often described as "urban innovation ecosystems" that serve as frameworks for co-creation of innovation in cities (Yilmaz & Ertekin, 2023). As platforms for iterative learning, they are characterized by experimentation, geographical embeddedness, participation and user involvement, leadership and ownership, and evaluation and refinement

(Beecroft, 2018). However, limited research has been completed so far on Urban Living Labs as educational environments going beyond higher education contexts (Martinez-Acosta et al., 2023; Bogedain and Hamm, 2020). Some of the prior studies have focused on living labs as spaces for testing a mobile app-based health program (Kim et al., 2022), indirect education on energy consumption habits (Brohmer et al., 2023), and increasing awareness of food waste reduction targets (Black et al., 2023). Still, no prior research has used the concept of Urban Living Lab to engage households in the co-designing of a mobile-app-assisted system for the self-production of food in cities.

2.2 SmartFood Project Case

To address the identified challenges, the "SmartFood: Engaging citizens in food diversity in cities" project (SmartFood) aims to contribute to the reduction of the environmental footprint by presenting a model for self-produced food, thereby reducing food transportation. The project is aimed at shaping a vision of cities of the future in which sustainable patterns of food consumption and production, based on healthy eating habits, controlled dependence on food retail, reduced food waste and social networks in urban buildings play a dominant role. The ambition of the SmartFood project team is to implement a controlled experiment involving a local neighborhood community, its building administration and local stakeholders in the process of co-creating an educational model for shaping pro-environmental behaviors that counteract climate change. SmartFood serves as a starting point for the co-design of sustainable hydroponic installation in the common corridors of urban residential blocks of flats and the preparation of a social experiment within SmartFood Urban Living Lab in Poland.

3. Methodology

The aim of the research progression is to diagnose problems of food production and waste as well as to understand its essence. We invited people to share their experiences, needs, understandings of the problem and expectations. The research material presented here consists of qualitative data collected during two sessions of co-design workshops (Örnekoğlu-Selçuk et al., 2023) with future Urban Living Lab participants, conducted online. Data analysis was carried out by applying the thematic analysis methodology proposed by Braun and Clarke (2019). Due to the high cost of the hydroponic installation envisaged by the SmartFood urban experiment, the project was designed for 20 residents of a selected residential block who participated in the workshops. The research presented here therefore has the status of a case study (Sjoberg et al., 2020). It aims to answer the following research question: How a mobile application could increase the engagement of households in sustainable food production?

4. Results and Discussion

Participants of the workshops found the mobile application to be a useful tool to support the learning process, both in terms of self-growing food in hydroponic cabinets and as a valuable source of knowledge. In particular, the SmartFood App is regarded as a promising contact channel between the ULL's participants and researchers. Its most important feature is the information, it provides the user related to cultivation conditions, such as light, humidity, substrate parameters, and send notices of emerging irregularities.

Participants of the SmartFood co-design workshops identified more enablers than barriers to the project implementation. Supporting factors identified included economic factors, the ability to monitor changes in one's diet and grocery purchases, the associated opportunity for self-reflection, the strengthening of environmental awareness, the opportunity to develop interests by growing one's own fruit and vegetables, and the desire to reduce one's carbon footprint. Predominant among the barriers were people's inherent prejudices, low public commitment to any kind of pro-environmental innovation, fear of insects, reluctance to change eating habits, lack of time and technical problems in entering data into the app.

A more effective implementation of the SmartFood vision could be enhanced by patient education of future users, dissemination activities, encouraging the consumption of edible

insects rather than farming them, creating a space in the app for advice on how to use the products from the cabins (vegetables, worms). Workshop participants expressed approval of this form of involving potential users in the co-design of SmartFood solutions. They saw their advantages in terms of being able to actively participate, to speak freely, and to be able to obtain a lot of information that was important and interesting to them. In the future, however, it would be useful to hold more frequent but shorter workshops, and to provide more detailed and specific educational information.

5. Conclusion

Upon reflection on the findings from the co-design part of the ULL conducted at the beginning of the project period we found that it taught us valuable lessons in how to implement important elements of the project when moving forward with participants. In introducing them to elements of the educational format and co-producing aspects of the Lab we strengthened the ULL design to be more inclusive and productive. With high levels of participation throughout the project progression we found that discussing the barriers and drivers of use of the hydroponic solutions, the mobile app and surrounding technologies was necessary for increasing the legitimacy of the experiment and generating more sustainable use and engagement. Despite high levels of participation being somewhat resource draining, we concluded that more frequent and detailed educational sessions are necessary to ensure the process fulfills its educational potential and to maximize the sustainability impacts and engagement in pro-environmental behaviors. The findings also offer practical implications for the co-design of sustainable urban food systems, highlighting the key role of mobile applications and the need to address both enablers and barriers to implementation.

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