

Designing a Learning Space for Unified Collaboration and Communication between Universities, Industry and the Public Sector

Igor Vušanovic

University of Montenegro, Montenegro

Bojan Knežević

University of Banja Luka, Bosnia and Herzegovina

Robin Støckert

Sør-Trøndelag University College, Norway

Abstract

The goal of this paper is to present theoretical and technical approaches, which acts as guidelines for the design of multifunctional rooms (MFR) enabling communication and collaboration. Furthermore, to define a method to mix key trends in education technology, pedagogy and room design together to facilitate various types of scenarios and users. The Norwegian Ministry of Foreign Affairs is financing a program in Higher Education, Research and Development in the Western Balkans 2010-2016 (HERD). A sub program within HERD focus on the energy sector. This paper refers to a project within the energy sector called: Quality Improvements of Master Programs in Sustainable Energy and Environment (QIMSEE). The projects members in QIMSEE are eight universities (Trondheim, Belgrade, East Sarajevo, Tuzla, Sarajevo, Banja Luka, Podgorica, and Skopje). The main goal of the project is to improve the quality of education at Master's programs. A milestone in this project process is to enhance interconnections between universities, industry and the public. The need for a common technological platform and standards for cooperation and communication is fundamental. A multifunctional room (MFR) or "learning space" will be set up at each location to support activities defined in the project synopsis.

Keywords: Collaboration and communication, learning environment, BYOD, technology and quality in education.

JEL classification: I23

Introduction

The QIMSEE project aims to contribute to educating a national work force at WB countries that has adequate innovative qualifications in the energy sector by building sustainable capacity of higher education institutions. The project has a set of specific objectives: (i) Develop and establish three new internationally recognized master study programs for the field of "Sustainable Energy and Environment", at University of Banja Luka, University of Skopje and University of Montenegro, (ii) Increase the quality of the newly established master programs at the other four WB Universities in order to enable international transparency, recognition of qualifications and international mobility of learners and graduates. The three new network members will also participate in all quality improvement processes, (iii) Establish close cooperation between WB participants for mutual support in achieving better quality of master studies, (iv) Contribute to the development of outstanding and innovative master thesis projects that solves problems of industry and public

sector in achieving energy and resource efficiency and/or zero emissions, application or research on new materials and new technologies for renewable energy, (v) Increase institutional quality and capacity of the WB Universities in the field of teaching staff improvement, laboratory organization and logistics, networking and supplementing expertise to match closer to the Norwegian partners, (vi) Establish and support interconnection of the WB Universities with industry and public sector in the WB region.

To obtain the goals in the QIMSEE project listed above, we need to create a common learning space/workplace/arena for local and global activities/scenarios. In this paper, we describe how to construct a new type of Multifunctional Rooms (MFR), with a flexible design/layout to support scenarios utilizing mobile/networked and audio/visual technology. The scenarios may consist of active learning and teaching activities, meetings, presentations, development, adaption and production of teaching material/curriculum, unified collaboration and communication, or facilitate a vast selection of relevant activities needed in joining the universities, industry and the public sector.

In the methods chapter we give an overview of how changes in higher education interacts with the introduction of evolving pedagogical tools and methods combined with new technology that changes the way and space where people interact, communicate and collaborate. Based on these observations, we use a pedagogy-technology-space model (Radcliffe 2009) to define the building blocks for the MFR. The result chapter describes the design criteria for the physical room, and the arguments for choosing flexible but standardized low cost equipment. The last chapters with discussion and conclusion emphasize the critical success factors for implementation and usage of the MFR within and after the QIMSEE project.

