Mattila, P., Arhippainen, L., Ryymin, T. Towards Innovative and User-Friendly Future Learning Spaces. (TEPE2013) Teacher Education Policy in Europe Conference, 16-18 May 2013, Helsinki, Finland.

Towards Innovative and User-Friendly Future Learning Spaces

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Abstract

Learning is at the core of the society and its renewal. There is a need to develop a socio-technical engaging learning environment. In this kind of innovative future learning spaces, individuals and teams in different learning environments contexts with new technologies, can develop their skills and competences in the best possible way. Innovative physical learning environment and immersive 3D virtual worlds create spaces enabling new educational methods and pedagogical models. Development of future innovative learning environments involves stakeholders from a range of education environments using a Living Lab approach focusing on key innovation, research and impact measures. The aim of this paper is to encourage creating a new knowledge in new learning spaces through collaboration and social interaction instead of transmitting existing information on the traditional classroom. We have designed, developed and researched a range of extensible learning solutions based on the combination of ´smart active classroom´ physical world components, immersive activities and learning solutions. Components are integrated into innovative physical learning spaces in order to facilitate structuring and supporting collaborative learning activities.

This paper first discusses the changes required in the future physical learning environments. Then the findings of the empirical study of changing physical spaces towards more innovative and user-friendly learning environments are presented. The paper outlines basic ideas about development of an innovative physical learning environment. This paper provides information for facilitating a development of teacher training and physical learning environments from a traditional classroom towards future learning spaces taking into account immersive environments and utilizing digital learning materials. In the future, it is important to develop innovative learning environments for the 21st century learners by taking into account pedagogy, architecture and technology approaches. The key issue is to change school working culture, which includes changes in teaching, strategic leadership, in-service training, technologies and physical school infrastructure.

Keywords: innovative learning environment, physical learning environment, virtual worlds, immersive environments, collaborative learning

Introduction

Future learning environments, both virtual and physical, are currently under a large interest and investigation in education field. Learning environments can have strong impacts on pupils' and students' learning experiences. Barret and Zhang (2009) have reported that there is an explicit relationship between the physical learning environments and educational outcomes. Poor conditions of learning spaces can make teaching and learning more difficult. They have provided the principles for designing optimal learning spaces. (Barret & Zhang 2009.)

Playful aspect in learning is important. There has been an increased interest regarding play in education, for instance, outdoor technology-enhanced playful learning environments (PLEs) have been designed and implemented in Finnish schoolyards. (Hyvönen 2011.) It is important to regard learning as a life-long process, which takes place in different learning environments, for instance, schools, classrooms and other innovative and informal places and spaces (Kangas 2010).

The use of mobile and ubiquitous information and communication technologies (ICTs) including three dimensional (3D) virtual learning environments and digital content have provided new additional value to previous e-learning environments and learning processes. Tools for collaborative and phenomenon based learning which support new kind of visualization, guidance, experiences and learning regulation are under development. However, learning still has a role of social activity, and thus social interactions are important in virtual learning situations. Discussions and argumentations with others can lead into more profound learning results. Learning environments are needed to be developed towards supporting learners to be more self-guided and self-directed, which can help them to control their cognitive learning process. Self-regulated learning (SRL) and meta-cognitive skills become more and more essential in a development of future computer supported collaborative learning environment (Järvelä et al. 2011). From traditional classroom type of learning environment we are moving towards game-like learning environments, simulations and learning modules where learning can happen faster and the knowledge retention is more effective. Into the future virtual learning environments we should develop tools that can facilitate the learner in thinking and learning processes. (Soliman and Guetl, 2011.)

This paper presents the findings of the empirical study of changes in primary school's physical learning spaces and outlines basic ideas about development of an innovative physical learning environment. This information will help to develop teacher training and physical learning environments from a traditional classroom towards future learning spaces taking into account immersive environments and utilizing digital learning materials and ubiquitous technology solutions.

