Understanding technology-rich learning spaces

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Abstract
A number of novel technology-rich learning spaces have been developed over the last few years. Many claims have been made in terms of how they can support and enhance learning, collaboration, community participation, and creativity. This line of research is investigating whether such learning spaces are living up to such claims. The approach is ethnographic; a number of field studies have been conducted examining how people use the spaces in practice. Findings so far have shown that the positioning of the technology, flexibility and a sense of ownership and control over the technology are key issues.

Keywords
Technology-rich learning spaces, ethnographic approach, designed and actual use

Introduction
In the last few years, a substantial amount of funding has been allocated to schools and universities in the world, but especially the UK, for creating new ‘technology-rich’ learning spaces. These new spaces have been proposed as examples of future places for supporting and enhancing informal and formal learning, collaboration, creativity and socialising [4]. However, little is known as to whether these claims are being realized in actual practice. This research is examining how and whether they are used, focusing on the interdependence of physical space, furniture and technology configuration.

Background
Several studies of technology situated in educational settings have been carried out that focus on understanding how technology affects users’ everyday life and vice versa; and whether the technology serves the purposes it was designed for. Findings from these studies have been mixed. For example, Brignull et al. [1] implemented Dynamo, a large multi-user interactive surface to enable the sharing and exchange of a wide variety of digital media, in the common room of a high school and report that users appropriated the functionality of the display in a way that was consistent with the space’s previous use. Moreover, it did not
support other uses that the researchers expected. Similarly, McDonald et al. [3], situated three proactive displays in an academic conference to augment the participants’ interactions; specifically to enhance the feeling of community, facilitate social networking and future collaborations. Findings from this study showed that people appropriated the technology by extending its use in an innovative and fun way which conflicted with the common practices and social conventions already in place and thus, led to negative comments about the application. More dramatically, a study evaluating the use of interactive whiteboards in UK schools found no significant impact on the pupils’ performance relating to the use of interactive whiteboards [2].

Much research to date has focused on single technology interventions, where a public display or interactive whiteboard has been placed in a pre-existing space to serve a specific purpose/functionality. However, there are learning spaces that have been designed from scratch to be ‘technology-rich’ and where their spatial and technological design is intended to be much broader (e.g. Saltire Center, CILASS). An assortment of new technologies and furniture have been configured to create new learning spaces. This research focuses on how successful these multi-purpose spaces have been in supporting what they were designed for. The questions addressed are:

- What are the differences between anticipated and actual use (if any)?
- What is the nature of the interactional work in these novel spaces?
- How do people behave and interact with the space?
- How do people interact with each other and the technology?
- What insights emerge for the use of the technology by understanding the use of the physical space?

To address these questions, in situ ethnographic studies have been carried out on three multi-purpose technology-rich settings, called Dspace, Qspace, Cspase. Dspace was designed as a technology-rich space set in a library on a university campus. It was created as a creative play area for visitors to experiment with and explore new ideas and share knowledge; a space that brings together new technologies and ideas on how they could be used for learning and teaching now or in the future. Qspace, is a large space that was designed to support a variety of planned learning activities (e.g. workshops) to enable groups of individuals to come together within a high technology environment to communicate their ideas and generate their designs in a creative way. It is a blank space that can be re-shaped physically and technologically depending on the activity that takes place. The space was deliberately designed to be technologically-rich as a means of promoting creativity and supporting collaboration in innovative ways. Cspace, was designed as a study space for students to work together both during lab sessions and in their own time. It is a flexible technology-rich working environment that allows multiple ‘study’ activities including teaching, programming, hardware experimentation, and facilitated discussions.

**Methodology**

The method used is ethnographic involving participant observation and semi-structured interviews. A series of ethnographic studies was carried out in the different settings throughout the last 18 months and will
continue for another 6 months. The collected data consist of fieldnotes (made during or after the observational sessions), audio and video recordings, still pictures and documents. The data is analyzed and interpreted in terms of prevailing themes and tensions occurring between desired, actual and anticipated use.

**Findings**

As a result of the ethnographic approach, a rich description has been achieved providing a unique understanding of the three settings’ everyday use. In general, findings from all settings show how people appropriate technology-rich learning spaces quite differently from what the designers or managers have planned or anticipated. Additionally, a more in depth examination of the findings provides a selection of interdependent vignettes that offer insights on critical issues such as the use of technology, the appropriation of the physical space, groupwork and individual work, private and public aspects of interaction and the community of users.

Regarding the use of the technology, the insights emerging so far suggest that for technology-rich learning spaces to be successful, they need to be flexible (supporting fluid transitions from individual work to group work and from public to private use), lightweight (users moving between the spaces’ and their own devices) and accessible (providing to the users the option to control, take ownership over the technology). For instance, fieldwork data showed that Cspace was set up in a way that offered the students the freedom to choose how and when to use it. The technology in the space consisted both of laptops/tablet PCs and SmartBoards providing users the option to switch between individual and group work, and also to share (public) or not (private) their work with others. Moreover, the technology was ‘out there’ for anyone to walk in and use it and students were allowed to ‘plug and play’ with their personal devices (laptops, mp3 players, mobiles) and combine them with the existing technology of the space (figure 1). This technological flexibility, among other things, contributed to the Cspace becoming a ‘hot spot’; a cosy learning space where students feel comfortable experimenting with technology and at the same time engaging in their everyday social and work activities.

In contrast, Qspace proved to be rather technologically inflexible. The majority of activities involving technology, during the event observed, were limited to the managers of the space manipulating the lights via a display interface. The actual users did not appropriate or interact with the technology, as they didn’t have direct access to it. The reason for this is that before any use of the space the managers are pre-setting how the technology can be used depending on the needs of the event or the users. In addition, users are discouraged from using their own laptops or other devices in combination with the spaces’ existing technology. In a...
way, the technology was patrolled and used by the managers, and it was only 'post hoc' available to the actual users.

Another critical element for successful technology-rich learning spaces seems to be the physical arrangement of the technology in the space; specific spaces or physical layouts bear established associations and etiquettes that can affect the way users interact with or appropriate the technology. For example, in Dspace it was found that despite the abundance of technology and the many motivating cues and clues, its use was limited. The technology was not experimented or played with in the ways planned for [5]. A plausible explanation for this, based on the collected data, has to do with the positioning of the technology in the space; most of the devices were placed on shelves (Figure 2), creating the impression that they were for display only, thus discouraging potential users from interacting with them.

**Figure 2.** A collection of mobile phones for users to interact with and experiment are displayed on shelves.

**Conclusion**

This paper discusses briefly a selection of findings emerging from a series of ethnographic studies carried out in three novel technology-rich learning spaces. Our findings so far suggest that for these spaces to support informal and formal learning, collaboration, creativity and socialising, issues such as the spatial arrangement, flexibility and accessibility of the technology need to be considered. Future work involves further in situ studies to a variety of similar settings with the aim to develop a set of design guidelines and concerns for those involved in developing ‘learning spaces’ and ‘classrooms of the future’.

**References**


