A CREATIVE LEARNING SPACE DEVELOPMENT TOOLKIT: EMPIRICAL EVALUATION OF A NOVEL DESIGN METHOD

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Abstract

The physical environment in design education can have a significant impact on students' creativity, learning performance, and wellbeing. However, little attention is given to the question, how to design such spaces in a scientifically sound manner and how to involve the relevant stakeholders. Specifically, the future users of the space—students and teachers—might have important insights about the spatial requirements. To support spatial planners, teachers, and students, who want to improve their existing learning spaces or to design them from scratch, we developed a toolkit, consisting of several checklists, card sets, floor plans, and canvases to frame spatial requirements and ideas. The toolkit was tested and evaluated in a workshop at a design school in the UK that was in the process of moving departments to a new building. Hence, this paper presents an action research cycle including the four steps of 1) designing the toolkit, 2) conducting the workshop, 3) observing the workshop and obtaining feedback, and 4) reflecting on and iterating of the creative learning space development toolkit.

Keywords: Workspaces for design, Design education, Design methods, Evaluation, Co-Creation

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Please cite this paper as:
Surnames, Initials: *Title of paper*. In: Proceedings of the 21st International Conference on Engineering Design (ICED17), Vol. 9: Design Education, Vancouver, Canada, 21.-25.08.2017.

1 INTRODUCTION

The awareness that it is important to involve the end users of a project into the design process has reached most design disciplines already. Sanders and Stappers (2014, p. 7) state that "there is growing interest in and support for this mind-set that the end-users are the experts of their future lives and that designers/design teams can design *with* the people. It is a growing recognition of and skill at involving end-users in design processes as ‚experts of their experience.'" However, according to Outram (2013), many architects do not talk to the future users of the spaces they are going to build. Many architectural buildings—also design schools—are planned and built by architects that do not involve the future users of the space: in this case, the students and teachers. A tool that would bring all stakeholders of a design educational space together at one table, to systematically define requirements, wishes, and needs for the to-be-build space, seems to be of high relevance. The presentation and evaluation of such a tool is the objective of this paper. This paper is structured as follows: In the following we present the theoretical foundations and previous work. Section 2 describes the used action research methodology. Sections 3, 4, 5, and 6 pass through the four steps of the action research cycle: Plan, Act, Observe, and Reflect. Section 7 concludes by discussing the results and giving an outlook to a possible iteration of the toolkit.

1.1 Theoretical foundations of co-creation toolkits

There is a large body of literature about co-creation approaches with end-users in different contexts that we adapted for the context of Creative Learning Spaces. For example, Sanders (2005) outlines the development of co-creation over the past thirty years. Also, Sanders (2000) suggests to provide generative tools for co-designing that enable and facilitate collaborative thinking, mapping, dreaming and storytelling. According to her, a toolkit usually contains a background on which to work, together with a large number of simple and ambiguous components that can be arranged and juxtaposed in a variety of ways. Posters and Canvases are hence a part of our presented toolkit, together with stickers that can be placed thereupon. Additionally, three card sets are part of our toolkit. In the design field there are several card-based design tools (see e.g. Wölfel and Merritt, 2013, for an overview). As a design tool, cards have the advantage of making a problem or design process tangible (Lafrenière et al., 1999; Lucero and Arrasvuori, 2010) and of enabling a better communication between designers and users (Beck et al., 2008; Wölfel and Merritt, 2013). Rochelle and Penuel (2006) present a 7-step process for co-design projects in classroom contexts. Among these steps they emphasize the need for a flexible tool, as well as the importance of conducting a bootstrapping event to catalyse the team's work—for example in a workshop. Also Sanders (2000, p. 9) stretches the idea of so-called "strategic visioning workshops" as the next step of co-creation approaches: "in these workshops we use an assortment of large toolkits to enable a group of people to work together to express their ideas and dreams." The conducting of such a 'strategic visioning workshop' facilitated with mass-tailored toolkit materials, as well as testing and evaluating the tools in a real-life scenario is the objective of our paper. Ali and Liem (2015) provide a classification of different types of co-creation toolkits, consisting of probes, generative toolkits, or prototyping toolkits, that they put in alignment to the different phases of the design process (pre-design, design research and discovery, design, marketing and sales, and after sales). Our toolkit is addressing the phase of design research and discovery and it can be categorized as a generative toolkit. For this paper, we focus on the theoretical foundations of co-creation toolkits. A full description of the toolkit development can be found in (Thoring et al., 2016). For a detailed discussion of the theoretical foundations of creative learning spaces, we refer to (Thoring et al., 2012a, 2015). To the best of our knowledge a toolkit for co-creating creative learning spaces has not yet been developed and evaluated.

