Author(s): Mäkelä, Tiina; Kankaanranta, Marja; Gallagher, Claire

Title: Involving students in the redesign of learning environments conducive to learning and wellbeing

Year: 2014

Version: Published version

Please cite the original version:

Mäkelä, T., Kankaanranta, M., & Gallagher, C. (2014). Involving students in the redesign of learning environments conducive to learning and wellbeing. In Proceedings of the 6th Annual Architectural Research Symposium in Finland 2014 : Designing and Planning the Built Environment for Human Well-Being (pp. 268-282). Oulun yliopiston Arkkitehtuurin osasto. Julkaisu / Oulun yliopisto, arkkitehtuurin osasto. A., 61.
https://journal.fi/atut/article/view/46489

Involving students in the redesign of learning environments conducive to learning and wellbeing

Tiina Mäkelä
Ph.D. Student, Faculty of Education and Researcher, Faculty of Information Technology, University of Jyväskylä, Jyväskylä, Finland
tiina.m.makela@jyu.fi

Marja Kankaanranta
Research Professor, Faculty of Information Technology and Finnish Institute for Educational Research, University of Jyväskylä, Jyväskylä, Finland; Docent, Faculty of Educational Sciences, University of Oulu, Finland
marja.kankaanranta@jyu.fi

Claire Gallagher
Professor, School of Education, Georgian Court University, Lakewood, NJ, USA; American Institute of Architects, Committee on Architecture for Education, Advisory Group; Academy of Neuroscience for Architecture Advisory Council, Salk Institute, LaJolla, CA, USA
gallagherc@georgian.edu

Abstract

Increased understanding of the interrelations between overall wellbeing and learning calls for a holistic and multidisciplinary learning environment (LE) design. Considering learners' perception in the design of LE supportive to learning and wellbeing is expected to positively influence (a) the design quality, (b) participatory organizational culture, and (c) learning. The nature of this process creates contradictions and difficulties, however. Stand-alone co-design efforts may convert into pseudo-consultation without actual effects; neither is it easy to consider various stakeholders' perceptions in a balanced manner. And if not planned carefully, instead of experiencing learning benefits, participation may also be considered to be an additional burden. This paper examines how these kinds of challenges were intended to be circumvented, or avoided, in a case involving Finnish upper secondary school students in the redesign of learning spaces so as to better support their learning and wellbeing. In this project, design activities were embedded in the cross-curricular visual art project course involving 11 students, which culminated in an exhibition, during which a more representative number of students (n = 175) expressed their views in a written format. After other stakeholders, such as teachers, had expressed their views, students were given another opportunity to evaluate whether their ideas were considered in the design. In addition to evaluating the procedures employed in this project, this paper will discuss their possible transfer to other contexts. Based on the overall evaluation of the procedures, it will also propose some procedural design principles for involving learners in the LE design.

Introduction

Cognitive, affective, social, and physical dimensions of both learning and wellbeing are found to be interconnected (e.g., Awartani, Whitman & Gordon, 2008). It is also understood that the design of *psychosocial* (Fraser, 1998), *physical* (Higgins, Hall, Wall, Woolner & McCaughey, 2005), and *virtual* (Scardamalia et al., 2012) learning environments (LE) influence both learning and wellbeing, which calls for a holistic and multidisciplinary LE design. In this paper, we will examine procedures employed in a case involving Finnish upper secondary school students in the redesign of learning environments so as to holistically support their overall learning and wellbeing.

Involving students in the LE design is expected to (a) increase the quality of the design, (b) improve participatory organizational culture, and (c) lead to a positive impact on learning, and by so doing, also improve students' overall wellbeing.

Involving students in the LE design is expected to (a) increase the quality of the design, (b) improve participatory organizational culture, and (c) lead to a positive impact on learning, and by so doing, also improve students' overall wellbeing. First, as an example of the improved design quality, considering students' views in the design may augment its desirability and adequacy for them (Könings, Brand-Gruwel & van Merriënboer, 2010; Woolner, 2009), and thus positively affect their learning and sense of overall wellbeing.

Second, participatory design is expected to foster democratic or participatory organizational culture (Staffans, Teräväinen, Meskanen & Mäkitalo, 2008; Woolner, Hall, Wall & Dennison, 2007). According to the *Convention on the Rights of the Child* (United Nations, 1989), all individuals under the age of majority have a right to express their views in all matters affecting them, and be considered according to their age and maturity. Learners' participation in the LE design is also directly encouraged in other official documents (e.g., UNESCO, 2000). In Finland, co-designing LE with learners is in keeping with citizens' rights to participate in planning safe, healthy, pleasant, and socially functional environments (Land Use and Building Act, 2000), essential for promoting individuals' wellbeing (e.g., Awartani et al., 2008). Promoting participatory organizational culture and student participation in the design of safe, diversified, collaborative, ICT-enhanced, and aesthetically pleasing LE is also encouraged in Finnish national core curriculums (see Finnish National Board of Education, 2003; 2004).

Third, with regards to improvements in learning, co-designing LE with students is in line with contemporary learner-centered pedagogies and learners' active role as designers of their own learning (Scardamalia et al., 2012; Staffans et al., 2008). Increased ownership and dominance of the co-designed solutions can also lead to their more efficient personal use in support of learning (Könings et al., 2010; Sanoff, 2001; Woolner, 2009). Further, the participatory design process itself can already be considered as an engaging real-life learning experience in which students (and other participants) practice cross-curricular skills considered important in the 21st century (Mäkelä, Kankaanranta & Helfenstein, 2014) such as creativity, collaboration (Binkley et al., 2012) and social and civic competence (European Parliament and Council 2006). Also fittingly with LE co-design project objectives described in this paper, one of the cross-curricular themes in *Finnish National Core Curriculum for General Upper Secondary School* (Finnish National Board of Education, 2003) is safety and wellbeing focusing on how students can positively influence both their own and other's physical, mental, and social safety and wellbeing.

