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The future of the physical learning environment: school facilities that support the user
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The future of the physical learning environment: school facilities that support the user

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This paper presents the conclusions of a study, carried out in collaboration with schools in six European countries, which focused on tomorrow's physical learning environments. It resulted in the creation of a learning space model that is flexible, modifiable and sustainable while supporting the teaching and learning processes.

It is widely acknowledged amongst today's educators that teachers' roles have changed dramatically since the last century. In recent years, we have witnessed rapid social and cultural changes, phenomenal advances in communication and information technologies, as well as the introduction of the Internet within schools. These factors have contributed to shape the teaching and operating cultures of schools and created shifts in our expectations of the physical learning environment. They have affected teachers, educators and researchers the world over. These miniature revolutions have given rise to an urgent need for a new generation of facilities to cater for 21st century teaching and learning needs.

This paper presents the conclusions of a study carried out in collaboration with schools in six European countries over a three-year period and explores what tomorrow's physical learning environments will be like. The study, which stemmed from a project entitled Forum for the Future and which was funded by the Finnish National Board of Education (FNBE), was designed to contribute to the quality of education and to promote new methods, networks and tools, both locally and globally. It required students to answer questionnaires and work in simulation laboratories.

CONCEPTUALISING THE PHYSICAL LEARNING ENVIRONMENT

The concept of "learning environment" will become increasingly significant as schools of the future become centres of lifelong learning. "Learning environment" is a term used liberally in educational discourse because of the emerging use of information technologies for educational purposes on the one hand, and the constructivist concept of knowledge and learning on the other (Mononen-Aaltonen, 1998).

The OECD (2006) defines "educational spaces" as "a physical space that supports multiple and diverse teaching and learning programmes and pedagogies, including current technologies; one that demonstrates optimal, cost-effective building performance and operation over time; one that respects

and is in harmony with the environment; and one that encourages social participation, providing a healthy, comfortable, safe, secure and stimulating setting for its occupants". In its narrowest sense, a physical learning environment is seen as a conventional classroom and, in its widest sense, as a combination of formal and informal education systems where learning takes place both inside and outside of schools (Manninen et al., 2007). Manninen criticised traditional school teaching for conveying too much theoretical information and for preventing in-depth learning. He claims that inert knowledge is relevant for exams but not for real-world problems. This idea is posing new challenges and exerting pressure to bring about changes in physical learning environments.

The concept of the physical learning environment with respect to physical structures relates to spaces, equipment and tools within the school. Lehtinen (1997, p. 21) suggests that the concept has evolved into an even more complex structure that includes teaching equipment, sources of information and events outside of schools, where students can take part in the learning process both directly and virtually. The term evolved as a result of the recent changes taking place in pedagogy, whereby actual learning has been transposed outside of schools thanks to developments in communication and information technology. Internet has already brought about significant changes in schools. Both the immense quantity of information available and easy access to social networks have weakened the link between schools and learning and therefore modified the traditional teacher-student scenario. The learning process is becoming more co-operative, changing the teacher into a learner too. Manninen (2007, p. 27) categorises learning according to five different contexts: physical, local, social, technological and didactic.

The basic structure of teaching spaces does not seem to have evolved much over the past century. This fact inspired the research team to investigate the reason why, despite the recent changes in pedagogy and the widespread use of information technology inside classrooms and school spaces, the physical learning environment has not yet changed in keeping with this evolution.

In order to plan and construct effective physical learning environments, not only technical specifications need to be elaborated; qualitative aspects also need to be considered (Nuikkinen 2009, p. 64). The concept of "quality design" has become critical the world over. It relates to school construction and, more particularly, defining a quality physical learning environment, measuring it and analysing the results (OECD, 2006). With regard to quality criteria for school building and design, the key actors are students; requirements are determined by specific age groups, in conjunction with societal needs and regulations relating to usability and safety (Heitor, 2005).