1.2 Toolkit development

The 'creative space development toolkit' presented in this article constitutes the agglomeration of four years of research on the topic of creative learning spaces. The underlying insights have been developed based on a qualitative research approach with a) interviews with eight experts from different areas of design education, design practice, and architecture, and b) a cultural probes study (Gaver et al., 1999; Mattelmäki, 2006) among design students in two different design schools. The findings from these studies have been transformed into a typology of creative learning spaces. This typology consists of five space types that are necessary for design activities in an educational context: a personal space, a collaboration space, a presentation space, a making space, and transition spaces. At the same time, a

creative learning space can have various qualities: it can serve as a knowledge processor, it can provide stimulation, it can facilitate social interaction, it can provide a specific infrastructure, and it can express a certain organizational culture. Figure 1 outlines the space types and qualities of creative learning spaces. Moreover, best-practice examples from various design schools around the world have been collected and aligned to the typology of creative learning spaces.

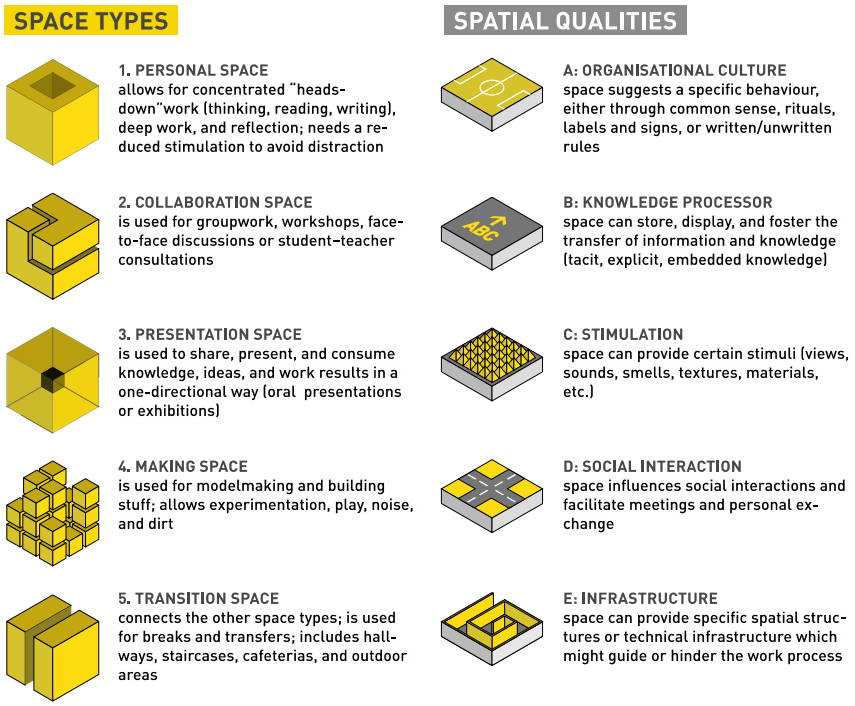

Figure 1. Typology of Creative Learning Spaces, adapted from Thoring et al. (2012a)

The results of these previous studies are partly published in different conference proceedings (Thoring et al., 2015, 2012a, 2012b). A first version of the 'creative learning Space development toolkit' was already created and presented as prior work (Thoring et al., 2016). After the initial feedback from the audience of the conference presentation, and in preparation for the upcoming evaluation workshop, the toolkit has already undergone some substantial iterations. Hence, the toolkit evaluated in this study constitutes already a second version.

