

FRI-K1-1-QHE-07

VISION FOR THE CLASSROOM OF THE FUTURE (FUTURE EDUCATION SPACE)¹

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***Abstract:** The paper will describe a vision for the classroom of the future in which innovative educational technologies are tested, adapted and used in the learning process. The classroom of the future will be described as futuristic educational environment with high-tech technological solutions for an innovative educational process based on modern educational methods. Traditional (passive) classrooms have to be replaced with learner-centered flexible learning environments – called active learning spaces.*

***Keywords:** interactive whiteboard, interactive monitor, interactive table, 3D scanner & 3D printer, virtual reality, augmented reality, holograms, video conferencing*

***JEL Codes:** I20*

INTRODUCTION

Currently, the new generation of learners (students of the future) attend universities of the past. Separate isolated attempts are being made to change the exterior or interior of universities, in order to bring them closer to the expectations of the digital generation. Cosmetic changes in the environment are one of the requirements for the vision of the classroom of the future, but more important are other changes related to the teaching style. These changes are needed to adapt the educational system to the needs of the digital learner’s generation.

Nowadays, there are emerging trends in educational technologies and methods. The new generation of learners are born with new technologies and require new educational approaches that improve their understanding and speeding up the whole learning process.

The paper will describe a vision for the classroom of the future in which innovative educational technologies are tested, adapted and used in the learning process. The classroom of the future will be described as futuristic educational environment with technological solutions for an innovative educational process based on modern innovations in line with the trends in the field.

¹ Presented a report of October 25, 2019 with the original title: ВИЗИЯ ЗА КЛАСНА СТАЯ НА БЪДЕЩЕТО (ОБРАЗОВАТЕЛНО ПРОСТРАНСТВО НА БЪДЕЩЕТО)

INTRODUCTION

The classroom of the future is designed as innovative infrastructure. It can be stated that it will provide an experimental educational environment for research of models of training for the future generation of learners.

The vision for futuristic educational infrastructure corresponds to the current tendencies for digitalization of education, namely (Smrikarov, A, 2018):

- Introduction of innovative training and educational methods in educational institutions;
- Construction of specialized infrastructure and purchase of equipment necessary for the realization of the concept;
- Building a strategic partnership with researchers focused on innovative training methods
- Construction of specialized infrastructure and purchase of equipment necessary for realization of the vision;
- Attracting highly qualified experts and strengthening the expert and technological capacity of the team;
- Accumulation of critical mass of interdisciplinary researches related to the vision and maintaining the innovative educational environment with new ideas and concepts. The interdisciplinary specialists have to be from the different scientific fields, such as: technical sciences, natural sciences, mathematics and informatics, humanities and arts, social, business and legal sciences. A positive effect will be the development of interdisciplinary scientific capacity by attracting qualified researchers in different scientific fields.

BASIC EQUIPMENT IN THE CLASSROOM OF THE FUTURE

The vision will be provided by the implemented high-tech equipment, which will include:

- Table with an interactive monitor to test the possibilities for integration and use in the educational process;
- 49 inch interactive display for experimentation and testing to implement and use in the learning process as a substitute for interactive whiteboards;
- All-in-one computer and portable computer for multi-platform testing of the developed educational models;
- Tablet for testing experiments of educational models;
- Virtual Reality glasses - can be used for a number of educational simulations involving virtual reality elements and objects or spaces of the virtual world.
- Augmented Reality glasses – will allow learners to see digital information superimposed on things they see in the real world.
- Mixed Reality glasses – will allow learners to interact with real and virtual objects, which co-exist in real time.

A future education space will be created at the University of Ruse. The future classroom room will feature an interactive whiteboard and an interactive monitor. Students in the classroom of the future will sit at interactive tables and they will write down directly on the board using the interactive table so going out on the board will be rare. Each student will have a tablet that will replace textbooks and notebooks. Adapted study material for individual needs will be downloaded from the "cloud". The smartphones will be used as personal assistants.

3D scanner & 3D printer, virtual reality, augmented reality and holograms will be used as innovative technologies in future classroom. Video conferencing activities will be used to invite lecturers from all over the world.

Virtual glasses can be used to simulate learning simulations to overcome fears and phobias, and more. This technology can be especially useful for educational games and simulations for people with special educational needs to represent situational activities.

ACTIVE LEARNING ENVIRONMENT

Traditional (passive) classrooms have to be replaced with learner-centered flexible learning environments – called active learning spaces, Fig. 1.