Methodology

According to the "NMC Horizon Report" (NMC 2015), higher education continues to move away from traditional lecture-based programs to more hands-on scenarios, where University classrooms will start to resemble real-world work and social environments that facilitate organic interactions and cross-disciplinary problem solving. On the other hand, we can correlate these classrooms to the workplace of the future, where technology, people and processes interact and create a collaborative, contextual and visual environment, independent of physical location. The European Commission's "Modernizing Universities" agenda ((CR, 2007) emphasize similar objectives as the QIMSEE project, focusing on implementing reform in higher education by restructuring institutions to enable faculty and students to be active participants in the global marketplace of research and innovation. The EC's goals include stimulating a more open research environment, fostering stronger partnerships with businesses, and rethinking how qualifications are recognized. A recent OECD review concluded, that universities could serve a broad range of functions for regional economic development and innovation through education, research, as well as culturally related activities (OECD, 2007). We must have in mind that different universities have varying functions, based on their capabilities and industrial contexts (Lester, 2005; Hatakenaka, 2008), however the society needs Universities which focus on research and Universities which focus on teaching. They are an integral part of the national or regional innovation systems (Mowery and Sampat, 2005) and a critical component of the evolving triple helix in which universities, government, and industry change their roles through interaction (Etzkowitz and Leytesdorff, 1997).

Furthermore, if we compare the objectives of the QIMSEE project with the key trends accelerating technology adoption in higher education (NMC, 2015): We see that today's global environment is allowing universities to unite across international borders and work toward common goals concerning technology, research, or shared values. Support behind technology-enabled learning and integration of sophisticated multimedia and communication technologies in higher education classrooms, gives us a lot of flexibility, which facilitates and increase the use of blended learning and flipped classrooms. More universities are helping to facilitate these emerging models of education, by rearranging learning environments to accommodate active learning. Collaboration is a critical element of learning and often interpreted as social interaction, conversation and dialogue, which are fundamental to learning from a socio-cultural perspective (Vygotsky, 1978).

Our design methodology has its foundation in educational/pedagogical theory having in mind that the MFR, may be applied to a vast type of scenarios with many types of users. It all boils down to create a space where people can meet, learn, create and interact. Research done on how people learn (Bransford, Brown, and Cocking, 1999) has shown that learners are not passive receivers of knowledge. Each learner actively constructs knowledge. In other words, an effective model for learning is to engage students to create their own knowledge through active and collaborative learning. (Honebein, 1996).

These statements have inspired us to rethink the instructional mode completely, and the term "learning spaces" represents a fundamental shift in our thinking (Brown and Lippincott, 2003). We have to design learning spaces (MFR) that support, encourage, and enable active learning engagements. According to Brent G Wilson, a definition of a "constructivist learning environment" would be a place where learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem solving activities. (Brent Wilson, 1996).

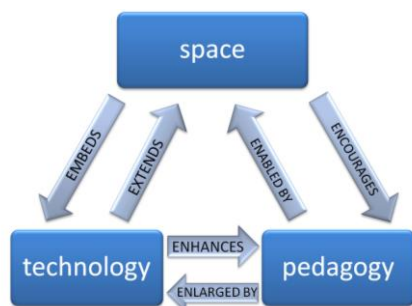
The major components in the design of our "Multifunctional Rooms" are space, technology and pedagogy (Radcliffe, 2009). In addition we add the users, which we can define as teachers/facilitators and learners within the QIMSEE project, and as collaborative and interacting users from the industry and private sector.

Physical space

A number of authors have proposed lists of design principles or similar as guides in the creation of contemporary learning spaces. (JISC, 2006), (FLEXspace), (Malcolm Brown, 2015) There is no generally agreed approach to the creation of new learning spaces and various groups are promoting particular sets of guiding principles for the creation of such spaces. As a short summary of buzzwords for these design principles, when can mention: Flexibility, motivation, collaboration, personalization and inclusion, future proof, tools and technology, innovation, design aligns with the campus context, management and administration, enable activities.

However, we cannot find objective data based on well-documented case studies or analysis to test these approaches. As well, there is little or no empirical evidence provided to support the proposed principles. (D. Radcliffe). In our case the most important design features, will be to follow the international rules and regulations of classroom/control room design, which describes parameters for optimizing acoustics and sound, lights, HVAC, sightlines, size of display surfaces and colours and of course layout for optimal technical infrastructure. In other words focus on "environmental" quality and atmosphere first, and then on the flexibility to utilize the room with a selection of learning scenarios and adapted technological/ pedagogical measures.

