SUSRETI 2022

Informacijski sustavi

Nastava tijekom pandemije COVID-19

Zbornik radova

5. simpozija

Veleučilišta Hrvatsko zagorje Krapina

Krapina, 22. i 23. travnja 2022.

VELEUČILIŠTE
HRVATSKO
ZAGORJE
KRAPINA

Sadržaj

Advanced teaching methods and tools for online higher education, suitable for pandemic condition

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Abstract. The COVID-19 pandemic has affected the common practice of the higher education process such as going to the university, attending lectures, conducting practical exercises, exams, and knowledge and skills assessments. This paper analyses the suitable teaching methods and tools for online teaching during the pandemic, the main principles of presentation design for students' perceptions regarding the effectiveness of online education. The manuscript outlines a methodological approach for the implementation of adaptive online higher education, emphasis on structuring of the learning content in presentation, to attract and retain the student attention achieving adaptability of the online education, better interaction between the teacher and the student, commensurate with the traditional education.

Keywords. Online education, Advance teaching, Higher education, Students' perceptions; COVID-19 pandemic

Sažetak. Pandemija bolesti COVID-19 promijenila je edukacijski proces i odlazak na fakultete, pohađanje predavanja, praktično izvođenje vježbi, provedbu ispita i metode vrednovanja. Ovaj rad analizira napredne nastavne metode i alate za online poučavanje tijekom pandemije, glavna načela dizajna prezentacije vezano uz percepciju studenata o učinkovitosti online edukacije. Rad ispituje metodološki pristup i implementaciju prilagodljivog online visokog obrazovanja s naglaskom na strukturiranje sadržaja učenja u prezentiranju, privlačenje i zadržavanje pažnje studenata postižući prilagodljivost online edukacije, bolju interakciju između studenata i nastavnika razmjerno tradicionalnoj edukaciji.

Ključne riječi. Online edukacija, napredno poučavanje, visoko obrazovanje, percepcija studenata, pandemija COVID-19

1. Introduction

The COVID-19 pandemic has a strong influence on higher education all over the world. According to UNESCO (2022) at the end of December 2021, educational institutions shut down in 186 countries, affecting approximately 43 518 726 enrolled learners worldwide. However, the learning process continued to take place online. Students suffer a learning loss having important consequences. Reimers et al. (2020) in their paper present that online learning is more effective when students and teachers have had the time to prepare and get used to it and educational institutions have had the time to test its implementation.

In many cases, this didn't happen as COVID-19 forced educators to go out of their comfort zone and try out new teaching and assessment methods, collaboration techniques, and learning resources suitable for online and blended learning. The shortcomings of the

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traditional teaching practice to adapt to pandemic conditions have become more explicit. One of the main challenges has been motivating the students for active participation; organizing laboratory exercises and assessment methods of students´ competencies.

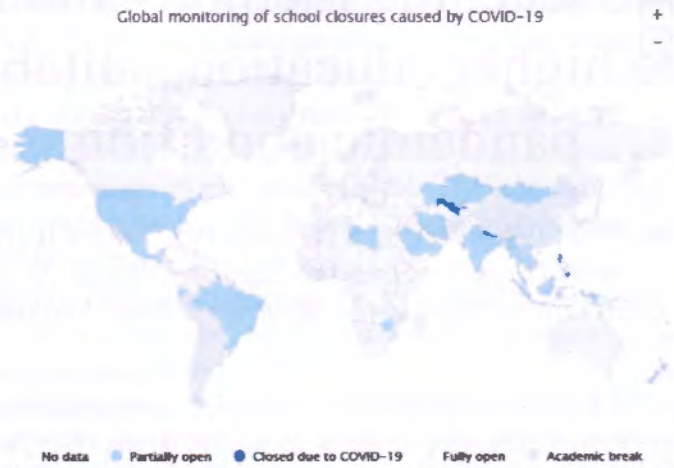

Figure 1. Global monitoring of school closures by COVID-19. (UNESCO, 2022)

Besides challenges imposed by the COVID-19 pandemic, there is a strong need for the transformation of traditional education. Traditional teaching methods with emphasis on knowledge transmission, do not support the development of higher levels of understanding that enable learners to combine gained knowledge and apply it to new situations. According to modern learning theories, knowledge cannot be transmitted but has to be constructed by each learner in the appropriate social context. The main role of the teacher, therefore, changes from lecturer to facilitator for learning. In the book Crawley et al. (2014) and in the book Pellegrino and Hilton (2012) assessment methods are shown to be the key factor that steers the way students learn.