2 RESEARCH METHODOLOGY

The presented toolkit for developing creative learning spaces represents a novel design method that can be used by spatial planners, design educators, or students to design or redesign a creative learning environment. It consists of a set of different tools and methods, such as postcards, inspiration cards, and canvases (see section 3 for a detailed description of the toolkit). Action research has been proven a valuable method to evaluate design artefacts and design methods in a qualitative way (Lewin, 1946; Oosthuizen, 2002). Participants are presented with a real case that they are actually interested in, which results in far better feedback than, for example, a laboratory experiment would do.

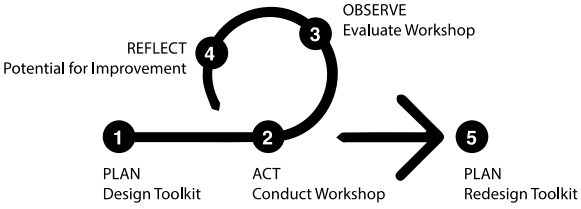

Figure 2. Action research process, adapted from Kemmis et al. (2013)

According to Kemmis, McTaggart, and Nixon (2013) action research should be conducted as a spiralling sequence of four consecutive steps: Plan, Act, Observe, and Reflect (Figure 2). The following sections describe these steps and their application in the evaluation workshop.

3 THE CREATIVE LEARNING SPACE DEVELOPMENT TOOLKIT (PLAN)

A toolkit to facilitate the design or redesign of a creative learning environment should bring participants from all stakeholder groups together in a discussion about the future space and provide a canvas and the tools to facilitate "collaborative thinking, mapping, dreaming and storytelling" (Sanders, 2000). In particular, the participants should be able to define certain areas within the space for specific activities (defining areas for space types). They should be made aware about certain interdependencies, for example that one space type at a specific location might have a positive or negative influence on adjacent space types, (e.g. noise from a making space would disturb individual work in a personal space). Thereupon the participants should be able to explicitly define the spatial characteristics of the selected space type areas and consider possible problems regarding the different spatial qualities, as well as develop solution ideas for these problems. The toolkit should inspire them and depict (positive as well as negative) possibilities. And finally, the toolkit should provide for follow-up reflections and the retention of developed insights, also after the end of the in-situ workshop. Figure 3 illustrates the components of the toolkit. In the following we describe the developed toolkit in detail. It consists of six elements: 1) a poster with an adapted floorplan, 2) five canvas posters for the five different space types, 3) stickers with icons of the five space types to place on the floorplan and canvas posters, 4) problem checklists with trigger questions for the five spatial qualities, 5) a set of inspiration cards, and 6) two types of postcards to sketch identified problems and solution ideas. The toolkit can be used in a co-creation approach by the involved stakeholders (potential users of the space such as students and teachers, together with spatial planners and/or university management) to identify possible problems in existing spaces, agree on spatial requirements, and discuss new ideas for future spaces.