Figure 1
Pedagogy-Space-Technology Framework



Source: Radcliff, 2009

Technology

In the NMC Horizon Project (NMC, 2015), educational technology is defined in a broad sense as tools and resources that are used to improve teaching, learning, and creative inquiry. In fact many of the technologies we want to adopt in this project already has been applied in major companies to increase cooperation and communication in the development phase of a product and furthermore to optimize production and sales. Examples of these new technologies may be "Mersive" with its product Solstice, "Oblong" with Mezzanine3. In our MFR, we have recommended the EPSON interactive projector as the main hub in the technical setup. It is a cost effective and flexible solution, which supplies many of the features of the more expensive "company" based products mentioned above.

Many companies develop and use technologies within the fields of Consumer technologies, Internet of Things, Learning, social media, video/audio conference and visualization. As a part of the QIMSEE goals, we need to define digital strategies to find ways of using low cost, flexible technology to enhance our learning and to enable technologies in new meaningful ways. We do not want to invest large sums of money in a rigid technical solution, which is obsolete in 3 years. Then it is better to invest in low cost gadgets that can solve technical challenges on the fly and evolve together with pedagogical changes and methods, in a seamless way.

Pedagogy

The development and enhancement of the master studies in the QIMSEE project, are work in progress, hence the interconnection between technology and the pedagogical framework is not fully developed. We can assume a major part of the lessons will be unchanged and that the teacher/instructor transfer knowledge to the students. This is taking place in the local classroom, but also via videoconference, where the teacher is located in Trondheim, and the students are present in their respective local MFR. However, the multifunctional rooms will enable and facilitate teachers to evolve their instructional techniques and to give the students the possibility for flipped classroom scenarios, blended/adapted learning activities and new ways of collaboration and communication. The Infrastructure and technological solutions will support pedagogical tools for sharing and working on a common workspace. Data regarding learning monitoring, outcome and progression will be collected. Support interaction, initiate discussions and peer learning by using response technology. One example of this technology is the SRS and PELE software

products, developed at Sør-Trøndelag University College. The students use their own mobile devices with the software and gives the teacher immediate feedback/results on questions and assessments. These software tools can initiate several pedagogical approaches and make the lessons more interactive and engaging. These tools are online, which makes it easy for the teacher to collect answers in real time from groups situated at different locations/Nodes in the QIMSEE.

Learners and teachers

A large amount of today's students already have skills and competences in a variety of practices related to learning and the use of digital and networked technologies (Traxler, 2009). So educators have, first of all, to meet the expectations of new generation of young learners who are commonly referred as the Net Generation (Tapscott, 2009) and Digital Natives (Prensky, 2010) whose perception of the responsibilities and roles of themselves in relation to lecturers and universities has changed (Traxler, 2009). Secondly, the teachers also need to adapt their curriculum and pedagogical methods accordingly.

Results

At this stage of the QIMSEE project, four rooms are in the design/building phase, and three rooms are finished and in daily use. An analogy to the earlier mentioned space-technology-pedagogy framework by Radcliff, was used to define a set of building blocks. The building blocks of these MFR, were divided into three segments. First, we defined the physical environment in the room. Then we defined the type of technology and equipment in the room. The third part of finding the correct pedagogy is work in progress and related to the general progression and milestones of the QIMSEE project.

Physical design of the room: Most of the multifunctional rooms started out as redesigned and refurbished rooms that already existed on campus. This approach introduced some limitations regarding the placement, size and shape of the rooms, and also heating and ventilation (HVAC). However, then most of the budget could be allocated to flexible inventory and infrastructure to optimize the functionality of the multifunctional room.

Rooms were optimized to facilitate videoconference and other types of AV-communication, by improving acoustics (sound quality), lights for different videoconference settings and finally by using nice colours and materials to create a good atmosphere. Choice of furniture and tables reflected the multipurpose functionality of the room. Flexibility was paramount in the room design.

Equipment: A set of standard equipment was set for all the multifunctional rooms. The reason for this was that each node in the QIMSEE network should be able to help each other with technical issues. Furthermore, to ease implementation of needed defined standards for communication and collaboration into existing network infrastructure. This common platform of equipment and support services, are crucial to make the basic functions operative. It also makes it easier to have common technical training sessions and to develop and exchange experiences regarding the role of the MFR in the QIMSEE project.