Change of working culture and media

The world has changed, learning has changed and even learners have changed, while the school as an institution and the classroom has stayed almost the same for the past hundred years. The narrowness of the definition of the learning environment, classroom- and book-orientated teaching, the central role of the teacher as well as a limited variety of teaching methods have hindered the school's progress, making it unable to keep up with the development of society at large. A comprehensive change in the school's operational culture is required. The role of teachers, management and support systems and learning environments need to be developed simultaneously so that they can meet today's and tomorrow's requirements. Inspiration for this can be found in young people and their genuine willingness to learn. A change in the operational culture will enable technology to be utilized in a sensible manner. The time for projects, that are isolated and sometimes very narrow in their scope, is over.

The school can no longer claim the sole right to learning, the teacher no longer owns the knowledge and the book is no longer the only source of learning. In addition to formal circumstances, learning happens in informal situations, anytime and anywhere. Pupils utilize technologies and media mostly in order to create networks and to find information for them. Critical evaluation and judgment of information and their source becomes a new skill to be developed by students. Our homes are more modern and furnished to create cozy environments in which people can relax together. Companies have also invested in making work environments comfortable and inspiring. The school, however, has persisted in keeping the same basic format unchanged. Today's pupils and parents know how to present demands on their work environment and will express their dissatisfaction if necessary. This puts pressure on schools and physical teaching/learning environments with regard to their functionality, architectural solutions, furniture, lighting and technologies. Virtual learning environments are going to play a more and more important role in the future.

As long as learning involves a teacher in the central role and is book-, subject- and classroom-orientated, a traditional classroom will do. When we think of project-based learning, phenomenon-based teaching and learning methods, investigative problem-solving, or collaborative or communal approaches, new view points are required. Add to this individual learning styles and we should consider flexible learning environments that can be adapted for groups of different sizes and of different needs, furniture that is suitable for various uses, and the utilization of ubiquitous or mobile technologies and adaptable lighting.

Learning environments in the school of the future cover a new variety of different pedagogical opportunities without excluding traditional learning and teaching methods. They offer a wide range of flexible areas that can be used by the entire local population from morning until evening. Teachers' opinions must be taken into account, but equally pupils/students, parents, local companies and the entire community must have a say. The premises must be suitable for all user groups and all occasions, from everyday operations to school celebrations. In the school of the future the central areas will be in efficient and versatile use during evenings, weekends and school holidays.

An investment made in the school system is often one of the most expensive decisions a municipality can take; it is always a long-term investment. Is there any point in building a traditional schoolhouse with traditional classrooms if we are aware that the requirements for the future learning environment are changing and that the adaptability and versatility of the building will be more varied, that work environments are changing and a solution that is a little bit different will better serve all its users? A comfortable, healthy and home-like solution is pleasing for its users and enhances learning results. It is an investment for the future and offers versatile operations for the surrounding community.

Teaching technology, virtual 3D learning and training environments

A pupil's relationship with technology is personal, and therefore it is best to provide each pupil with a personal terminal (1:1). The device is tailored for the user's needs and offers access to information at all times. This requires fast connections and wireless solutions that guarantee mobility. A personal terminal creates a feeling of ownership and makes pupils to look after their devices so that they can fully focus on learning. The school currently forbids pupils to bring their own devices to school, which means that they are not utilized in the learning process at all. Such devices include laptop computers, camera and smart phones, mobile devices and games consoles. It is easy to ban them from the school and formal learning, but has anyone considered that this may also hinder learning? We should really be thinking about what the rucksack of the future contains and how its contents support learning.

Virtual worlds will soon be a reality in learning and living. Children have virtual access to everything else except the most important thing: their school. Virtual environments have mostly developed on platforms such as Second Life. In the future, we will be able to move between different worlds, virtual spaces, using our electronic identities, avatars. These spaces can be utilized in learning and teaching. The aim is to create 3D virtual learning environments for pupils. The environment is an extension of the school and a safe place to learn when the time comes to make the transition from the traditional school into a virtual space. The realXtend (Alatalo, 2011; realXtend, 2012) virtual

environment platform can provide a virtual learning space that is the model of the future learning environments, where pupils use their own scripts or tools for working in a 3D environment or for building their own virtual worlds. This type of open development closely follows the developments of the 3D Internet, which can lead to a more immersive use of 3D virtual environments and mobile services.