There are, however, many challenges inherent in the involvement of learners in the LE design. First, there is a risk that instead of improving the design quality, student participation converts into pseudo-consultation, which is used to confirm designers' original intentions (Woolner, 2009). Even if students' ideas were considered, especially in stand-alone student consultations lacking follow-up and clear communication, participants may not perceive how their ideas were put into practice (Fielding, 2004; Woolner, 2009). A case in point is the UK government's projects intended to include children in the design of schools in the early 2000's (Commission for Architecture and the Built Environment, 2004). Coupled with the establishment, and funding of CABE (the *Commission for Architecture and the Built Environment*) and its myriad programs in which children were to serve in a variety of capacities, the lasting legacy is meager.

Little can be seen in terms of the children's voices but the political ramifications, and negative sentiments among the other stakeholders remain.

Second, student participation does not automatically foster democratic organizational culture. It is, for instance, challenging to recruit a representative group of students in the co-design; often more forthcoming, confident or keen students get selected (Woolner, 2009; see also Fielding, 2004) thus leaving other student profiles underrepresented. Further, due to power disparities between the adults and students, it may be difficult for young peoples' voices to be heard (Könings et al., 2010; Woolner, 2009). Adults speaking for students easily interpret their views in order to support their own interests (Fielding, 2004; Seale, 2009). An illustration of this challenge can been seen in the 2005 participatory design project conducted as a part of the *View of the Child* design cluster in the United Kingdom, in which a group of children ages 7-12 were asked to collaborate to solve a design problem (Burke, Gallagher, Prosser & Torrington, 2007). Field notes and accounts of the process indicate a significant problem in disengaging the teachers and minimizing their influence in order to allow the children to collaborate, generate a collective design response, and to "speak" with their work. The other extreme is that focusing on students' perspectives leads to marginalizing other relevant stakeholders, such as teachers (Woolner, 2009; Woolner et al., 2007). As writ large in the *The School I'd Like* project inviting children to express their thoughts about what school could be (Burke & Grosvenor, 2003), the intuitive responses of young people in terms of the redesign of school may be far reaching and include changes in pedagogy, interaction, and the physical structure and spaces associated with their perception and experiences of education, running counter to the beliefs and training of most teachers, further marginalizing them. In addition to suggestions regarding changes as to what, where, and how they learned, much of what the children described shifted the power and decision-making in the classroom from the teachers to themselves, thereby subverting the existing hierarchy (Burke & Grosvenor, 2003).

Third, neither are learning benefits always guaranteed. One of the challenges is how to transfer the envisioned benefits into actual benefits. This requires not only focusing on designing anticipated use (i.e., design for use) but also design in actual use during the appropriation of the new design, followed by the redesign in use phase (Bjögvinsson, Ehn, & Hillgren, 2012). Without a proper support in the appropriation phase and long-term follow up, benefits may either not be reached or they may not last after the short-term wow effect (Woolner, 2009). Further, if not planned properly, instead of being experienced as an inspiring cross-curricular learning activity, participation may also be considered to be an additional burden.

Aims

In this paper, we will discuss how above-mentioned challenges related to the positive impact of student involvement on design quality, participatory culture, and learning were intended to be circumvented, or avoided, in a project involving Finnish upper secondary school students in the redesign of their LE. This project focused on the redesign secondary school's terraced-floored natural science classroom (see Figure 1), its adjacent hallway, and an interior balcony (see Figure 2), which were to be combined in order to enlarge the floor plate. The goal was to convert the existing classroom and hallway into an inspiring, diversified and comfortable technology-enhanced space that fosters 21st century ideas of learning and wellbeing. Further, the contemporary educational ideas of ubiquitous LE and learning beyond the classroom matched with more practical physical design objectives, namely, the need to augment the usability and utilization of the large but underused hallway next to the classroom. Lessons learned during the project were then planned to be used when designing larger changes both within the school and elsewhere. (See Mäkelä, Mikkonen & Lundström, 2013.)

The goal was to convert the existing classroom and hallway into an inspiring, diversified and comfortable technology-enhanced space that fosters 21st century ideas of learning and wellbeing.

Followed by the description of the background for the study, we will present the method focusing particularly on the procedures involving students but also other relevant internal stakeholders. This will lead us to the evaluation of how participatory methods employed seem to have influenced design quality, participatory culture, and learning. In that section, we will also discuss the

possible transferability, or applicability, of the methods to both similar and other cultural contexts such as the USA. To conclude, we will also propose some procedural design principles for involving learners in the design of LE conducive to learning and wellbeing.

Figure 1. A classroom before the changes.

Figure 2. A hallway corner and the interior balcony before the changes.

Background

The study represents so called educational design research, which considers education as design science (van den Akker, 2007; Plomp, 2007). These studies typically

- involve various stakeholders,
- are conducted in real-life settings,
- consist of iterative semi-independent research cycles leading to progressive improvement, and
- aim at both practical and theoretical contributions (Plomp, 2007).

This long-term research initiative, in particular, aims at developing a research-based toolkit including both substantive (i.e., content-related) and procedural (i.e., process- or method-related) design principles or guidelines (see Plomp, 2007) for the participatory co-design of learning environments (see Mäkelä et al., 2014; Mäkelä & Helfenstein, 2014); this paper focuses on the development of the procedural design principles.

The approach chosen for this study has similarities to both the contemporary participatory design originating from the Scandinavian political and democratic aspirations and to user-centered approaches typically originating from the North America focusing more on economy, efficiency, and quality (see Kujala, 2008; Sanders & Stappers, 2008; Steen, Kuijt-Evers & Klok, 2007). In our view, these aspirations do not have to be mutually exclusive but of equal importance. However, user-centered approaches are sometimes viewed to represent “expert mind-set”, that is, designing for people, instead of “participatory mind-set”, designing with people (Sanders, 2008) and as such focus more on the product than an effective process leading to a successful and appropriate solution. Although this may not always be the case, in this study we do not refer to participants as user or customers (Kujala, 2008; Smeds, Huhta & Pöyry-Lassila, 2010) but as co-designers, all experts in their experiences (Könings et al., 2010; Sanders & Stappers, 2008).