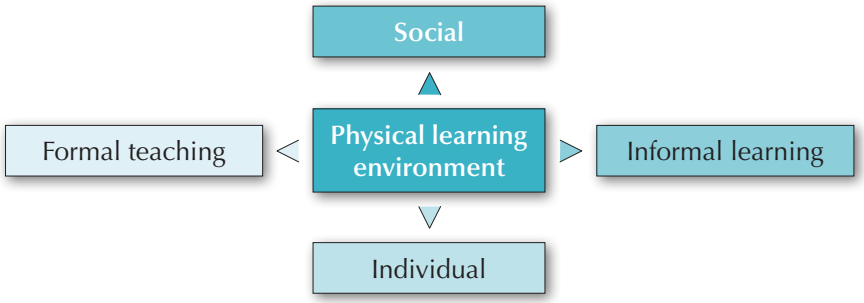
It has been demonstrated that international comparisons of education can be achieved through comprehensive quality management and quality criteria (Finnish National Board of Education, 2008; OECD, 2006). As a result, the emphasis is shifting from developing physical learning environments using norms and regulations to comparing these environments on the basis of qualitative improvement (OECD, 2009).

OBJECTIVES OF THE STUDY

With these considerations in mind, a comprehensive study was undertaken of what composes a physical learning environment. This would seem to consist of four learning contexts: social, individual, formal teaching and informal learning processes. These elements form an interactive whole in which the physical learning environment plays a central role in reforming the school's operational culture; it should be analysed and developed holistically. This study approaches the subject by considering the

learning space and its operational environment as such. Within it, flexible and modifiable learning spaces and their related learning environments are formed through pairs of dimensions. They are all interactive and totally supportive of one another, as shown below.

Supportive learning contexts



The study took place between 2007 and 2010. Its objective, which was to contribute to the quality of education, arose from concerns shared by groups of students, teachers and educational administrators about the changes which needed to be implemented in physical learning environments. A school from each of the following countries – Belgium, Finland, Holland, Portugal, Spain and Sweden – participated in the study. They all shared common features such as infrastructure, educational level and socio-economic conditions.

The study set out to conceptualise the relationship between education, the physical learning environment and the facilities needed by its users. Participants were asked to identify the components that make up good qualitative and modifiable learning spaces: it was commonly agreed that improving educational facilities was key in this regard. It attempted to highlight the qualitative factors and user-oriented design features of physical learning environments. When comparing international physical learning environment criteria and their associate recommendations, we found that expectations relating to changeability, flexibility and sustainability were key factors.

IMPLEMENTING THE STUDY

Information on users' and school authorities' perceptions was collected from the six countries using different methods: 250 14- and 15-year-old students from the six participating countries were invited to design their ideal model classroom, using a 1:50 scale and including a specific set of furniture and equipment. Students were asked to arrange the furniture to suit their learning needs and according to how they would like tomorrow's classroom to be configured; they were also asked to suggest alternative space solutions. In addition, 65 teachers completed questionnaires and 35 administrative school authorities were interviewed.

The study also took into consideration the views of different expert groups. Processing all the information from these groups was key to completing the development and planning process successfully, and also in line with Evagorou et al. (2009). We therefore used process simulation, which is a targeted research method used in specific circumstances such as when the physical learning environment is inspected through a co-operative design process (Smeds et al., 2007). This method has been used in Finland

to plan large-scale future learning physical environments; it is proving to be an effective design tool because it enhances users' capacity to have an effective impact on the work environment. The process simulation method can be illustrated with the aid of the figure below.

The different phases of the process simulation method

Kick off	Process modelling	Interviews	Preparing SlimLab™ Process Simulation	SlimLab™ Process Simulation Day	Analysis of the results	Debriefing
• Objectives • Schedule • Resources • Cases	• Analysis of cases • Process model (as is / to be)	• Detailed process model • Analysis of the interviews	• Process model validation • Simulation day objectives	• Shared view & knowledge • Development ideas • Immediate implementation	• Written report • Development portfolio	• Feedback • Other deliverables • Implementation of ideas

Source: Smeds et al., 2006.

In addition to a phenomenological analysis, which is useful when dealing with verbal answers and pictorial responses, a hermeneutic approach was used to broaden the concepts and find points of convergence. Our study was based on the notion that by describing school authorities' and users' different perceptions, we could reach an accurate overall impression of a high-quality physical learning environment. One element of the study involved evaluating the quality of the latter: this was understood to be a value judgement resulting from users' everyday experiences and their subsequent interpretation of them (Heidegger, 2000; Marton and Booth, 1997).

STUDY FINDINGS

The results of the study highlighted several key factors relating to a quality physical learning environment, namely the relevance for school users of the teaching space as a whole as well as their specific needs in relation to furniture and equipment. It showed that the physical learning environment is pivotal to users' desire to develop the school's operational environment as well as their need to renew its operational culture. The more meaningful and challenging the operational environment is, the more the user is willing to improve the physical learning environment. The needs of teachers, head-teachers and students call for practical solutions, and these too have an impact on it.

