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Catching sight of students´ learning – a matter of space?

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Abstract

Based on a two-year study of a development project aiming to enhance students´ learning in a natural science course by making their understanding more visible to themselves and their teachers, this paper analyzes the role of physical space in this context. Data were collected through systematic observations, photo and film documentation, student surveys, interviews with students and teachers, and also from students´ examination results over an extended period. Previously, the course used traditional teaching methods and spaces. The students found the contents difficult, and the average examination results were poor. The teachers developed more student-active working methods, challenging students to make their understanding visible. However, the course literature and type of examination tasks remained unchanged, allowing for comparisons over time. The instruction took place in a large, innovative "flex-room", equipped with touchscreens, whiteboards, highly accessible technology and flexible furniture, allowing for increased student communication and feedback. The teachers could interact with student groups in the same room, spot and quickly correct misunderstandings in student presentations. The students´ examination results improved considerably. They argued that the work methods contributed to deeper understanding and improved retention of the course contents. Finally, few observed space-related time-losses occurred. We conclude that well-designed spaces were crucial preconditions to enable these positive results.

Keywords

learning, understanding, space, higher education

Introduction

Until the early 2000s, the role of physical spaces was a largely neglected aspect of teaching and learning in higher education (HE), something that was reflected in the limited research published on this topic (Temple, 2008; Cox, 2011). Recently, however, the interest in spaces for learning in HE has grown considerably, particularly in the US, Great Britain and Australia (see research overviews in Ellis & Goodyear, 2016; HERD, 2016; and Keppell et al. 2012). Research has hitherto largely centered around students´ learning in ICT-enhanced spaces, but also in informal learning environments, such as cafés and libraries (e.g. Beckers et al. 2016; Harrop & Turpin, 2013). Yet there are still relatively few studies on the interactions between

students and teachers, and instructional strategies enabled or rendered difficult by different kinds of spaces, although the volume of such research is now starting to expand (e.g. Beery et al. 2013; Brooks, 2012; King et al. 2015; Temple, 2014). Not least in this burgeoning field has been the influential work and research on so-called active learning classrooms (see Brooks et al. 2014, for an overview). The spatial design of such classrooms is rather standardized; they are commonly large and are equipped with round tables and chairs, each table hosting laptops or stationary computers for approximately 8–10 students; and the walls tend to have several screens (Figure 1). The students work actively and discuss their questions and solutions with the teacher, who has more of a supervisor´s role than that of lecturer delivering to the students in the ordinary classroom. Systematic studies have shown that students´ performance improves when working more actively with the course contents than in traditional classrooms where the students are less active and the teacher has the role of transmitting knowledge to them (Dori & Belcher, 2005; Brooks, 2011).

Figure 1. An active learning classroom

Source: http://scaleup.ncsu.edu/

The major research interest of the Swedish R&D project "Spaces for Learning"[1] concerns both the possibilities granted and the restrictions imposed on instruction and learning in physical spaces that allow for more flexible working forms than the active learning classrooms following the model described above. As the room and furniture open up for more spatial solutions, how will students and teachers in these "flex-rooms" accept the invitations to initiate new forms of classroom work, and will this affect students´ understanding and learning results?

This paper generally aims at increasing the knowledge of relationships between space, learning and teaching in HE. *More specifically, we ask to what extent highly flexible learning spaces enable students to work in ways that make their understanding and learning more visible to themselves and the teachers, and thereby further increase the potential for learning and development.*

The case

The case chosen is a natural science module originally characterized by traditional teaching methods in traditional spaces, where the essentially passive role of the student was to listen and take notes. Often having insufficient prior knowledge, the students found the course contents difficult and their studies resulted in many fails and re-examinations, which were time-consuming for them and the teachers. Together with a pedagogical consultant, the

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[1] The project was funded by Umeå University and the property company *Akademiska Hus*.

teachers initiated a change towards more student-active working methods based on the theoretical framework *Teaching for Understanding* (e.g. Ritchart & Perkins, 2008). They developed a set of methods aiming at challenging students to make their understanding visible, which would enable students and teachers to discern what the former did not understand, and help the latter to give timely feedback. However, the course literature and type of examination tasks remained unchanged, thereby making possible comparisons of examination results before and during the experiment.

Design of the study

We followed four first-year classes attending a natural science module in 2015–2016.[2] They were part of two programs (program A, two classes; program B, two classes), both with an overall social science orientation. The students on program A had somewhat lower merit points when they were accepted than the students on program B, and commonly showed greater problems in passing the course module than those on program B. On average, each class had 30–35 students. The instruction took place in a large flex-room, where the teachers introduced student-active working methods (see below). This space was equipped with a variety of screens, easily movable furniture, silencing devices and highly accessible technology (Figure 2).

