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Gamified energy saving behaviour change in European buildings: initial impacts from a web-based app developed with its pilot users

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EXTENDED ABSTRACT

This presentation draws upon initial evaluation of the Horizon 2020 eTEACHER project to explore the potential of user-centred design of a web-based app to support energy saving in a range of European buildings.

Introduction

International, national and organisational strategies for addressing climate change have for some time highlighted the need to reduce energy consumption in buildings. Alongside established technical interventions to improve energy efficiency, significant opportunity exists to reduce energy consumption through changes to occupant behaviour, such as only using lighting, appliances, heating and cooling when needed. However, interventions to realise this potential frequently struggle to achieve ongoing engagement and significant energy saving impacts.

This paper focuses on the opportunity to address this inefficiency gap by integrating three emerging approaches: Information and Communication Technology (ICT) -based interventions; gamification principles; and participatory design. ICT-based tools, such as in-home displays and web-based apps can provide accessible information and energy feedback to building users; gamification principles can motivate sustained engagement through use of competitions or rewards;[1] participatory user-centred design can enhance the effectiveness, adoption and evaluation of behaviour change interventions by devising solutions which are fit for purpose.[2] Through such approaches, three key dimensions recognised as influencing behaviour change (Capability, Motivation and Opportunity[3]) can each be enhanced.

These approaches have been integrated through the two-year development of the 'eTEACHER' web-based app. eTEACHER aims to enable building users to adopt energy saving behaviours in a range of building settings, including homes, offices, schools and public buildings. It was developed through extensive end-user engagement at twelve case study sites across three European countries, the UK, Romania and Spain.

This paper describes how eTEACHER was implemented, some early evaluative findings of engagement with and energy saving impacts of the tool and highlights some implications raised by the project.

[1] Orland, B. et al. (2014). Saving energy in an office environment: A serious game intervention. Energy and Buildings. 74. pp.43-52
[2] Lockton, D. et al. (2011). Behaviour change at work: Empowering energy efficiency in the workplace through user-centred design. In *Behaviour Energy and Climate Change (BECC) Conference,* Washington DC, 2011.
[3] Michie S, Atkins L, West R. (2014). *The Behaviour Change Wheel: A Guide to Designing Interventions.* London: Silverback

Methodology

To embed user-centred design, the Changeology[4] framework was used. This framework recommends input from end-users in identifying both the issues to address and the solution strategies. To this end an initial workshop and a series of three Feedback Forums were held (with respectively 112 and 119 building users attending across the 12 case study sites), where users discussed site-specific energy-related issues and fed back on the design and functionality of the app prior to its final specification.[5]

Roll-out of the app in 2020 was disrupted significantly by the Covid-19 pandemic response and technical challenges. An initial 'soft' release in early 2020 with accompanying training sessions for users revealed problems with account creation and linking the user accounts to specific buildings. These problems were resolved to enable a full launch in October 2020. Usage data reviewed for this paper therefore draws upon the period October 2020 to January 2021.

Initial evaluation of the project's impact is based upon a blend of self-reported and measured changes in both engagement with the eTEACHER app and energy-related behaviours, drawing upon the installation of energy monitoring equipment at each case study site and post-intervention Feedback Forums. Measured data includes the number of registered app users that linked an account to a specific building and evidence of ongoing usage (taken from the period December 10th 2020 to January 11th 2021) based upon logged usage of the tool. Engagement evidence was also compiled through an online survey sent to all registered users and feedback forum members from December 2020 to January 2021. This was complemented by informal phone conversations with key contacts at each pilot site to explore their current interest in using the tool.

Final evaluation will include a final feedback forum session, final user survey and further analysis of logged usage of the app and of changes in energy consumption in each pilot building.

Results

In terms of measured energy use, the pilot buildings demonstrated a wide range of changes, ranging from drops in consumption due to buildings being rarely used in response to Covid-19 (e.g. schools and offices), to increases for residential pilot sites, related to people staying at home more during lockdown. This data is still being analysed at the time of writing, but is not presented here as the significant Covid-19 changes are likely to make before-and-after comparisons invalid.

Therefore, data on user engagement and self-reported behaviour change could be employed to inform an early evaluation. Measured data seems to indicate low usage across the 12 sites. To date 49 users have registered and linked their account to a building (for 10 out of 12 buildings), and 18 of these users were active in the one-month period from December to January 2019 (in 9 out of 12 buildings, with 1-3 active users in each of the nine buildings). Thus, adoption and subsequent usage of the tool appears to be very low to date.

The interim evaluation survey elicited eight responses representing users from three buildings. Of these, three had successfully used the tool (one from each of the three buildings represented). Of the other five, three had struggled to set up a profile and two had been unable to login and had not continued to attempt to use it. The three active users surveyed all reported a positive experience of using the tool. One of the three reported a change in behaviour, switching lights off at the end of a work day. Pilot site contacts made in January highlighted a highly reduced occupancy (with many staff working from home) and that in many cases (e.g. health centre; schools), use of the app was a very low priority amongst other concerns related to providing healthcare and schooling amidst the Covid-19 pandemic.

[4] Robinson, L. (2011). How to design a change program: The Changeology process.

[5] Morton, A., Reeves, A., Bull, R. and Preston, S., 2020. Empowering and Engaging European building users for energy efficiency. *Energy Research & Social Science* 70: 101772

Conclusion & discussions

In conclusion, it should first be highlighted that this is a project that has been heavily disrupted by the Covid-19 pandemic, with usage of case study buildings substantially changed and motivation to participate significantly reduced. The intended evaluation strategy has also been hampered significantly.

Even at the current early stage in analysing results, some implications and conclusions can still be drawn. Firstly, the value in basing evaluation on complementary measured and self-reported evidence, both of actual energy impacts and of engagement with the intervention itself. Only by piecing this evidence together can a full picture of the impacts of this tool be established, and further work is needed to do so comprehensively.

Finally, the project highlights some of the risks and challenges of ICT-based interventions. These include the risk of participation being hampered by technical problems with software/hardware, privacy concerns limiting participation and interventions being pitched at the right level of detail to be intelligible and relevant for non-expert building users.