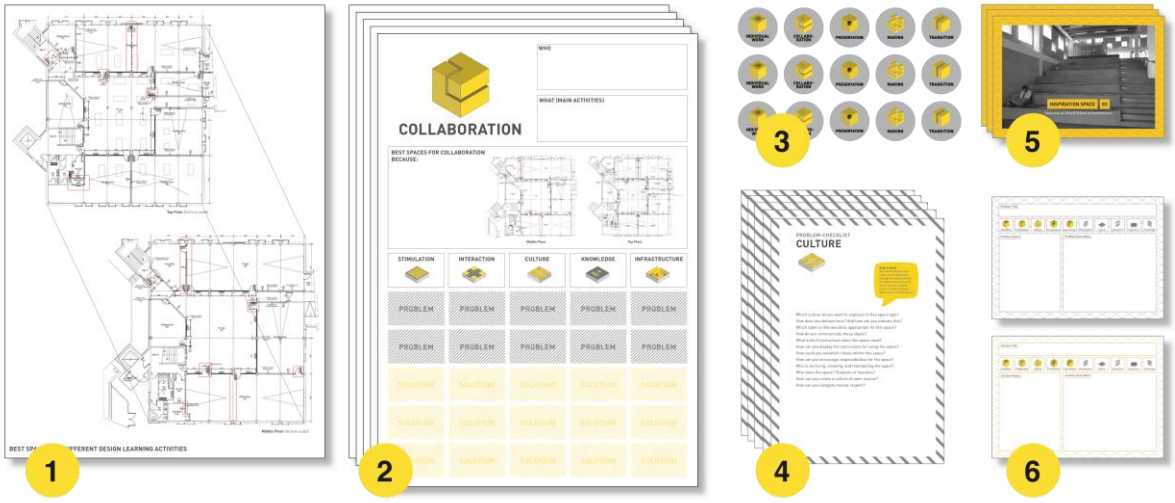

Figure 3. Overview of the toolkit materials: 1) Floorplan, 2) Posters for each of the 5 different space types, 3) Stickers of each space type, 4) Checklists with trigger questions for spatial qualities in each space type, 5) Inspiration Cards, 6) Ideation Postcards

Figure 4 shows an overview of the workshop process, including all the involved activities and materials. The materials are described in more detail in the following sections.

3.1 Floorplan and stickers to locate space types

The floorplan of the space that should be designed (two levels) was created by the workshop conductors beforehand and printed on a poster of A0 size (Figure 3, item 1). Additionally, stickers with icons of the five space types were provided. All participants should discuss which areas in the space would be suitable for which space type and place the stickers accordingly onto the floorplans. There were 40 stickers of each type available.

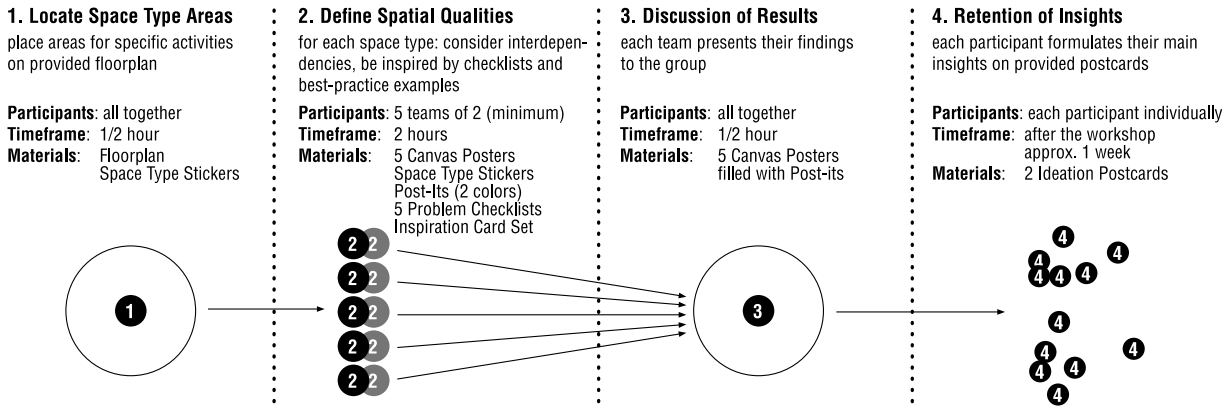

Figure 4. Flow chart of the 4-step workshop process and involved toolkit materials

3.2 Canvas posters to define the five different space types

A poster of A0 size was provided for each space type (Figure 3, item 2). Also floorplans were printed on these posters. A matching sticker should be placed in the chosen area to mark the space where this activity should ideally take place (Figure 3, item 3). Also stickers for other space types could be placed here to be reminded of possible interferences with other activities nearby. Now participants could define possible problems in that area related to the five spatial qualities and also sketch solution ideas. Grey areas were marked to place post-its with problem descriptions, and yellow areas to place idea sketches. The goal was to fill all spots with post-its. On the top of the poster areas were provided to describe the expected users of that areas and the kinds of activities.