Further, some studies draw a distinction between the concept “participatory design” as collaboration between professional designers and people without design background, and “co-design” (collaborative or cooperative design) as co-operation between professional designers often representing various disciplines (see Sanders & Stappers, 2008; Smeds et al., 2010). This study does not make this distinction but uses the concept “participatory co-design” in a very broad sense to refer to knowledge sharing and creation between participants representing various backgrounds (Mäkelä et al., 2014). Participatory design is also sometimes framed as focusing on issues related to the participants’ current situations, and co-design on the envisioning of future situations (Steen et al., 2007). As this design study reflects situations in the past, present, and future, we do not see it necessary to draw this distinction.

Finally, the approach chosen for this study has many similarities with “students as co-researchers”, and ”student voice” approaches emphasizing the importance of a genuine partnership, and doing research with, rather than on, students and ensuring their voice is heard (Fielding, 2001; 2004; Seale, 2009). The study does not, however, aim at representing student voices per se, but aims at collaborative sense-making and knowledge construction in consort with them (Mäkelä et al., 2014).

A priori content- and method-related choices for the study were made based on the literature review representing mainly educational and architectural LE design contents and processes, but also other disciplines, many of them referenced in this paper. In spring and early fall 2012, the preliminary conceptual framework and research design consisting of a web questionnaire, scale model construction group work, and group discussions were piloted with primary and secondary school students (n = 80) at the Finnish school at which

the redesign project to be described in this paper took place (see Mäkelä et al., 2014). Soon after this, another pilot study with a similar research design was conducted in Spain (students n = 76). Subsequent to the latter, a conceptual framework gathering and structuring relevant LE characteristics to support LE co-design, based on the consolidated data from these two pilots, was developed (Mäkelä & Helfenstein, 2014). This work provided a point of departure for the content- and method-related issues to be considered in the actual co-design project.

Method

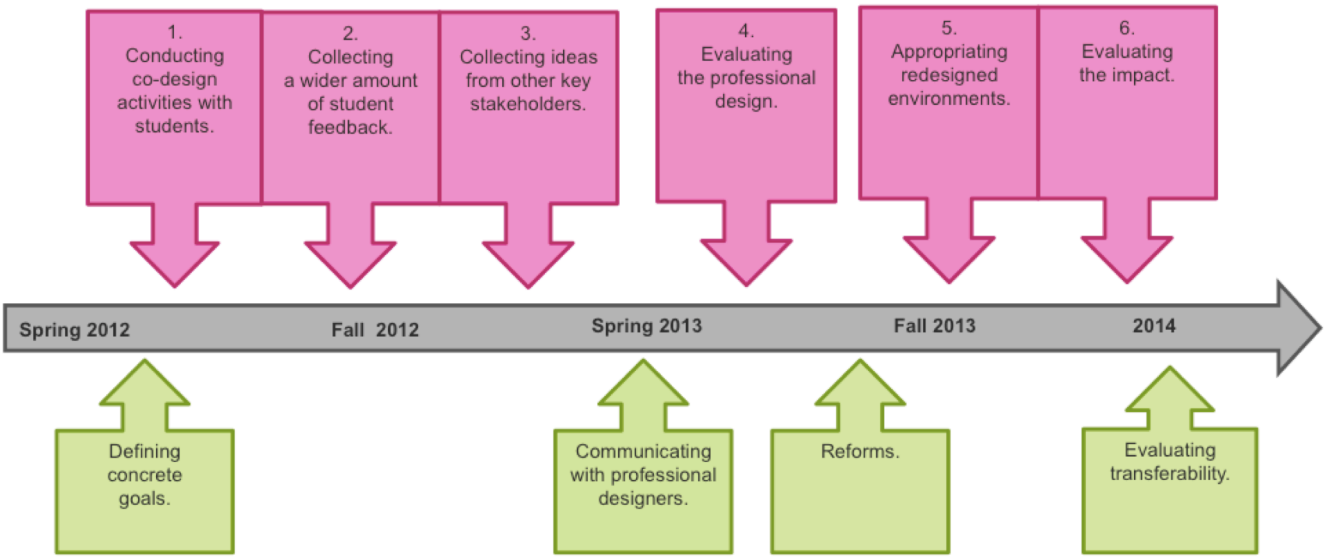
Participants

The project was carried out in a teacher training school (a comprehensive and upper secondary school where the aspiring teachers carry out their teaching practices) with approximately 1000 students located in Central Finland. As the redesign focused on premises mostly utilized by the upper secondary school level (students 16-19 years of age), the 300 secondary level students were invited to participate in the project, which was co-coordinated by a research coordinator and school directors. The project was research-led, not design-led (see Sanders, 2008) in the sense that the research coordinator and two educational researchers planned and conducted most of the co-design and research activities in collaboration with various internal (school administration, teachers, teacher students, students) and external (professional designers, constructors, companies, other researchers) stakeholders. This was the result of a delay in acquiring official permissions for the work, that professional space designers could be contracted only after initial participatory design efforts had begun.

Main phases of the project

Figure 3 summarizes the main phases of the project. Continuous planning, analysis, and evaluation during the project enabled the consideration of the lessons learned in prior phases in the construction of subsequent ones. Participatory co-design was initiated after defining concrete goals with the school directors. After the conclusion of the initial participatory design efforts (*phases 1-3*), the research team analyzed, summarized, and communicated results to professional designers. Before implementing the changes, participants were given another opportunity to evaluate the professional design (*phase 4*). After some final revisions to the professional design, changes were initiated in summer 2013 and completed during the first months of fall term 2013 leading to the appropriation and impact evaluation phases (*phases 5 and 6*), and finally, to evaluation of transferability. In the following paragraphs, we will describe phases 1-6 involving students and other key stakeholders yet more in detail.

Figure 3. Main phases of the project.



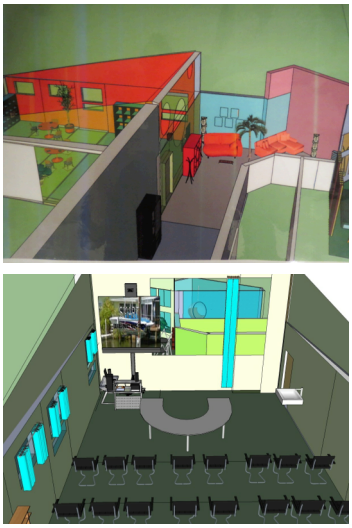


Figure 4. Examples of the student designs (virtual 3D sketch-ups).