Student-active teaching methods with emphasis on student collaboration and reflection on the learning process are shown to be much more appropriate for the new needs. Constructive alignment of learning goals, teaching methods, and assessment practice is, therefore, a key issue.

2. Online learning during the coronavirus pandemic

New teaching methods are changing the higher education environments during the Covid-19 pandemic and motivating better communication between the teacher and the students. Learning knowledge and skills through active learning can be extremely interesting and easy by integrating activities into the class together with the traditional lecture.

2.1. Spaced learning

Spaced learning involves breaking into several sessions or segments with a few breaks in between these segments. One long course can be divided into the following segments with a duration of 10 minutes: the learning active, break, repeat learning active, break, repeat learning active, and quiz yourself to check your learning.

With such an approach to teaching, the students can remember the taught information during the course for a long time. This allows students to acquire the necessary knowledge, skills, and competencies, using specialized software products and measuring equipment, gaining and improving their long-term knowledge. It was found that the results of the application of this approach in the educational process increase the interest of students in the subject.

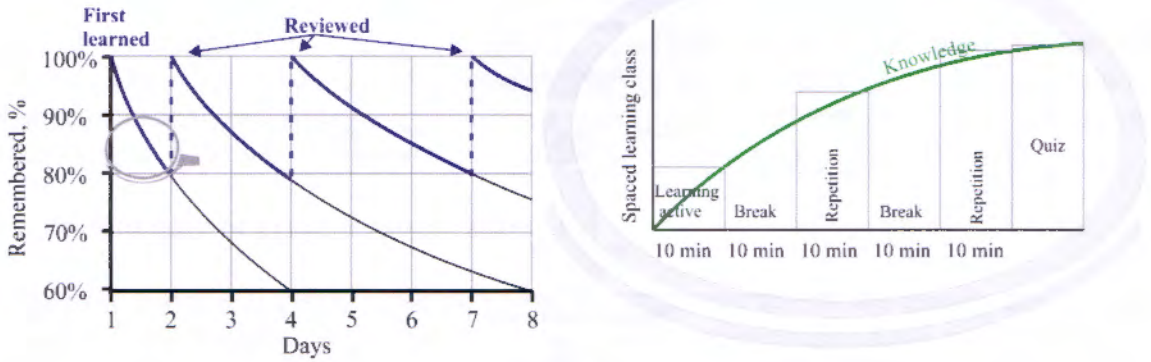

Figure 2. Forgetting curve for newly learned information. (Wranx, n.d.)

2.2. Collaborative learning

Every student is a part of a group. The members help and communicate with each other in solving the tasks. In their papers, Laal (2013) and Biggs & Tang (2011) analyze that the students develop skills to listen to others and work in a team.

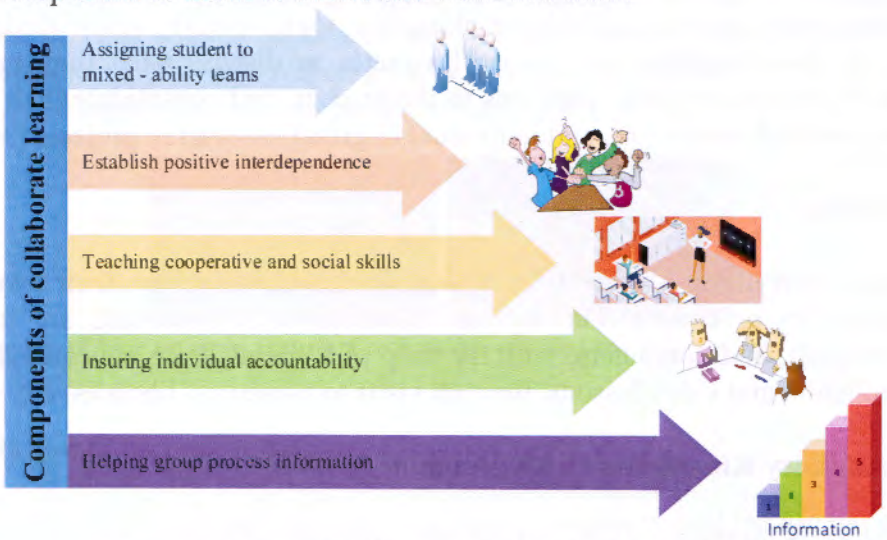

Figure 3. Main components of collaborative learning (authors)

Collaborative learning is not only a synonym for students working in teams. The learning process only qualifies as collaborative learning to extent that the listed elements are presented.