Learning environments of the future and learning innovation ecosystem

The ideology is applicable in new school buildings, schools to be renovated and during the planning process. It is also possible to only change the operational culture. The objective is to offer solutions for the need to develop the role of teachers, leadership, support services, updating training, educational technology, the building of schools and the development of the school network. If we only develop one sector, the entity remains the same. The core ideas relate to the development of learning environments, furnishing solutions and the reform of the operational culture so that it creates a sense of community (social responsibility) and builds a community learning centre (physical institute - virtual global education and learning technologies). Both traditional and virtual learning areas are learning environments.

The idea is to bring educational and learning innovations for the 21st century learning and test them in Living Lab type of pilot environments. This reform is based on a clear vision and "the big picture". Instead of starting separate reform projects, the school is developed as a unit and change happens on all levels: the teacher's job description; professional challenges and updating training; strategic leadership; pedagogical and technical support services; educational technology and learning environments.

Empirical study of the changes in physical learning environment

In the empirical study, we changed the physical classroom spaces towards innovative and user-friendly learning environments and investigated how teachers and pupils experienced these new spaces from learning environment and collaboration points of view. Our empirical study was planned based on Sawyer's (2006) theoretical framework, which includes the following approaches:

- Changes in learning concepts emphasize a deeper conceptual understanding and learners' active role in their own learning process.
- Learning is no longer seen as a knowledge transfer between a teacher and a pupil/student but the teacher's role has turn from a transferor to an instructor.

- In the light of these changes, one of the teachers' main task is now to design learning environments that help pupils and students learn deeper conceptual understanding.

Learning environment is a place, a space, a community or a practice that supports learning. In this case we see classroom as a learning environment, which is not just a space but a unity that includes many dimensions (Figure 1) and our focus is on physical and social dimensions.

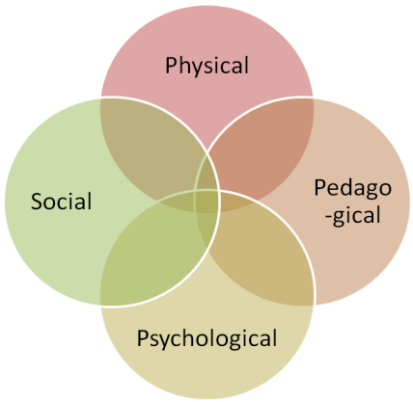


Figure 1. Dimensions of learning environment

The aim of the study was to find out how physical space and furnishing influence to learning activity in the classrooms from the collaborative point of view. We studied physical learning environment in old Finnish school. Two classrooms were developed towards future learning environment by changing furniture and ways to use space. Our approach was to make small changes in order to achieve immediate impacts. The study environment was the following:

- Start situation:
    - The classroom was old sport hall which was earlier divided into two similar sized classrooms (class A and B). Tables in the classes were placed in the traditional order (Figure 2).
- Two different classrooms:
    - Class A: 6. grade, 1 teacher and 29 pupils (16 girls and 13 boys), acted also as a music class.
    - Class B: 5. grade, 1 teacher and 18 pupils (5 girls and 13 boys)
- New situation:
    - these two classrooms were developed towards future learning environment by changing furniture and ways to use space (Figure 3 and 4):

- new tables (different shapes and sizes, easy to change order and amount of group members)
- mobile adjustable chairs
- personal lockers
- new sitting order for supporting collaboration between pupils and teacher.

Empirical data was collected by observations in the classrooms before and after the changing the furniture. Also pupils and teachers filled the questionnaire. Pupils' questionnaire was composed of two open questions and 18 statements related to physical characteristics and "collaborative atmosphere" of the classrooms.