1. Conducting co-design activities with students: Co-design activities were initially embedded in an optative project course (38 h) focusing on practicing cross-curricular skills such as creativity, collaboration (Binkley et al., 2012), social and civic competence (European Parliament and Council 2006), and safety and wellbeing (Finnish National Board of Education, 2003). Upper secondary school students (n = 300) were invited to participate in the co-design project course through an email invitation sent using the general mailing list.

As only few students enrolled in the optative co-design project course, school directors and an art teacher agreed to further delimit the participants according to those who were about to take the visual art course, *Environment, Place and Space* (n = 29, females n = 22, males n = 7) and that those students could choose one of the two formats for study: either in a traditional way or as a project course. As a result of this adjustment to the initial plan, researchers worked with the art teacher to ensure that the course was also in line with the visual art course's (Finnish National Board of Education, 2003):

- *objectives* (e.g., learning the basics of design, architecture, and environmental planning from the perspectives of aesthetics, ethics, economy, and socially and culturally sustainable development),
- *contents* (e.g., concept and perception of space as a mental, physical and social place; concepts such as scale, structure, color, form, shape, and material), and
- *activities* (e.g., creating scale models and experimenting with different materials).

A slightly modified, previously piloted, web questionnaire focusing on learners' perceptions of a good learning environment (see Mäkelä et al., 2014) was used as a sensitizing pair work activity for students enrolled in the visual art course, after which they were invited to join in the co-design project. Eleven students (females n = 8, males n = 3) chose to participate. The activities of the project course were designed to enable collaborative idea elicitation (Sanders & Stappers, 2008) and provided a vehicle for gathering oral, written, visual, and visuospatial data (Kostenius, 2011; Woolner, Clark, Hall, Tiplady, Thomas & Wall, 2010). Some of the introductory activities at the course were:

- using inspirational images to discuss about the ideal learning spaces,
- discussing about the results of the initial web questionnaire, and
- taking photos of spaces that were wished to be improved.

After the conclusion of these activities, the topic was explored and shared understanding created, for example, by:

- visiting and interviewing stakeholders in recently (re)designed nearby schools,
- visiting a furniture store and discussing with an interior designer, and
- using blog for sharing information and co-creating new ideas.

As a final outcome, participant students created (in groups) four LE designs consisting of 3D-models/sketch-ups (see Figure 4), and color, furniture and technology plans (including estimated budgets).

2. Collecting a wider amount of student feedback: The project course culminated in an exhibition, in which other upper secondary school students had an opportunity to express their written opinions about the outcome of the design process. In addition to background information (age and gender), the student feedback form created for this purpose consisted of:

- giving feedback regarding each student design's (a) advantages and (b) disadvantages,
- voting one's favorite design and justifying the choice, and
- recording what physical, virtual, social, and personal aspects
  (a) enhancing learning and wellbeing should be considered and
  (b) obstructing learning and wellbeing should be avoided.

The students participating in the co-design agreed that, based on other students' feedback, aspects from all designs would be considered in the final design, but special attention would be given to the design that received the most votes. Students could visit the exhibition during their weekly tutorial. Of 300 upper secondary school students, 175 students (females n = 104, males n = 61, gender not informed n = 10) participated in the project by giving their

written feedback during the student design exhibition, at which representatives from the main newspaper of the area were present.

3. Collecting ideas from other key stakeholders: Although students were given the key role in the design process, also other key stakeholders were provided ample opportunity to express their views (Woolner et al., 2007; Woolner, 2009). After student participation, student designs and summarized student suggestions were presented to teachers and teacher students, who, first, evaluated students' ideas and, subsequently, gave their own suggestions. The co-design sessions with teachers and teacher students took place during the teachers' weekly meetings. In addition to the active participation of 6 natural science teachers utilizing these spaces, teachers teaching biology, geography, and health sciences in the same premises, were also involved in the design. Additionally, teacher students were invited to participate in the project through using the research project as the point of departure, or focus, for their master theses. At this phase, one teacher student (of 40 to 50 teacher students following their training each year) volunteered to participate in the design by being present in co-design sessions with teachers and by conducting a study on the use of ICT in teaching natural sciences.

4. Evaluating the professional design: Before implementing the changes, participants of the co-design project course were invited to evaluate the professional design (see Figure 5) from students' perspectives. Two male students attended the session conducted by two researchers. The interior designer in charge of the redesign was invited to this session but was obliged to cancel the meeting at the last minute. Summarized feedback was thus sent to her by email.

Figure 5: Professional interior design, general view. *With the permission of the Interior designer Liisa Lundell, Architects LPV Jyväskylä Oy.*

5. Appropriating redesigned environments (Figures 6 and 7): Research collaboration continued during the appropriation period thus enabling both collaborative design in actual use or redesign in use (see Bjögvinsson et al., 2012). Teachers, teacher students, and students were encouraged to develop novel practices in the redesigned spaces. Teachers also received training for the use of new technology.

6. Evaluating impacts: Students were also involved in the impact evaluation (see Fielding, 2001; 2004; Seale, 2009). One way to evaluate the success of the participatory design is to ask participants if they view the design process as successful and if they are able to find elements of their own participation in the final design (Majgaard, Misfeldt & Nielsen, 2011). A student satisfaction survey (a web questionnaire) was created for gathering students' views in this matter. The survey was created based on the main elements of the student designs and themes highlighted in student feedback. It consisted of both numeric ratings and open-ended questions, and was directed to the approximately 100 students utilizing the redesigned spaces at that time. The students were asked, for example:

- to rate the renewed classroom and hallway, using a scale of 1 to 10,
- if they felt their perceptions and wishes had been considered in the redesign (why/why not), and
- to rate a list of 38 LE characteristics depending on whether they thought that, after the redesign, they had (a) improved (+ 1 or + 2), (b) remained the same (0), or (c) worsened (- 1 or - 2).