2.3. The flipped classroom

The flipped classroom is a modern pedagogical model in which the typical lesson in class and homework change their places. Kostadinova (2016) presents this model, where students prepare themselves at home, and in the class to discuss and make sense of the lesson.

The term „flipped classroom" is widely used to describe a classroom system in which lessons about new knowledge are prepared by students independently, at home, and during school activities, subjects are discussed with teachers, questions are asked, and exercises are done. In the most popular in-practice model of a flipped classroom, students are introduced to the topic of the lecture from several videos, prepared by the teacher with an average duration of 5 to 7 minutes. With this method of teaching, students can watch the videos indefinitely. Lo (2017) in his work presents that each student must then take an online feedback test with the teacher.

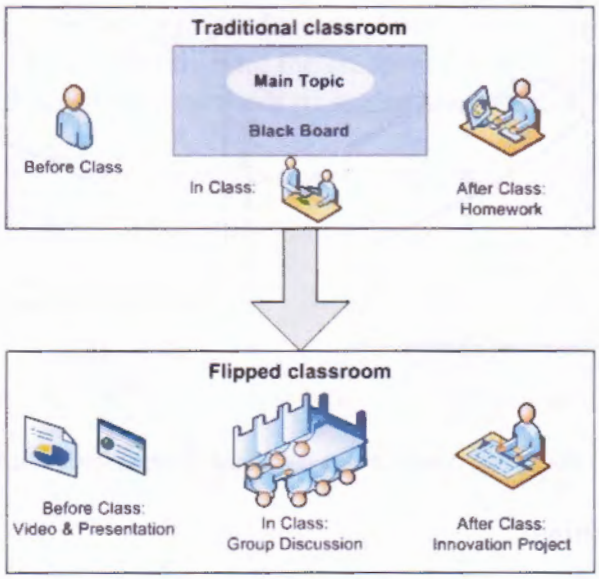

Figure 4. An example of flipped classroom (authors)

The prepared feedback through the test gives information to both, the student and the teacher, about where are the gaps in teaching the topic. Finally, each student has the opportunity in class, together with their classmates to discuss what they have learned (approximately 10 minutes), ask questions to the teacher, and consolidate their knowledge through exercises and discussions and individual or group innovation projects (30 minutes).

2.4. Self-learning

Self-learning is everything a student learns outside the classroom on their own without a specific curriculum or exams. The typical examples of self-learning are from books, textbooks, manuals, and computers, with the help of a friend, from educational television programs and audio and video lessons, through visits to museums, libraries, etc.

2.5. Visual Auditory Kinesthetic (VAK) teaching

Visual Auditory Kinesthetic (VAK) teaching provides a simple way to explain and understand the different teaching styles. The VAK teaching uses the three main human receivers: visual (learn by seeing and writing), auditory (learn hy listening), and kinesthetic-(learn by doing) (Fig. 5).

Figure 5. Visual Auditory Kinesthetic components. (gohlianni, 2015)

This method is the best solution for fast assimilation of the new information - by filtering what is being studied, the student perceives the interesting moments of the lecture, making connections with his professional experience and interests.

3. Main principles of presentation design for online teaching

Half of the human brain's resources are dedicated to seeing and interpreting what they observe. The paper (Carter, 2020) presents that the images entering the human brain are changed and analysed. Everyone can convince people or students to see things a certain way, depending on how they are presented. What they see is not what reaches the brain.

3.1. Presentation of graphic information

People use peripheral vision when they look at a computer screen and usually decide about the information based on a quick look at what is in their peripheral vision system. Although the centre of the screen is important for central vision, students' peripheral vision is not to be overlooked. The information at the periphery of the slide needs to clearly communicate the slide. For students to better concentrate on a certain part of the screen/slide, it is necessary to avoid placing animation or flashing elements in their peripheral vision. The conducted research has shown that students look at screens based on previous experiences and/or expectations.

The human perceives objects that are close to being related. When developing a presentation, objects that should be perceived by a student as belonging together (pictures, photos, titles, or text) should be located close to each other. Duarte (2008) in his work analyses that placing blue and red or green and red close together on a page should be avoided, as these color combinations impair vision.