A  B 

Figure 2. Start situation in the classrooms A and B.

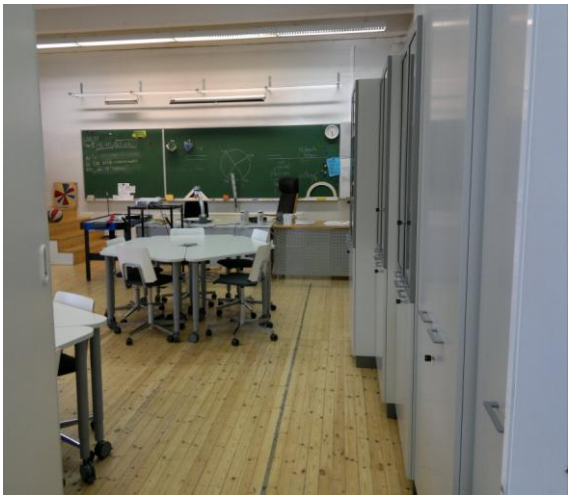
A  B 

Figure 3. New learning environments: Classrooms A and B.

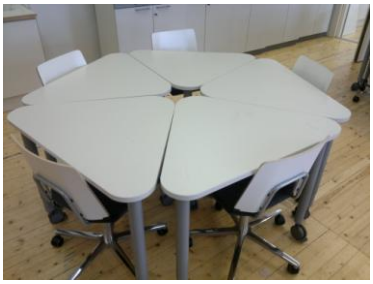
A  **B**  **C** 

Figure 4. New furniture (tables, chairs) selected for the classrooms for supporting collaborative work and flexibility. Tables (A, B) are not personal anymore, but lockers (C) are personal.

In the new learning environments tables are not personal any more. Instead, each pupil have own personal locker (Figure 4C). Tables and chairs were selected so that they can support collaborative work and are flexible to change according to the amount of pupils and needs of activities (e.g. music instruments). Chairs can be adjusted according to size of pupils (tall/short).

Teachers' experiences

Both teachers identified ideal physical learning environment as a space where is flexible furniture, which supports many kinds of learning activities. Difference in experienced impacts:

- Teacher A. ”no change in teaching methods or practice in the classroom”
- Teacher B. ”Big change in practice in the classroom”

The study indicated that the it can be a big challenge for teachers to change their working culture, especially in certain period of the year and with certain age group of pupils. for instance, the teacher A decided to continue teaching with the traditional methods, because of the hectic spring period. It would be the best to make small changes towards new innovative working culture. Teacher B commented that school books still tend to guide to follow certain (traditional) process in teaching. However, the teacher B still noticed changes in own working culture in the new environment:

- More standing and moving during teaching -> not any more just behind the teacher’s table
- Thought more how to speak and move in the classroom
- It is easier to take into account special needs of individuals and groups
- Group spirit is developed to a more open and encouraging
- New furniture enable many ways to organize pupils’ sitting order.

The study indicated that the changing furniture can launch the change in course of action.

Pupils' experiences of new learning environment and collaboration

In general, pupils experienced positively their new learning environment. They experienced that new classrooms were more comfortable and cozy but not more collaborative (Figure 5 and 6). In order to study collaboration in more detail, it would require more iterations and long-term studies. Pupils liked soft and movable chairs, as they commented that it is easier to make group works, because one can rotate the chair. It was interesting that a large amount of group works made in the class B was experienced negatively (Figure 6). This can indicate that pupils are part of the change. Thus, it is important to start to change physical spaces towards innovative learning environments in the beginning from the first grade. Pupils comes from the kindergartens and pre-schools, where environments are often more innovative, creative and playful than in primary schools learning environments.