A total of 83 students completed the survey, mostly while having classes in the renewed premises. In addition to the survey, video analysis, observations, and short teacher interviews were used for determining the actual use of the redesigned spaces. Further, internal (e.g., school directors, teachers, teacher students, students) and external (e.g., researchers, research coordinators) stakeholders were interviewed as a part of a case study and video-material produced by the *European Key Competence Network on School Education* (see e.g., Mäkelä et al., 2013), thus producing material both for the impact evaluation and future evaluation of the transferability.

Figure 6. Classroom seen from the sliding glass doors after the redesign.

Figure 7. Hallway corner after the redesign.

Data analysis

The evaluation of the procedures presented in this paper is based on meta-analysis of the results obtained during the project. The analysis is mainly based on self-evaluation but an external expert representing both educational and architectural fields has also been invited to initially evaluate the suitability of the procedures especially from the North American perspective.

Results and discussion

In the following three subsections, we will seek evidence concerning the overall results on how participatory methods employed appear to have influenced (a) the design quality, (b) participatory culture, and (c) learning, and by all this, overall wellbeing. We will also reflect on how to further develop the procedures. This section will then be concluded by the subsection discussing the possible transfer.

Improved design quality

The analysis of the overall data indicates that involving upper secondary school students in the design of LE conducive to learning and wellbeing has improved the quality of the design. Instead of converting into pseudo-consultation with no effect (see Woolner, 2009), student designs and feedback (*phases 1 and 2*, see section Method) supported designing flexible and functional spaces, which enable balancing

- *communality* (e.g., tables for group work; sofa-groups in the hallway) with *individuality* (e.g., private lounge replacing the interior balcony),
- *comfort* (e.g., soft furniture; interior plants; calming main colors combined with stimulating colors) with *health* (e.g., ergonomic classroom chairs; luminous spaces), and
- *novelty* (e.g., not so school-like design; use of technology) with *conventionality* (e.g., good teacher visibility; use of traditional materials).

Similar to other studies (e.g., Lievonen, Kinnunen & Kankaanranta, 2014; Mäkelä et al., 2014), students seemed to be very realistic and pragmatic in their thoughts, thus helping to avoid the design of overly radical changes. Many students' proposals also coincided with other stakeholders' views (*phase 3*). For example, neither students nor teachers wished to completely remove the boundary between the classroom and the hallway. Large sliding glass doors (possibly with blinds) were proposed instead (see Figure 6), thereby maintaining the separation inherent in the original boundary wall but creating a transparency that allows for visual communication. Teachers and students also wanted to keep the chalkboard that was located next to the interactive whiteboards. While students played an important role in designing spaces fostering good general conditions for learning and wellbeing, teachers' participation was fundamental especially for gaining detailed pedagogical and subject-related knowledge. For instance, teachers further developed some students' ideas such as using color-changing lamps, not only for creating different atmospheres as the students desired, but also for teaching color theory.

Similar to other studies (e.g., Lievonen, Kinnunen & Kankaanranta, 2014; Mäkelä et al., 2014), students seemed to be very realistic and pragmatic in their thoughts, thus helping to avoid the design of overly radical changes.

Inviting student representatives to evaluate the professional design (*phase 4*), in turn, helped to ensure that their wishes were considered in the design (see Fielding, 2004; Woolner, 2009). Student representatives (n = 2) viewed that students' ideas were generally taken into account. There were some issues, however, that students requested to be considered in more detail. For example, at this point, the initial goal of enlarging the floor plate (see Figure 2) had been abandoned due to its high costs meaning that, to the students' disappointment, the private lounge designed to replace the interior balcony, could not be implemented. Student representatives also noticed that professional design did not include interior plants–something that students had advocated to be included for decorative and educative purposes, as well as for purifying the air.

After the implementation of changes, teachers, teacher students, and students started actively designing and trying out new practices in the redesigned spaces (*phase 5*). For example, one teacher interviewed in the end of the year 2013, reported that teacher students were particularly adept at developing and implementing novel ideas as to how to use redesigned spaces. Although there was also research collaboration during this phase, as a suggestion for the improvement of future cases, more resources could be allocated in order to better support the appropriating and the active design in use phase (see Björgvinsson et al., 2012) so as to assure actual changes in practices.

Finally, in student satisfaction survey (n = 83) used to evaluate the impacts (*phase 6*), the relatively high average rating given to (a) classroom (M = 7.5 of 10) and (b) hallway (M = 7.7 of 10) indicate that students generally viewed redesigned spaces as desirable and adequate for them. This is also supported by the fact that students have started to use the formerly underused hallway in a more active manner. Moreover, most of the 38 LE characteristics, which students were asked to rate (scale: -2, -1, 0, +1, +2) in the survey, received positive average ratings. The LE characteristics, which were generally perceived to have improved most, were:

- "modern design" (M = + 1.2),
- "aesthetically pleasant design" (M = + 1),
- "not school-like furniture" (M = + 0.9), and
- "luminosity of spaces" (M = + 0.9).

Amongst the characteristics, which were generally perceived to have worsened most were "conventional furniture" (M = - 0.2), and "interior plants" (M = - 0.2). Responses to open-ended questions revealed, for example, that not all students were satisfied with the choice of novel triangular-shaped desks allowing multiple configurations, as they had less table surface than with conventional desks. Moreover, contrary to students' wishes, interior plants had not been added to spaces, as watering them during the vacations was considered problematic.

Fostering participatory culture

There is also evidence of increased participatory culture both during and after the project. The challenge of involving representative groups of various stakeholders in the project (Woolner, 2009) was overcome by embedding participation into school community members' everyday practices (see also Mäkelä et al., 2014). Combining multiple forms of collaborative idea elicitation with a small group of volunteers (*phase 1*, see section Method) with quicker data collecting methods from a more representative group of students (*phase 2*) not only supported considering various wishes in a balanced manner (see also Könings et al., 2010; Fielding, 2004; Woolner, 2009) but also increased the cost-efficiency of the data analysis. In addition to students, teachers also participated actively in the design (*phase 3*). We did not, however, achieve our intention of involving various teacher students in the design. This may be explained by the demanding and time-consuming pedagogical studies and teaching practices students were taking. Nevertheless, although teacher students' participation during the design phase was limited, they played an important role in designing new practices (*phase 5*), not as an additional activity, but as a part of their teacher training.