3.3 Problem checklists

A checklist (A4 size) with trigger questions was provided for each spatial quality (Figure 3, item 4). The questions should inspire the users to think about possible problems and related solutions. Example questions for the quality 'Social Interaction' are: "How can you increase coincidental meetings?", "How do you invite people to come into this space?", "How can you connect to people outside the university?", or "How can you bridge/reduce distances to other space types or floors?". A set of five problem checklists (one for each spatial quality: Social Interaction, Infrastructure, Culture, Knowledge Processing, and Stimulation) was provided for each Space-Type-Poster.

3.4 Inspiration card sets

A set of 34 cards with pictures of interesting best-practice examples from different design schools around the world was provided for additional inspiration (Figure 3, item 5). On the front side a picture of the spatial example was shown, while on the reverse side the involved space types and qualities for the shown example were explained.

3.5 Postcards

Two types of postcards (A6 size) were provided for each participant to sketch and describe one's own most effective insight in terms of identified problems and possible solution idea (Figure 3, item 6). The postcards were supposed to be filled after the workshop individually by each participant, in order to continue the discussion and to document the most important insights.

4 WORKSHOP IMPLEMENTATION (ACT)

The fashion and communication design departments of NTU had to move their teaching and staff spaces into a new building within a very short timeframe of a few months. The new space was located in a former office building, built approximately in the 80s or 90s of the past century, spread over two floors. The core of the entire building was being removed in order to install new partitions and rooms. The people from the design school were partly not happy about the move, because the new building seemed to be worse than their old one (e.g. lower ceilings and smaller windows). However, the move was necessary to create a new space for the two departments that should be spatially merged. Some major decisions about the design and layout of the new space had already been made. Twelve workshop

participants were recruited by the department head with the goal to cover all three relevant stakeholder groups: 1) students, 2) teachers and staff, and 3) spatial planners and decision makers. There were three students from second and third year of fashion design. The group of seven staff members was composed of one administrator and six teachers from different sections of the school. And finally, there was an external spatial planner and a member of the university's management, who did not participate actively in the workshop but acted as 'observers'. The half-day workshop was conducted on-site of the School of Art and Design of NTU. To prepare for the workshop, a floorplan and some pictures with the current state of the floors were sent to the workshop organizers. At the beginning of the workshop, a 30-minute input was given to the participants, explaining the typology of creative learning spaces and presenting a selection of spatial examples from other universities. After that, the entire group inspected the target space (which was located across the street)—the two floors that should be transformed into the future teaching space of the two departments. At that time the floors were a construction area, but the participants were able to grab an idea of the size and proportions, as well as the window situation of the space. Then, the toolkit materials were introduced and the workshop was conducted according to the flow chart in Figure 4.

5 WORKSHOP RESULTS (OBSERVE)

The workshop was observed and evaluated in three ways: 1) the entire workshop was video recorded by three cameras. These cameras were not able to capture all the activities, because five groups were working simultaneously on different tasks, but one camera was constantly recording one group as well as the plenum sessions, while the other two cameras were switching between groups and hence recording everything else that was going on at least in parts. After the workshop it was possible to recall specific activities and group dynamics by watching the videos. 2) The workshop was conducted by two researchers who took notes about their observations during and immediately after the workshop. 3) A follow-up survey was sent online to all twelve participants. A picture of each toolkit element was presented as part of the survey, as a reminder for the participants. The survey contained a mixture of multiple choice questions with a 5-point Likert scale, and open questions that allowed free-text responses. Three questions were related to the purpose and expected outcome of the workshop; three question were related to each of the five workshop materials (15 questions in total), prompting the usefulness of the material and possible improvements; three questions were targeting at the degree of self-explanation of the toolkit; and five questions were focusing on the overall experience and usefulness of the toolkit and workshop for the university's specific case. The complete questionnaire data is available upon request. The link to the survey was sent ten days after the workshop by email. After several rounds of follow-up emails to invite the participants to fill out the questionnaire, finally eleven out of the twelve participants completed the survey (one member of the Staff group did not respond). The main goal of the evaluation workshop was 1) to see whether the toolkit was useful for the three stakeholder groups, and 2) if and how the toolkit could be improved. We were particularly interested in any diverging opinions between the three stakeholder groups. The following sections describe the main insights from the observations and the survey.

