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# Implementing web-based interventions to promote energy efficient behavior at organizations – a multi-level challenge

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ABSTRACT

A web-based intervention program for changing habitual energy-relevant behavior was tested at workplaces of Higher Education Institutions (HEIs). In a web portal an intervention package was provided, that had proven to be successful in past field studies. For analyzing the usability of this platform, the HEIs implemented the intervention program autonomously. The intervention was established at five HEIs (23 buildings). Intervention outcomes were operationalized by measuring the development of energy consumption. Considerable outcome differences were found between the participating HEIs. These might be based on implementation differences. To assess possible relationships between implementation and outcome differences, data regarding implementation issues had been collected by questionnaires and in workshops with HEI representatives. By tendency we found lower levels of implementation (i.e. reducing the intervention materials) and lower levels of participation to decrease the interventions' outcomes. Additionally, indications showed that cultural differences due to the HEIs location might have influenced implementation levels and the interventions' outcomes respectively.



## 1. Introduction

Higher Education Institutions (HEIs)[1] play a key role for the transition to a more sustainable society. According to the Rio+20 Higher Education Sustainability Initiative HEIs can do so by taking different forms of actions – not only by promoting sustainable development through their research and teaching (UNCSD, 2012). One specific action HEIs could and should take is to promote environment-friendly behavior by using resources more efficiently. However, the relevant actors in this field are not students but mainly staff members, who make purchase decisions and who could contribute to a reduction of the HEI's environmental footprint by changing their everyday user behavior. Therefore it seems reasonable to provide environment protection training programs for staff and faculty. Given that certain employees (e.g. professors, lecturers) are regarded as role models, appropriate environment-friendly staff behavior may not only contribute directly to a reduction of the environmental footprint, but may also affect students' behavior on campus and beyond.

The main target of our research project was to create an intervention program for HEI staff members promoting energy saving behavior at university offices. In addition, the project aimed at bringing the intervention program into a format that could be used by HEIs (and other public institutions) autonomously. Therefore, the research program consisted of two stages: Primarily, an intervention program based on psychological assumptions about behavioral change was developed and tested. In a second step, this intervention program was standardized and integrated in a free web portal to make it widely available for HEIs. The present study particularly focuses on the second stage and analyzes the uptake and implementation of the web-based intervention program and evaluates its effects.

Results of the first stage intervention program have been reported beforehand (Matthies et al., 2011; Matthies and Thomas, 2011). To provide appropriate background information for the evaluation of uptake and evaluation of the standardized program, some aspects of the development and implementation of the intervention are reported repeatedly in this paper (see Section 2).

## 2. Development of an intervention program promoting energy saving behavior at the workplace

In order to create a tailored intervention program for HEI staff members working in offices it is necessary to take context-specific factors at their workplace into account. Firstly, particular distinctions resulting from the type and situation of action need to be

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[1] HEI = Higher Education Institution.

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considered. Namely, particular characteristics of energy consumption at the workplace are regarded for choosing appropriate intervention measures. In this section the theoretical background regarding energy relevant behavior at workplaces is introduced and it is shown how these assumptions lead the development of the intervention program. Some findings of the first program test are reported afterward, as far as they were relevant for the further development of the intervention program in stage 2 (see Section 4).

### 2.1. Energy relevant behaviors at (HEI) workplaces

A considerable amount of behaviors at the workplace are energy relevant (e.g. use of electrical devices, heating or airing). Commonly, these behaviors are simple and they are conducted regularly (e.g. turning off the lights when leaving the office). In the field of environmental psychology these behaviors are classified as *curtailment behaviors* (Gardner and Stern, 2002). They need to be distinguished from more complex and rarely conducted one-shot *efficiency behaviors* (e.g. investment decisions in a new heating system or improvements of a building's insulation). Given that most staff members at HEIs are usually not involved in efficiency decisions, the intervention program focuses on curtailment behaviors.

A wide-spread strategy to motivate employees to increase efficient user behavior is the diffusion of information (about the background problem or about possibilities of actions). However, mere information strategies have not proven to be sufficient to change environmental, respectively energy use behavior (for an overview see Abrahamse et al., 2005; Geller, 1989).