Further, possible pitfalls such as adults speaking for students for promoting their own interests (Fielding, 2004; Seale, 2009; Woolner, 2009) were avoided by giving students an opportunity to evaluate whether or not their ideas had

been considered in the design (*phase 4*). However, only two students (of 11) participated in the evaluation session. This can be explained partly because of tight schedules, which forced us to schedule the evaluation session in the final week before the summer holidays, during which many students still had exams. It is also possible that the two students showed special interest as they represented the group of students, whose design received the most votes (66 votes) from the other students. Their participation enabled them to determine whether their suggestions were considered in the final design, as promised earlier, but could be considered as confounding the process of interpreting the data.

Further, the small percentage (7 %) of respondents who thought students' wishes had not been considered, suggests that a greater effort could have been made to identify and better involve students representing contradictory views (see also Könings et al., 2010; Mäkelä et al., 2014).

Of 83 students responding in the student satisfaction survey (*phase 6*), 43 % felt that the students' wishes had been considered in the design, indicating that we had succeeded relatively well in allowing the students' voices to be heard. However, the high percentage (50 %) of students who did not have a clear opinion in this matter indicates that the effects of student participation on the design, and justifications for the design decisions, could have been communicated even more clearly to all students (see Fielding, 2004; Woolner, 2009). Further, the small percentage (7 %) of respondents who thought students' wishes had not been considered, suggests that a greater effort could have been made to identify and better involve students representing contradictory views (see also Könings et al., 2010; Mäkelä et al., 2014).

Due to organizational reasons (e.g., differing schedules, delay in obtaining official permissions), it was not possible to invite representatives of all relevant internal and external stakeholders to general meetings (see Mäkelä et al., 2013). Although it could have created more dialogue and shared understanding (e.g., Sanoff, 2001), we think that organizing separate sessions with teachers and students encouraged them to express their views more freely, therefore neither marginalizing students due to existing power disparities nor marginalizing teachers (see Könings et al., 2010; Woolner, 2009).

Finally, as an example of increased participatory culture after the project, the co-design project has served as an inspiration for redesigning the language studio, a project initiated by the language teachers. As well, other teachers visiting the renovated spaces have expressed interest in similar projects in the premises they occupy. Time will show whether participatory co-design will be adapted as a regular method for designing changes for learning environments within this school.

Learning benefits

There is also evidence supporting the claim that participatory LE design has positively influenced learning both during and after the project. In terms of the learning benefits during the project, co-designer students (*phase 1*, see section Method) were practicing a variety of skills considered important in the 21st century including:

- *creativity and collaboration* (e.g., free idea generation; practicing collaborative decision-making),
- *social and civic competence* (e.g., being involved in the participatory design; acquiring experience of interior designers' work), and
- *safety and wellbeing* (e.g., considering how redesigned LE would improve safety and wellbeing).

In addition, the exhibition (*phase 2*) provided opportunities for practicing 21st century skills, such as the active role the 11 co-designers had in presenting their work to exhibition visitors, and the citizenship skills that the 175 students actively practiced by participating in decisions concerning their immediate environment.

Based on the student satisfaction survey (*phase 6*) and initial results from the video analysis, redesigned LE also support better practicing 21st century skills and, as intended, have converted into inspiring technology-enhanced spaces that enable diversified teaching and learning. For example, average ratings in the student satisfaction survey indicate that novel spaces are more "motivating and inspiring" (M = + 0.7) and enable better:

- "versatile teaching and learning" (M = + 0.8),
- "use of technology" (M = + 0.8), and

- "group work" (M = + 0.7).

On the other hand, "teachers' visibility" was perceived to have worsened (M = -0.2). This was a due to the removed terraced classroom floor which, conversely, enabled better multiple furniture configurations and group work, also valued by students.

Based on the student satisfaction survey (phase 6) and initial results from the video analysis, redesigned LE also seem to support better practicing 21st century skills and, as intended, have converted into inspiring technology-enhanced spaces that enable diversified teaching and learning.

Evaluating transferability

Aligning procedures employed in this study with procedures employed in similar or varying cultural contexts and testing their transferability has not yet been established. An ongoing research and development project that focuses on reshaping facilities for the upper secondary level education, involving over 2700 students in the city in which this project took place (see Lievonen et al., 2014), provides opportunities for the study at the local level. What may limit the general replicability of the process in school communities is that such an extensive co-design project with various stakeholders, and somewhat costly physical changes, require external funding. We think, however, that the procedures could also be adapted to LE design projects with a more modest budget, which may only require choosing more cost-efficient and quick participatory methods (see Könings et al., 2010; Mäkelä et al., 2013).

With regards to applicability of the procedures in other cultural contexts such as the United States, precedents for this process exist also there. For example, a participatory charrette process aiming at rapid idea generation, decision-making, and problem solving, has been successfully employed in educational contexts there (see Sanoff, 2001). Groups such as the *American Institute of Architects* (AIA) and the *American Architectural Foundation* (AAF) have been conducting participatory design sessions and charrettes with school personnel and students for quite some time. The mission of the AAF includes a dedication to this process and sessions, in which architects and teachers, administrators, and school personnel work together to redesign their schools, take place around the country each year. Embedded in this process is the generation of good will, good design, and a perception of ownership of the design solution by those other than the trained architects, thereby creating buy-in and a built-in group of advocates for the implementation of the collaborative design when meetings are held with the school board and taxpayers who will fund the proposed changes. Some of these techniques for gaining the unified support of various stakeholders, for creating dialogue between participants, and for maintaining a sense of personal contribution of all participants in a limited time-frame (Sanoff, 2001) could also be used to enrich and improve the cost-efficiency of the procedures employed in the study described in this paper.

Further, seminal work in the United States, such as the *Our Town* project of the 1990's, in Pennsylvania, has demonstrated the potential of participatory design with children in this cultural context (Gallagher, 1997). The design-build nature of this project insured the cooperation, and collaboration, among all stakeholders, thereby allowing the children to manifest their voices in built form, which is lasting, valued by those living in the neighborhood, and is maintained by the community. In one example of the project, a neighborhood green space was designed by the children with input from the community that was contributed at open sessions where they presented their design ideas. The result was a holistic design solution that was intergenerational, accessible, and central to the lives of the community, and that is still maintained and used by the individuals who live there. (Gallagher, 2007). Taking the current research from Finland and integrating it with this project could create a rich opportunity in which a fabric could be created between the two.