Interactive projector: The last years the interactive whiteboard has entered the classroom, and it has helped the teacher to create and present material in a more interactive and engaging way. A vast collection of new tools can improve teacher presentations and distribution of teaching material. Our choice of interactive projectors supports wireless connection of any mobile device (BYOD), connection of

up to 8 projectors to one common workspace. Each node in the network can in real time, write and work on the same document displayed at the interactive projector. There are many more features, which enables real time networked communication and collaboration, between the nodes in the network.

Document camera: The document camera will act as tool to import video/photo/recordings into the interactive projector (pc) for further processing. It provides many new opportunities to "import" material into the learning environment. Secondly, the document camera can support recordings of small videos with audio. These videos can be teacher examples or student presentations.

Camera and videoconference: We have decided to use two types of qualities/systems for the multifunctional rooms. First, we have web cam solutions. These systems are for small group or 1-1 communication. Secondly, we use professional Tandberg videoconference systems with a centrally located Multi Conferencing Unit, (MCU). This gives us the option of sending a lecture from the University in Trondheim to seven other locations in the QIMSEE network at the same time, with the option of two-way communication.

BYOD: The MFR makes it possible to connect the students with learning opportunities using their own devices. Our solutions support different standards of sharing/mirroring displays. Students can do their own recordings of lab measurements, presentations of results etc. Students can be activated and interact with the teacher through student response systems. Communication through social media and other related audio-visual apps has become a natural part of every student's life, and it is up to the students and teachers to use this in a positive way, and integrate it as a part of the learning process.

Discussion

As mentioned earlier, there is not much well documented case studies/analysis or empirical evidence provided to support our proposed principles for the MFR design and usage. The design and implementation of the MFR are a small part of the whole QIMSEE project. The integration of the MFR into the project and the contribution it might have in reaching the defined goals depends on several critical success factors. First but not least, we need to create a common understanding about what these rooms represent and how they can support the quality enhancement process of the education. This anchoring of understanding should be done on all levels in the University, from administration/technical staff to teachers and finally to the students. It is of great importance that the room and its functions integrates with the development of new curriculum and the pedagogical methods used in presenting and learning the updated material. The technology in the MFR has no value without content and usage. The major challenge will be to integrate the MFR into the education, and to motivate, inspire and train the technical staff, teachers and students in using the MFR, with all its features. In a broader perspective, it is also up to the University to offer the MFR and its features to a broader audience, which may use the rooms in new exiting ways and create interaction between the industry and the public sector.

Conclusion

Within the project, the use of MFR can facilitate a good working environment and good starting point for communication and collaboration between students, both locally and between the nodes in the project. In addition, the MFR delivers a technical framework for universities to unite across international borders. The MFR

can facilitate an arena for interaction between the industry and the public sector to create regional growth. At the end of the day, the MFR is just a room filled with technology. It is up to the users of the room to fill it with content, cooperation and communication. The technology should just be a seamless tool in the process of reaching the goals. We cannot predict the use of MFR in the future, but we can create opportunities for things to happen.

We need to inspire, train and facilitate the users/partners in utilizing these MFR rooms. This will be an ever-changing process based on and adapted to changes in education and future workplace. Document and record the use, effect and role of the MFR in accordance with the QIMSEE goals. Furthermore to verify and improve our design model and the related building blocks, in conjunction with the project progress. We need to have a continuous update and evaluation of upcoming low cost technologies and gadgets, which can improve the functionality and effect of the MFR in the future.

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About the authors

Igor Vušanovic. PhD, Full Professor, University of Montenegro, Faculty of Mechanical Engineering. Author can be contacted at igorvus@ac.me

Bojan Knežević. Teaching assistant on Faculty of Mechanical Engineering in Banja Luka. Currently, PhD student at Faculty of Technical Science in Novi Sad. Author can be contacted at bojan.knez@unibl.rs

Robin Støckert. Assistant Professor at Sør Trøndelag University College. Author can be contacted at robin.stockert@hist.no