5.1 Observed insights (based on video analysis and researcher notes):

The toolkit served as a communication facilitator. It allowed people to discuss in-depth about the spatial requirements for more than two hours. High engagement of the participants was visible. All stakeholders were discussing at eye-level. It could be observed that some groups pursued different strategies: one group started with reading and discussing the inspiration cards for about one hour, while others started immediately with writing own ideas onto post-it notes. However, all groups were able to come to a satisfactory outcome (a completely filled poster with identified problems and solution ideas for one space type), which indicates the flexibility of the toolkit. During the initial session in which all group members placed stickers on the floorplan, a certain rush to place as many stickers as possible became evident. The lack of focus and priorities was however, later compensated for when working in smaller groups. The poster size for the floorplan seemed sometimes too small, as people tried to extend the canvas to include other (e.g. outdoor) areas. One participant spontaneously acted as a moderator for the group discussions. However, that person had to ask the workshop conductors several times to clarify arising questions.

5.2 Insights from survey data

One question that was of particular interest was what the participants would expect from the workshop. The survey provided a selection of six answers (multiple answers were allowed). The main purpose of the workshop for the participants was manifold: 10 participants (91% of the respondents) declared they wanted to "identify the user requirements for the space". 6 participants (55%) expressed their wish to "co-create ideas for the spatial design". 5 participants (46%) selected either the option to "detect possible problems before actually building the space", and the same number (5 people) said they wanted "to be inspired from the toolkit for future projects". The following quotes demonstrate exemplarily the main purpose for the participants: to involve also the students, and to get into discussions.

> "It was incredibly helpful in that we got to really think about how students would be using the space and the best way to make the most of this space to ensure that students were not only inhabiting an aesthetically beautiful space, but that it was also a space that functioned as a point on inspiration, which is very important for a creative school."
>
> "It was very useful to see how the tools worked in prompting discussions."

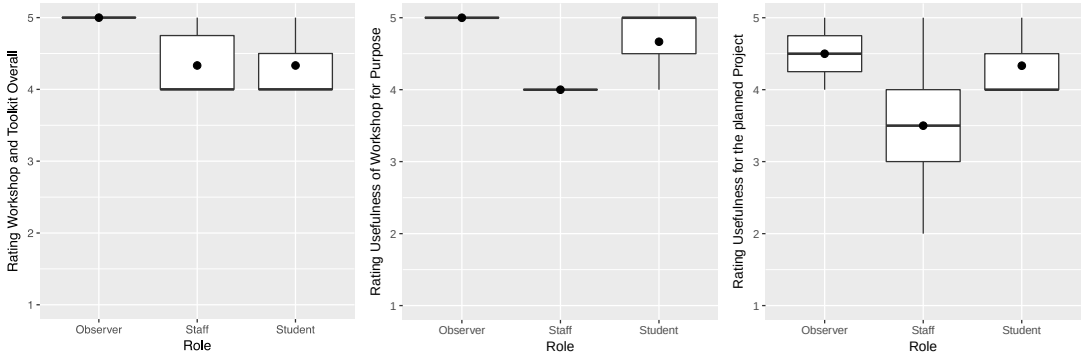

Figure 5. Ratings of the different user groups for the overall workshop and materials (left,), the personal usefulness (centre), and usefulness for the University's project (right), (n=11)

Figure 5 illustrates the different perspectives of the three user groups on the purposefulness of the toolkit and workshop regarding the overall impression (left), the usefulness according to the respective purpose (centre), and the usefulness for the planned project at the university (right). The charts show that the observers (spatial planner and management) rate the toolkit and workshop best. This could be either explained by the fact that they were not actually working with the tools and hence could not experience any difficulties, or by the possibility that they were more objective in terms of the overall insights they gained from observing the group. The students were more positive than the group of staff members, which can be explained by some of the students' quotes that indicate their pleasure about being involved in the process at all. The staff members rated the usefulness for the University's project as least good. In their written responses some of them explained their dissatisfaction with the timing of the workshop as most decisions were already made (which is, however, not a problem of the toolkit).