As an example of the possible challenges in applying the procedures described in this paper in the US school context, less flexible curriculum and more defined course objectives and evaluation methods in the USA may complicate embedding similar cross-curricular co-design projects in the existing course offering. However, the current move toward problem-based learning and the "maker movement" in American schools may make this point moot in the near future.

The potential for cross-cultural comparisons between Finland and the USA, as yet untapped, is rich with possibilities, and the results of this project could

inform and support the current work being conducted by such groups as the American Institute of Architects (Committee on Architecture for Education) and the American Architectural Foundation already referred before, as well as by the *Academy of Neuroscience for Architecture*. In the recent Academy of Neuroscience for Architecture 2014 conference held at the Salk Institute of biological sciences in LaJolla, CA, a presentation by Peter Barrett demonstrated why the concerns of young people can inform the design of schools in a positive manner. His research in schools in the UK (Barrett, 2009) has pinpointed critical concerns of daylight, acoustics, air exchange, and other environmental factors about which students raise concern in their school designs and which, may be deficient enough to cause negative effects in student learning, and in the case of elevated CO2 levels, challenges in decision-making. Children and young people sense these things and bring them to adults' attention but it mainly falls on deaf ears. In The School I'd Like project, one child referred to wanting a "listening school" (Burke & Grosvenor, 2003); perhaps that is what she meant. Allowing for student voices to be heard in the design of schools could ensure the integration of the most basic of concerns regarding issues of wellbeing, as Barrett describes in his work as critical to teaching and learning, generally seen as intuitive and evident in the views of children and young people in The School I'd Like project.

Concluding remarks

Involving upper secondary school students in the design of LE conducive to learning and wellbeing seems, first, to have improved the quality of the design by augmenting its desirability and adequacy for students. While student participation was crucial for gaining general knowledge of their perceptions of LE fostering learning and wellbeing, teacher participation was necessary for considering pedagogical perspectives in the design. Teacher students, in turn, have been particularly active in relation to the design of use of educational technology and novel teaching practices in the redesigned LE.

While student participation was crucial for gaining general knowledge of their perceptions of LE fostering learning and wellbeing, teacher participation was necessary for considering pedagogical perspectives in the design. Teacher students, in turn, have been particularly active in relation to the use of educational technology and novel teaching practices in the redesigned LE.

Second, results indicate that involving students and other school community members in the design has fostered participatory culture both by giving everyone plenty of opportunities to get their voices heard and by considering their views in the design. And finally, the participatory LE design appears to have influenced positively learning both during the project and after it, for example, by supporting learners' active agency and learning cross-curricular skills such as creativity, collaboration, social and civic competence, and safety and wellbeing. Nevertheless, active design and re-design in use may be needed also in the future in order to achieve sustainable changes.

Some important lessons learned during this project can be summarized into the following procedural design principles for the participatory co-design of LE:

1. Embed co-design activities with students into the already existing course offering.
2. Combine more interactive co-design sessions with smaller number of participants with quicker data collecting methods involving more representative number of participants.
3. Assure that all key stakeholders viewpoints are collected and organize sessions with them both separately and all together.
4. Provide participants opportunities to evaluate the professional design and also communicate well both how their views have been considered and why some of their ideas were not implemented.
5. Allocate enough resources to support school community members in the appropriation and design in use phase.
6. Involve school community members in the impact evaluation and use its results in the redesign in use phase.

In the future, we wish to be able to replicate the process in both similar and varying cultural context in order to test the local and cross-cultural transferability and to further develop the procedural design principles formulated so far.

Acknowledgements

This study has been funded by Finnish *Funding Agency for Technology and Innovation* (Tekes) through the *Indoor Environment Program* (2011-2015) and the *Finnish Cultural Foundation's Central Finland Regional Fund*. The co-design project has also been chosen as one of the case studies in *European Policy Network on Key Competences in School Education*. By the time of writing this article, the development of design principles has continued as a part of an ongoing redesign project funded by the *Jyväskylä Educational Consortium*. All internal and external stakeholders participating in the study are gratefully acknowledged.

References

van den Akker, J. Curriculum Design Research. In: T. Plomp and N. Nieveen eds. 2007. *An Introduction to Educational Design Research*. Enschede: the Netherlands SLO, pp. 37-50.

Awartani, M., Whitman, C.V., & Jean Gordon, J. 2008, "Developing Instruments to Capture Young People's Perceptions of How School as a Learning Environment Affects of Their Well-Being", *European Journal of Education*, vol. 43, no. 1, pp. 51-70.

Barrett, P. & Zhang, Y. 2009. Optimal Learning Spaces: design implications for primary schools. *Salford Centre for Research and Innovation in the built and human environment (SCRI)*, Salford, University: Salford, UK

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M. & Rumble, M. Defining twenty-first century skills. In: P. Griffin, B. McGaw and E. Care eds. 2012. *Assessment and Teaching of 21st Century Skills*. Dordrecht: Springer, pp. 17-66.

Bjögvisson, E., Ehn P., HIllgren, P.-A. 2012, "Design Things and Design Thinking: Contemporary Participatory Design Challenges", *DesignIss*ues, vol. 28, no. 3, pp. 101-116.

Burke, C., Gallagher, C., Prosser, J., & Torrington, J. The View of the Child: explorations of the visual culture of the made environment. In: T. Inns, ed. 2007. *Designing for the 21st Century: interdisciplinary visions and insights.* Ashgate, UK: pp. 68-78.

Burke, C. & Grosvenor, I. 2003. *The School I'd Like.* Routledge: UK.

Commission for Architecture and the Built Environment 2004. *Being involved in school design: a guide for school communities, local authorities, funders and design and construction teams.* Department for Culture, Media and Sport (DCMS) and the Office of the Deputy Prime Minister: London, UK.