Fig. 1. Examples for active learning spaces

Some difference between active and passive learning can be summarized in Table 1. Traditional classroom must meet the expectations of the digital generation. Active learning is a method that support modern methods, such as learning by doing. Learners in active learning spaces participate in discussions and work in teams. Flipped model is also one example of innovative learning method which can be used in active learning spaces, (Kozov, V., 2019). The flipped classroom approach optimizes learners time and focuses on solving real problems in the classroom, instead of dry theory, which can be self-learnt in advance.

Table 1. Active vs Passive Learning

	Active Learning Space	Traditional classroom (Passive learning)
Learner	<ul style="list-style-type: none"> •Learners are engaged and active in classroom •Learners team activities in classroom •Learners take control and responsibility of their learning process – Learners center classroom •Generate questions and find solutions in 	<ul style="list-style-type: none"> •Learners are passive tape recorders – they have to write down everything •Mostly verbal lectures •Boring lessons •Individual study •All the learners have to be good listeners •Learners need to remember long information without time for practical lessons •Carefully follow teacher’s instructions
Teacher	<ul style="list-style-type: none"> •Teacher is a coach or facilitator •Guiding learners to use their knowledge to solve problems in practice •Lets learners explore the learning content •Ask learners to find solutions 	<ul style="list-style-type: none"> •Teacher is mostly engaged with learner’s discipline •Teacher have to present long lessons and usually there is limited time for practice and discussions •Transition of information from teacher to the learner – Teacher center classroom

Our vision for an active learning future space in University of Ruse is presented on Fig. 2. The classroom can be arranged in several different styles. Seating places in the classroom of the future will be able to be rearranged, depending on specific group tasks or specific activities. The walls of the classroom can be movable and, if necessary, the classroom will be expanding and

allow joint lessons - mathematics and physics, for example, which will be an interesting multidisciplinary approach.

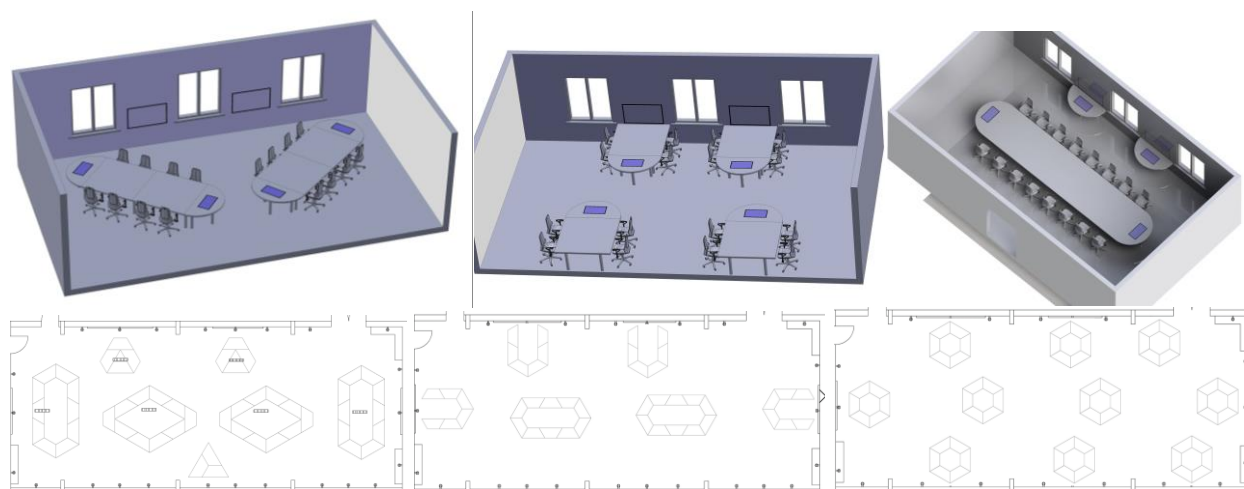


Fig. 2. A vision of an active learning future space in University of Ruse

AUGMENTED REALITY IN EDUCATION

Augmented reality is used today as innovative educational approach. Augmented reality use modern smart technologies (smart phones or tablets) which engage learners and give them more detailed quality digital learning content (Videnov, K, 2018). 3D augmented reality textbook is designed in University of Ruse used in the training of mechanical engineers (Aliev, Y., 2017). Augmented reality usage while interacting with the textbook leads to a more engaging experience and attractive learning for the students, Fig. 3.