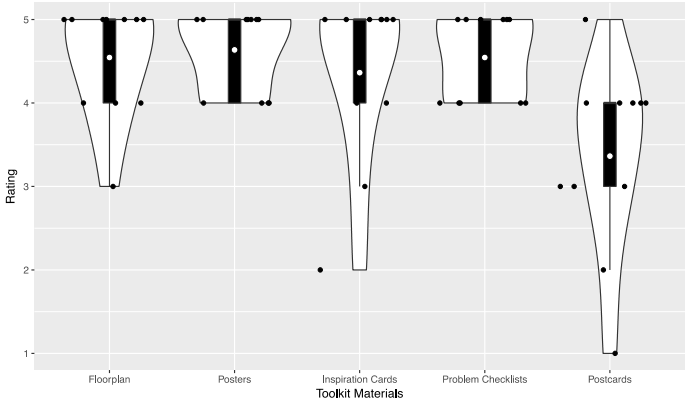

Figure 6. Ratings for the different toolkit materials (n=11)

Figure 6 shows the participants' ratings of the different toolkit materials. It indicates that the Space-Type-Posters and the Problem Checklists were rated highest by all respondents, while the Postcards had the lowest ratings. From the following free-text answers it was possible to deduce possible reasons for the low ratings of the postcards:

> "I did not use these.", and "I do not remember these."
>
> "Our discussions didn't really continue beyond the session, but I can see that they would be useful for other projects."
>
> "Just timing really, nobody has returned their cards […], so maybe they could be sent in advance or time given in the workshop to complete them."

The Inspiration cards were mentioned by four respondents as their favourite item, but there were also some suggestions for improvement:

> "Make these [inspiration cards] available before the workshop so that people could research, discuss with wider group and have more opinions on them. "
>
> "Maybe have more 'problematic' spaces where innovative solutions were found. "

The floorplan with the stickers was mentioned by most participants (5 respondents; equals 46%) as their favourite item from the toolkit. Almost everyone mentioned in their responses that this tool was helping to focus the discussions.

> "It brought everything together in one place and helped give a focus to our discussions."

However, also some problems were mentioned:

> "Some groups I noticed almost put all the stickers in each area rather than really prioritising."
>
> "It might be useful to have prompt sheets with definitions of the qualities and types of spaces as I think some people were forgetting these".

Of particular interest is the question, what impact the toolkit and workshop actually had on the spatial planning project of NTU, because any method is only as good as its respective usefulness.

> "It allowed for more attention to the finer detail ".
>
> "It certainly changed the usability of the existing space they'd already laid out; how we might change the materials of the walls, breakout spaces etc. "
>
> "It was a great way to force them [management] to pause for a moment and consider how we [the students] actually use the space."
>
> "If we were planning a space from scratch it would have more impact."
>
> "The toolkit made us think about the varied types of work taking place in the space and specific requirements for each of these ".
>
> "In an ideal world the workshop and materials would be used to plan a building or space that has not already to a certain extent been defined ".

These quotes corroborate the usefulness of the tool. However, a detailed analysis and description of the actual changes in spatial planning that resulted from the workshop would exceed the page limit of this paper.

6 TOOLKIT EVALUATION (REFLECT)

In this section, the insights from the workshop are recapped and interpreted. A summary of the identified strengths of the toolkit, as well as the weaknesses and potentials for improvement is presented.