European Parliament and Council 2006, "Key Competences for Lifelong Learning: European Reference Framework", *The Official Journal of the European Union*, 30 December 2006/L394.

Finnish National Board of Education 2003. *National core curriculum for General Upper Secondary Intended for Young People.* Opetusministeriön julkaisuja: Vammala.

Finnish National Board of Education 2004. *National Core Curriculum for Basic Education 2004.* Vammala: Vammalan Kirjapaino oy.

Fielding, M. 2004, "Transformative approaches to student voice: theoretical underpinnings, recalcitrant realities", *British Educational Research Journal*, vol. 30, no. 2, pp. 295-311.

Fraser, B. J. 1998, “Classroom Environment Instruments: Development, Validity and Applications”, *Learning Environments Research*, no. 1, pp. 7-33.

Gallagher, C. Our Town’: an architectural perspective. A program for inner-city, at-risk children. In: R.E. Griffin, J.M. Hunter, C.B. Schiffmann, W.J. Gibbs, 1997. *VisionQuest: Journeys Toward Visual Literacy*. International Visual Literacy Association. pp. 17-22.

Gallagher, C. 2007, “Our Town’: children as advocates for change in the city”, Childhood, vol. 11 no. 2 , pp. 251-262

Higgins, S., Hall, E., Wall, K., Woolner, P., McCaughey, C. 2005. *The Impact of School Environments: a literature review.* The Centre for Learning and Teaching: School of Education, Communication and Language Science, University of Newcastle.

Kostenius, C. 2011, “Picture This – Our Dream School! Swedish Schoolchildren Sharing Their Visions of School”, *Childhood,* vol.18, no. 4, pp. 509-525.

Kujala, S. 2008, “Effective User Involvement in Product Development by Improving the Analysis of User Needs”, *Behaviour & Information Technology*, vol. 27, no. 6, 457-473.

Könings, K.D., Brand-Gruwel, S., & van Merriënboer, J.J.G. 2010, “An Approach to Participatory Instructional Design in Secondary Education: an Exploratory Study”, *Educational Research*, vol.. 52, no. 1, pp.45-59.

Land Use and Building Act. 132/1999, amendment 222/2003 included. Chapter 1 Section 5.

Lievonen, M., Kinnunen, P. & Kankaanranta, M. 2014, “Student Views on Ideal Learning Space: a Case from Upper Secondary Education”, *World Conference on Educational Multimedia, Hypermedia and Telecommunications 2014*, pp. 511-514.

Majgaard, G., Misfeldt, M. & Nielsen, J. 2011, “How design-based research and action research contribute to the development of a new design for learning”, *Designs for learning*, vol. 4, no. 2, pp. 8-26.

Mäkelä, T., Mikkonen, I., & Lundström, A. 2013. Co-designing 21st Century Secondary School Natural Science Learning Environments. *European Schoolnet*: Brussels.

Mäkelä, T., Kankaanranta, M. & Helfenstein, S. 2014, “Considering Learners’ Perceptions in Designing Effective 21st Century Learning Environments for Basic Education in Finland”, *The International Journal of Educational Organization and Leadership,* vol. 20, no. 3, pp. 1-13.

Mäkelä, T. & Helfenstein, S., 2014, “Developing a Shared Conceptual Framework for Learning Environments Co-design in Europe”, *European Educational Research Journal* (in review process).

Plomp, T., Education Design Research: an Introduction. In: T. Plomp & N. Nieveen eds. 2007. *An Introduction to Educational Design Research*. Enschede: the Netherlands SLO: pp. 9-35.

Sanders, E. B.-N. & Stappers, P.J. 2008, “Co-creation and the New Landscapes of Design”, *CoDesign: International Journal of CoCreation in Design and the Arts*, March 2008.

Sanders, E. B.-N., 2008, “An Evolving Map Practice and Design Research”, *Interactions*, November and December 2008.

Sanoff, H. 2001. *A visioning process for designing responsive schools.* AIA, School of Architecture, College of Design, North Carolina State University.

Scardamalia, M., Bransford, J., Kozma, B. & Quellmalz, E.E. New assessment and environments for knowledge building. In: P. Griffin, B. McGaw and E. Care eds. 2012. *Assessment and Teaching of 21st Century Skills.* Dordrecht: Springer.

Seale, J. 2009, "Doing student voice work in higher education: an exploration of the value of participatory methods", *British Educational Research Journal*, vol. 36, no. 6, pp. 995-1015.

Smeds, R., Huhta, E., & Pöyry-Lassila, P. Using Process Simulations to Co-design Future School Networks. In: M. Taisch, J. Cassina, R. Smeds eds. 2010. *Experimental Learning in Sustainable Management, Economics and Industrial Engineering*. Poliprint: Politecnico di Milano, Italy, pp. 196-205.

Staffans, A., Teräväinen, H., Meskanen, S., & Mäkitalo, A. 2008, "InnoArch. Collaborative Planning and Design and Students' Epistemic Agency", *Conference Architectural Inquiries*, Göteborg 2008.

Steen, M., Kuijt-Evers, L., & Klok, J. 2007, "Early User Involvement in Research and Design Projects: A Review of Methods and Practices", *Proceeding of the 23rd EGOS Colloquium*, Vienna, July 5-7, 2007.

UNESCO 2000. *The Dakar Framework for Action. Education for All: Meeting our Collective Commitments.* Paris: UNESCO.

United Nations 1989. *Convention on the Rights of the Child.* Geneva: United Nations.

Woolner, P. Hall, E., Wall, K. & Dennison, D. 2007, "Getting Together to Improve the School Environment: User Consultation, Participatory Design and Student Voice", *Improving Schools* no. 10, pp. 233-248.

Woolner, P. 2009, "Building Schools for the Future Through a Participatory Design Process: Exploring the Issues and Investigating Ways Forward", *Proceedings of BERA 2009*, 2-5 September, Manchester.

Woolner, P., Clark, J., Hall, E., Tiplady, L., Thomas, U. & Wall, K., 2010, "Pictures Are Necessary But Not Sufficient: Using a Range of Visual Methods to Engage Users about School Design", *Learning Environment Research*, vol. 10, pp. 1-22.