When physical learning environments offer resources and possibilities that support new teaching methods and learning goals, schools are much more prompt to change their operational culture. In other words, they are important when developing school operational culture, as well as work environments. Despite the differences within education systems, the basic principles of using physical learning environments and the concepts behind ideal teaching spaces are very similar. The study's findings indicate that pressure for change in teaching and learning is felt at the national level. Consequently, the expectations for physical learning environments do not differ significantly between countries. Moreover, today's well-educated and committed teachers offer a largely unharnessed resource for planning and implementing future learning environments.

Once the designs by participating students had been examined, a single model was selected. A mock-up of it was made and tested by groups of students. The resulting simulation provided a prime example of a learning space that supports teaching and learning operations, while demonstrating flexibility, sustainability and modifiability. The model is illustrated below.

The ideal learning space

Future technological advances and developments in social networks and media, as well as different teaching and learning methods, will undoubtedly require dynamic teaching spaces. The design of the proposed model takes these factors into account: the carefully conceived flexible layout and furniture arrangement facilitates individual, pair and group work methods. The simultaneous enhanced interaction between the student and the teacher, on the one hand, and the physical environment, on the other, optimises new information flows (Lehtinen, 1997). Respondents perceived the traditional classroom as a passive area, which hindered the full use of space. They associated dynamic teaching spaces with flexibility and the possibility of creating different furniture configurations. The latter can be achieved by ensuring that furniture is mobile and that there is free and easy access to information technology. A dynamic teaching space concept is summarised below.

A dynamic teaching space concept

Classroom space

- Static space
- Permanent furniture solutions
- Content-driven work methods
- Technology is confined to specific areas
- Emphasis on individual work

Teaching space

- Dynamic space
- Flexible furniture solutions
- Context-driven work methods
- Technology is integrated into the space
- Emphasis on individual and group work

The study participants did not decry the traditional classroom as such, but they called for additional spaces of different sizes in optimal locations to support teaching and learning processes. The spaces should offer various possibilities for learning to take place: this can range from individual study to large group activities. They should also support teacher coaching and individual work. Such flexibility fosters new types of teaching and learning, as illustrated above, which are determined by the demands of the subject or activity. In order to be successful, the sustainable physical learning environment needs to be equipped with both modular workstations and areas with comfortable seating, which contribute to support individual learning. It should be possible to adapt the furniture to different configurations. Similarly, as teaching and information technology tools facilitate flexible teaching, it should be easy to displace equipment and wireless terminals according to different subjects and work methods. The key operational elements of the teaching space are illustrated in the table below.

The key operational elements of the teaching space

	Number of pupils	Work method	Processing method	Type of workspace
Reflective learning environment	1-2	Individual or pair work	Personal processing	Personal workstation
Creative learning environment	4-6	Small group work	Group processing	Flexible workstation
Interactive learning environment	20-40	Large group work	Democratic group processing	Flexible and changeable workspace

CONCLUSION

Nuikkinen (2009, p. 278) argues that users' expectations and the theoretical concept of what makes a good school building do not match up. In practice, this runs counter – to a certain extent – to traditional planning, which on the whole requires teachers and students, as users of the buildings, to adapt to given environments (Dudek, 2000; Sanoff, 2009).

The research findings were clear: all participants recognised that significant changes must be implemented to the physical learning environment to better support users' needs. Pedagogical and physical structures need to be remodelled in parallel so as to respond to the challenges posed by changes in schools' operational culture.

In order for a school to develop into a dynamic physical learning environment, there needs to be a behavioural change in relation to planning and producing spatial solutions. Change cannot occur without input from teachers and students – the main school users. Teachers and students who conceived the study applauded the significant shift away from the traditional classroom and said how much they would like to work in a similar space.

If a school provides a quality environment for students, this will facilitate the acquisition of skills that are important for society. The choice of equipment is important: it should be versatile, resistant, durable and easy to repair. User-based innovative processes should be at the heart of designing the physical learning environment of tomorrow's schools. This process should take into account the global needs of students, teachers, school administrators and the community, while respecting the environment. A judicious selection of products and services that minimises negative environmental impacts will also be of benefit to all.

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