Figure 2. The flex-room

Photo: Andreas Nilsson

The data collection methods included systematic observations (on average 20 hours/course), photo and film documentation, student surveys, interviews with students and teachers, and also gleaning information from students´ examination results over an extended period of time.
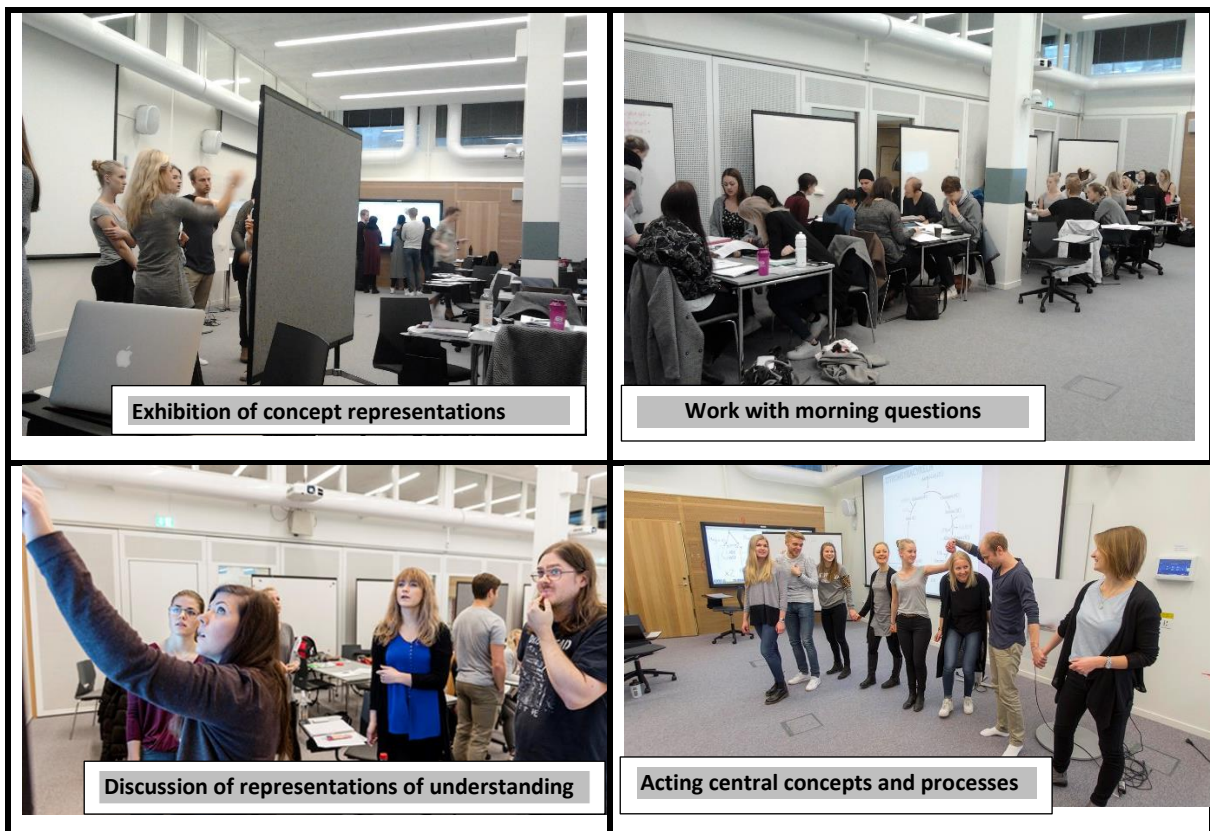
Making students´ understanding visible

Initially, the teachers identified key or "threshold" concepts (Meyer & Land, 2005), regarded as particularly important for understanding of the course contents, and the instruction focused on these concepts in particular. The teachers introduced several new working methods compelling the students to be considerably more active in engaging with the course contents than before: morning questions; student-led repetitions of difficult contents; performing/acting the

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[2] A pilot project introducing the new ways of working took place in 2013–2014, but it was not mandatory for students to attend. In fall 2014 focus interviews were conducted with the students, but no other data collection took place.

threshold concepts; and finally a group-produced presentation focusing on a threshold concept.

Figure 3 a–d: Students engaging with the central contents of the course module

Exhibition of concept representations

Work with morning questions

Discussion of representations of understanding

Acting central concepts and processes

Photos: The authors

Taken together, these approaches meant that the students had to make visible their own interpretations of central components of the course contents in various ways – by oral and written presentations and by acting. In addition, they had to share and discuss their fellow students' representations of the course matter (Figure 3 a–d). The teachers thereby had numerous opportunities to detect students´ misunderstandings and difficulties, and could direct their own interventions and feedback more effectively.