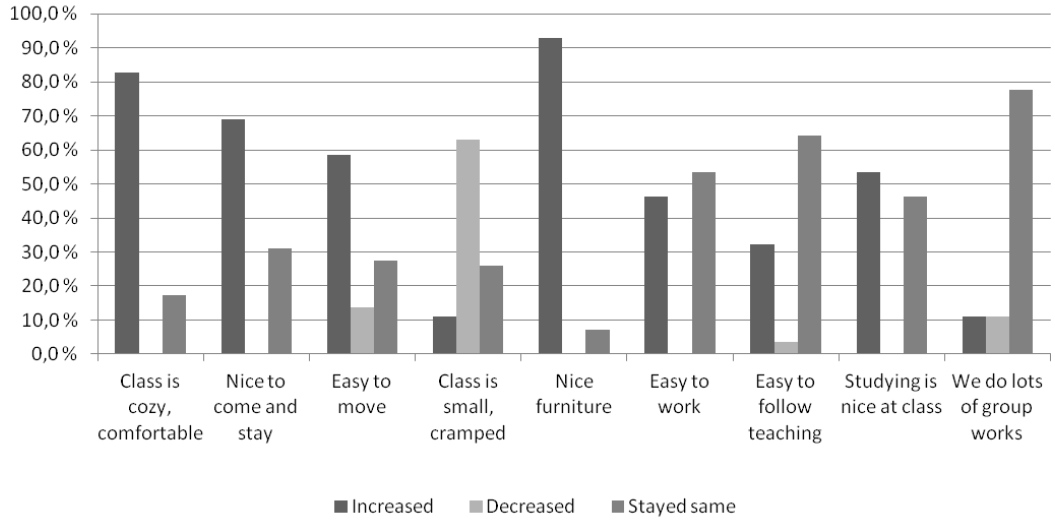


Figure 5. Classroom A: Pupils' experiences about change: learning environment

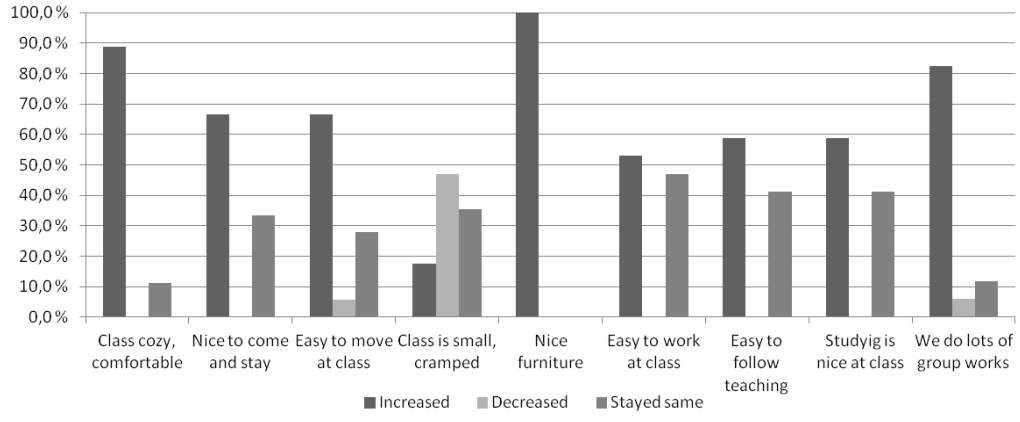


Figure 6. Classroom B: Pupils' experiences about change: learning environment

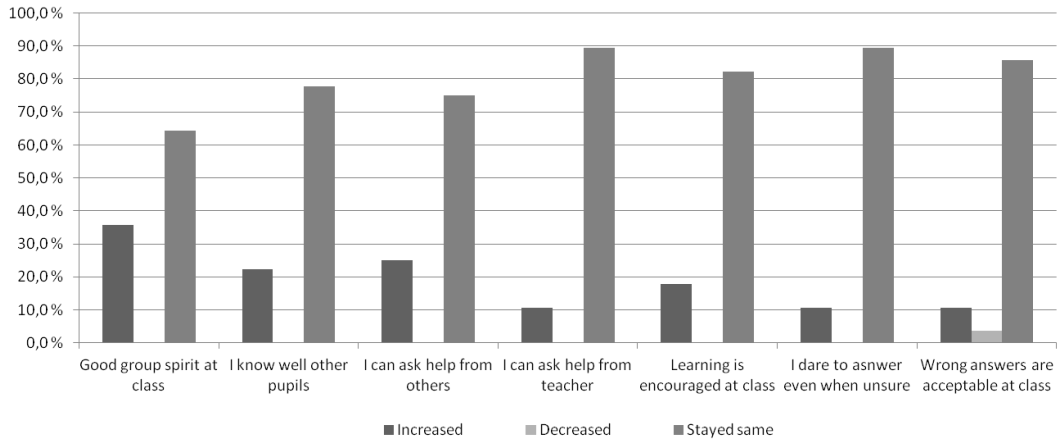


Figure 7. Classroom A: Pupils' experiences about change: collaboration

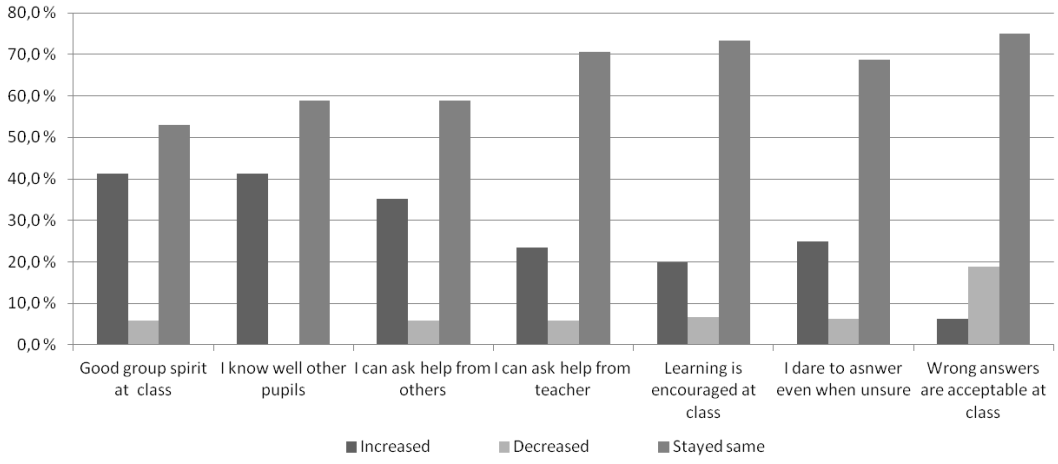


Figure 8. Classroom B: Pupils' experiences about change: collaboration

Based on this study is seemed that changes in the physical environment had impacts more on how comfortable and cozy pupils experienced the learning space. Instead, changes in the furniture did not influences on pupils' experiences about collaboration and security. (Figures 7 and 8.)

Conclusion and future work

In this paper, we have discussed about the needs for the changes in future learning environments, both physical and virtual. One aim of this paper is to raise the discussion about the state of the traditional learning environments and their inability or weaknesses to meet future challenges of the 21st century learning. In this paper, we also present the empirical study where we changed the furniture and use of space in order to provide innovative and use-friendly learning environment. Teachers' and pupils' experiences of the changes are also presented. Our study indicated that it is good to start to do small changes in order to achieve immediate impacts. Even though, one teacher noticed changes in own teaching habits in the new classroom environment, there are several other

aspects that have impacts on teaching, for instance, class sizes, space sizes, time periods and books. Also, teachers' working experience, habits and personality have still a strong impacts on teaching. A change in the learning environment can launch a change in working culture, but it is not enough. In the future, it is important to develop innovative learning environments for the 21st century learners by taking into account pedagogy, architecture and technology approaches. The key issue is to change school working culture, which includes changes in teaching, strategic leadership, in-service training, technologies and physical school infrastructure. At best, change in working culture and change of physical environment go hand in hand.

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