The reason why mere information strategies do not work well might lie in the nature of curtailment behaviors. Given that they are performed regularly (e.g. daily), they qualify as *habitual behaviors* or *routines* (here, both expressions are used synonymously) determined by cognitive constructs i.e. *habits*. Habits emerge from a long-term learning process. If any kind of behavior leads to any kind of (subjective) positive outcome (e.g. heating up rooms in winter to a high level) people tend to repeat that behavior. Over time suchlike behaviors get automatized. Habitual behavior that is frequently performed in a stable situation (e.g. tilting windows when entering the workplace) starts to be triggered and performed without awareness (e.g. Ouellette and Wood, 1998; Wood et al., 2002, 2005; Verplanken and Aarts, 1999; Verplanken et al., 1994).

It is reasonable to believe that new knowledge (e.g. about environmental problems) could cause changes in people's intention toward more sustainable behavior. Additionally, the behavioral repertoire (e.g. in terms of sustainability) can be expanded. Nevertheless, as long as the situations that trigger habitual behavior remain unchanged, there is a high chance that people will automatically stick to their old habits even though their intentions have altered (e.g. Aarts et al., 1998; Danner et al., 2008; Klöckner and Matthies, 2004). Therefore, intervention programs should be complemented with elements that help people to overcome old habits. One proper approach could be to change contextual factors at the workplace. The more a situation is altered the less likely it gets to trigger habitual behaviors (e.g. Verplanken and Wood, 2006; Verplanken and Aarts, 1999). Another approach is to support people to act according to their (mostly environmental friendly) intentions. If people envision their intentions and plan the corresponding activities thoroughly, that intention based (*volitional*) behaviors (Heckhausen and Gollwitzer, 1987; Gollwitzer, 1993) might overlap habitual behaviors (Verplanken and Aarts, 1999; Wood et al., 2005). In this field, a number of specific techniques going beyond the scope of mere knowledge transfer are available. Some suitable techniques are commitment (e.g. Pardini and Katzev, 1983/1984; Abrahamse et al., 2005) and goal setting (McCalley and Midden, 2002; Abrahamse et al., 2005).

In the intervention program reported here, two different strategies were tested in order to determine the assumed benefits of *habit focused intervention techniques*. An intervention program using information transfer strategies only (knowledge-based intervention) was compared to a second variant that was being complemented by techniques focusing on changing habitual behavior (habit intervention).

### 2.2. Development and test of the initial intervention program

#### 2.2.1. Setting selection and program preparation

The program was developed and tested in close cooperation with four HEIs. HEI selection criteria included a general willingness of decision makers to support an intervention promoting energy saving behavior at the workplace, and sufficient administrative, technical, infrastructural, and personnel resources to meet the demands of applying the intervention and evaluation. In order to be able to choose appropriate trial buildings a number of mandatory criteria were prescribed by an interdisciplinary research team of engineers and psychologists. Firstly, the intervention program was designed for office buildings. Consequently, only such buildings were selected. Secondly, consumption data of the participating buildings needed to be available in order to evaluate the programs' outcomes. All buildings needed to have relatable electric and heat meters. Moreover, consumption data from the last three years were required to create a reliable time series, respectively a reference point for consumption development. Altogether 15 trial buildings were selected in close cooperation with contact persons at the HEIs. To depict the German higher education system thoroughly two different kinds of universities, which are typical for Germany, were taken into account. On the one hand, two historical grown universities were involved. These institutions are usually relatively old – sometimes several hundred years. Since they grew over time together with the towns where they are located in, they generally are not limited to a certain location. They typically are spread all over town and are established in various building types. On the other hand, campus-based universities were involved. Campus-based universities were mainly established in the 1960s and 1970s. These institutions usually are not spread but located on a single campus, mostly in an outlying district. The buildings on one campus are usually fairly similar. Two historical grown and two campus-based universities were chosen. All participating HEIs were located in North Rhine-Westphalia (Western Germany).

The analysis was started with a preliminary investigation of the current energy consumption behavior at the participating HEIs. The data was collected six months prior to the intervention's onset by questionnaire and site visits at the selected buildings. The site visits were meant to asses energy relevant building characteristics (particularly (infra-)structural and technical building characteristics such as energy transmission values due to the material of the building's envelope). The questionnaire addressed all staff members. It covered workplace characteristics (e.g. types of windows, electric and heating devices) and energy consumption behavior (e.g. computer use and settings, airing behavior, use of light). Based on that information, room for behavioral changes could be assessed. Beyond this, the most efficient behavioral changes could be detected by dynamic simulations. Here, the influence of actual staff behavior on energy consumption was estimated and compared to an ideal energy usage scenario implying the highest possible energy saving behavior by all staff members. The simulation showed that a great quantity of energy could be saved by rather simple behavioral changes at the workplace. Four behavior tips were identified which have considerable energy saving