Improved learning and raised examination results

The developmental work described above was clearly successful. The examination results improved considerably, both as measured by the proportion of students passing the course module, and by the quality of the answers to the examination questions. As we mentioned initially, these questions were of the same character as before the changes described here were introduced, and hence a meaningful comparison is possible. Figure 4 summarizes the examination results from the academic year 2012–2013 (that is before the introduction of student-active learning methods) and from the period of course development in 2015–2016. It is notable that the students on program A – those with the weakest prior knowledge in natural

science – benefitted the most from the new forms of studying. In 2012, only slightly more than half of the students passed the course module after two examinations, but in 2016 almost all succeeded in doing so. Even the results from program B represent a considerable improvement compared to the academic year of 2012–2013.

Figure 4. Students passing the course module after two examination opportunities (%)
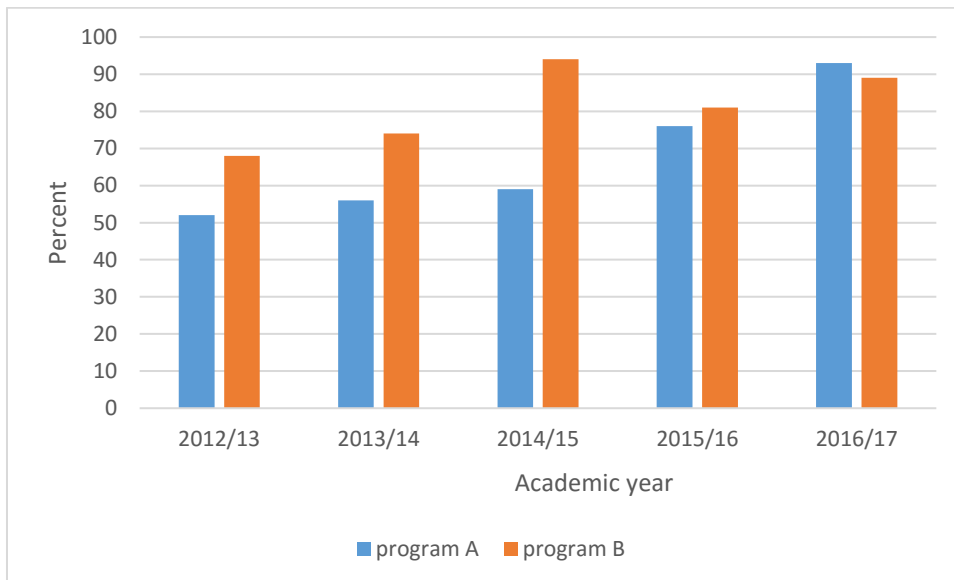
Throughout, our observations showed a high intensity and involvement from the students, and with few exceptions they were very positively inclined to these new and varied forms of working with the course matter.

The role of the learning space: Some conclusions

Similar to previous studies (cf. Ellis & Goodyear, 2016; Brooks et al. 2014), we find that access to spacious, multi-functional rooms with generous opportunities for both teachers and students to present, communicate and utilize digital resources is crucial for developing and applying student-active working forms. Such methods, if well designed, in turn result in increased understanding and improved study results. We have specifically studied methods that focus key concepts and systematically engage the students in making their understanding visible, thereby allowing them to develop their own learning, with appropriate input and guid-ance from the teachers. This way of working would not have been possible in traditional spaces that commonly delimit students´ learning activities considerably. In our case, the de-sign of the flex-room invited a variety of pedagogical approaches that could stimulate students to present their understanding of central course contents. However, the students themselves perceived it as less optimal for traditional lecturing; as this element of teaching remains important, we do not advocate a general closing down of traditional lecture halls – they are definitely needed as complements to the flex-rooms. The large size of the room was important for several reasons – for enabling quick switches between different constellations of people, reconfiguring furniture and equipment as changing circumstances required, and for enabling

the teachers to directly catch sight of and tackle misunderstandings and other problems in the groups. In addition, the students could easily circulate and take part in the presentations of peers in other groups. The common way to organize group work in separate rooms and other spaces does not permit this. It also often results in substantial time-losses, when students have to split up for group work and later gather again. In our case we noted very few space-related time-losses generally, which is particularly important when teaching time is sparse.

It is, however, important to add that access to optimal spaces is no guarantee that teachers will make use of the possibilities that they afford, and that instruction and learning will improve consequently. Our previous studies clearly show that if teachers do not get time for developing their courses and do not get any pedagogical and ICT support, at least initially, they are little inclined to take any risks by reconsidering their traditional teaching methods (Lundahl et al., in press).

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