6.1 Identified strengths and weaknesses of the toolkit:

Overall, the toolkit and workshop were evaluated as helpful for the particular spatial planning case at NTU. The combination of several tools—floorplan, posters, checklists, and inspirational cards—allowed for a mix of group discussions and individual constructive focus work on parts of the design case. The floorplan was able to engage a group discussion, while the posters allowed in-depth discussions and idea development in smaller teams. The toolkit involved all three stakeholder groups, and particularly the students were pleased to be involved in the decision process, which was seemingly not often the case. The inspiration card set was perceived positively, because it showed what was possible, while the checklists helped to focus the work process. Overall, the different tools were able to guide the design process in a structured way. At its present state, the toolkit would not work without a trained moderator and a proper introduction of the space typology. Also, written instructions are missing. Since the participants were not yet familiar with the presented typology (space types and qualities) it was difficult for them to define those spaces. The postcards have not been used at all. The idea to keep

the discussion going after the end of the workshop was not working out. Placing stickers on the floorplan was very engaging, but as a result, some participants were placing a sticker at almost any space of the floor plan, without focus and without a clear reflection (we assume that the amount of provided stickers was too large). And finally, the timing of the workshop was not ideal, as many decisions had already been made, which is, however, not a problem of the toolkit.

6.2 Potential for improvement:

The toolkit could be made more self-explanatory, for example by providing an animated or video-recorded summary of the introductory input and by adding visual or verbal instructions. Also, a visual legend might be helpful to remind participants about the definitions of space types and qualities. A smaller floorplan on the poster would leave more space on the canvas to include also external areas. Fewer stickers might force people to focus and prioritize. The postcards could be larger (A5) and maybe filled out during or right after the workshop (not at home), in order to have a visual documentation of the main insights. Some materials could be sent in advance so people would be better prepared, for example the definitions of space types and qualities, or the inspiration cards.

7 DISCUSSION

The presented action research study evaluates the potential of a developed toolkit for facilitating the process of designing a creative learning environment in design educational contexts. The development of this toolkit has been conducted in an evidence-based way, based on an extensive prior research. The action research cycle used in the workshop resulted in a positive feedback from the participants but at the same time revealed many insights on how to further improve the toolkit. Future work will focus on designing the next iteration of the toolkit.

7.1 Facilitation of the co-creation process

Feedback from the participants indicated the wish to be able to conduct the workshop by themselves, without having to involve the external researchers as moderators. Hence, the idea emerged, to make the toolkit more self-explanatory, for example by adding a video-summary of the introduction as well as visual or verbal instructions. However, as Rochelle and Penuel (2006) point out, one of the seven crucial factors for successful co-design projects is a "strong facilitation with well-defined roles". We argue that a co-creation workshop as suggested by our presented toolkit needs a well-trained facilitator and cannot be conducted without any experience in co-creation methodologies. Hence, the toolkit does not only consist of the 'hardware' materials, but also the trained facilitators.

7.2 Internal and external validity

Action research allows testing the toolkit in an organizational context with real users. Compared to traditional hypotheses testing (such as laboratory experiments that result in yes/no answers to the research question) action research provides qualitative feedback on to how to improve the concept. The institution in this case had a real design problem and hence the feedback to whether the toolkit was useful to them or not is based on a real context and their actual experiences. Hence, the external validity is very high. The internal validity is obviously lower, because we rely on only one case without a control group.

7.3 Theoretical and practical relevance

The possible impact of the physical environment on creativity and learning is experiencing increased attention. However, to the best of our knowledge a systematic method to design such spaces and to balance the different spatial criteria does not yet exist. We argue that the presented toolkit is able to facilitate spatial planners and decision makers of design educational institutions with the required knowledge to consider all relevant aspects, as well as provide the platform to involve all the relevant stakeholders. Although the toolkit addresses only the domain of design educational spaces, it can also be adapted to other domains outside the educational sector and it might be useful to any institution that wants to (re)design their creative environment. However, further research is necessary to validate this assumption.

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ACKNOWLEDGMENTS

We would like to thank Nottingham Trent University for providing the platform to conduct the workshop, as well as their participation in the evaluation workshop and the follow-up questionnaire.