Fig. 3. Augmented Reality Textbook for Mechanical Engineers in University of Ruse

3D TECHNOLOGIES, VIRTUAL REALITY AND FLIPPED MODEL

Virtual reality is used today in education to enhance learners understanding. They are several advantages that can be summarized from the experience of virtual reality with engineering students in University of Ruse: carrying out virtual experiments when it is not possible to work in real environment; using 3D models in the virtual reality gives the opportunity to measure parameters, which are difficult to get in real life with preliminary virtual reality simulations, the risk of physical harm for students is lowered; virtual reality gives the opportunity to measure parameters, which are difficult to get in real life; expensive equipment can be measured in virtual reality, (Kozov, V., 2019). 3D scanners and 3D printing are also emerging technologies that can find different applications in the future classroom (AbouHashem, Y., 2015), (Szulzyk-Cieplak, J., 2014), (Short, D. B. , 2015), (Wang, W., 2017).



Fig. 4. Virtual reality application in Cutting Tools

PERSONALIZED LEARNING ENVIRONMENT

Future education will focus on personal learning experiences to help learners with individual learning needs, some disabilities or needs for personal learning tempo and special knowledge. Modern technologies can improved accessibility - learners with disabilities can be empowered through reading apps, audio books, computer-based games, dictation software and digital devices. Fig. 5 presents learners profile of user-centered PhD web system in University of Ruse, (Zlatarov, P., 2018). The PhD system traces the individual learning path of learners. Personal learning profile is maintained. The profile stores real-time data about all learning activities: courses, credits, documents, deadlines and etc.

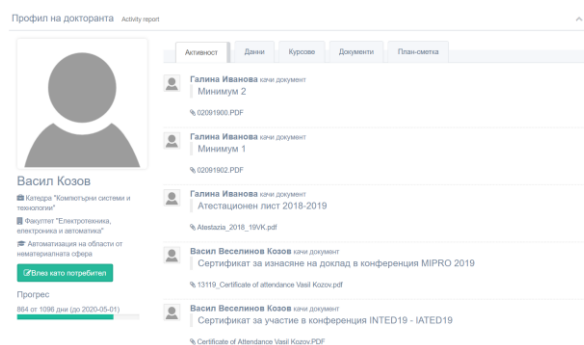


Fig. 5. Lerner's portfolio - user-centered PhD web system in University of Ruse

All classroom activities in the future classroom, such as: study materials, homework, projects and student outputs will be stored in a shared cloud platform and database to maintain individual student portfolios. The learning materials in the platform will be used by teachers for flexible learning styles with adapted supplementary teaching materials, for example for advanced students or students with special educational needs.

GAMIFICATION IN EDUCATION

Games are an innovative educational approach, which will be also used in the classroom of the future. Gamification and game-based learning can be applied with older learners, even in the engineering field. Several examples for games in software engineering course in University of Ruse are given in the paper (Ivanova, G., 2019): role-playing games in software teams – managers, programmers, tester and etc.; millionaire game - software engineering edition; poker planning game; code combat programming game and etc.

INTERNET OF THINGS

The classroom of the future will be a smart environment with a network of connected smart devices. Internet of things wireless nodes can be placed in the room to track learners and collect data about their activities: visit, homeworks, assignments and etc. The data about learner's activity and all the learner's results will be stored in a common database in order to be analyzed and shared from a teacher to the learners or their parents. Such IoT devices in the future classroom can be

used to control the access to the classroom (Chang, F, 2016). Attendance information will automatically be entered into the database for each student. This will no longer take the time to check and record absences from the actual class time, and control over attendance and accuracy of students and teachers will be greater.

Multi-location game scenarios can be also played in the classroom as an engaging learning activities. Learners may use personal mobile device to return feedbacks in real time in different learning activities.

CONCLUSIONS

The time for change in the education system is long overdue and digital transformation of education is needed to meet the needs of the digital learners. The vision of the classroom of the future is learner-oriented and plan to solve some challenges related to individual learning needs, even for learners with some disabilities giving them a sense of belonging and recognition in the educational system.

Working group with specialists in different fields were engaged to create the vision for the future educational space in University of Ruse - pedagogues and engineering researchers work together to built a complex multidisciplinary future classroom vision. The main task of this working group was to draw some didactic parameters and requirements to the vision of the future classroom.

ICT-based innovative educational technologies are tested and adapted to educational models in the pilot future classroom, which will be used for demonstration and introduction to teachers. The educational models and research results will be able to be used to support educational institutions or learning centers working with learners with special educational needs.

The presented future classroom vision is distinguished from the traditional classroom by the addition and enhancement of modern technologies to enrich the active learning in the classroom. The following common characteristics can be summarized for the vision of the future classroom: interactions, collaboration and flexibility - important active learning characteristics for the vision of the classroom of the future.

Technologies will certainly be a major factor in the room of the future, but they will not be enough if teachers are not involved. The teachers in the future classroom will place the needs of each student at the center of that education and each learner will be taught in an individual flexible educational way according to special educational needs.

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