Figure 6. Example of blue or green text on a red background and red or green text on a blue background (authors).

3.2. Presentation of textual information

The human perceives all capital letters as "screaming", in this regard the use of capital letters should be minimized. Capital letters can be used for the titles and/or when you need to draw the student's attention to a part of the presentation.

Important	IMPORTANT
For the next lecture	FOR THE NEXT LECTURE

Figure 7. Text with small letters vs. capital letters (authors).

Students are active readers, and what they understand and remember from what they read depends on their previous experience, point of view while reading, and instructions given to them in advance. Unusual or overly decorative fonts can affect recognition patterns and slow down reading. Many fonts are easy to read. Any of them are fine to use. But avoid a font that is so decorative that it starts to interfere with pattern recognition in the brain. Carter (2020) and Duarte (2008) in their papers present that serif and non-serif fonts are comparable in terms of readability.

The font size should be large enough for students to read comfortably. It is necessary to use a large x-height font for presentation and observation on the monitor screen so that the letters look larger.

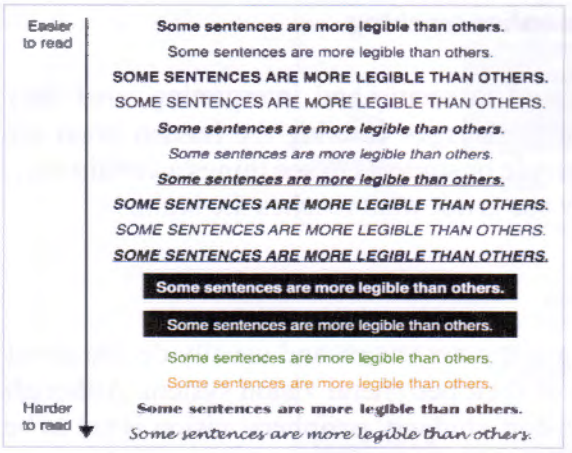

Figure 7. Examples of easier and harder-to-read fonts.

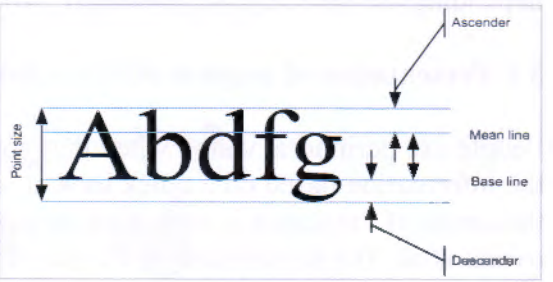

Figure 8. The point size of the fonts. (authors)

In Fig. 9 are presented different fonts with the same size of 12pt, but some look larger than others because the x-height of different font families can vary.

This text is with Arial font
This text is with Times New Roman font
This text is with Verdana font
This text is with Tahoma font

Figure 9. The point size of the fonts (authors).

In online learning, students acquire their knowledge through an electronic device (computer, tablet, smartphone, etc.), in this regard, it should be borne in mind that reading from a monitor is more difficult than reading from paper (Fig. 10),

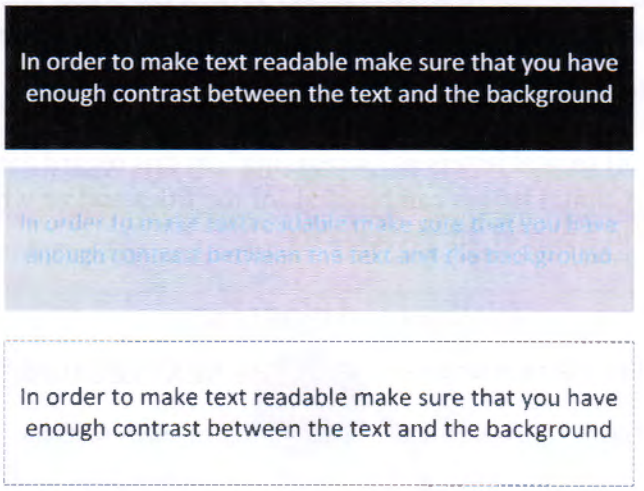

Figure 10. Text with different colours and different backgrounds (authors).

White text on a black background is hard to read. The teacher should ensure that there is enough contrast between the text and the background. The best combination for readability is black text on a white background.

4. Promoting problem-based education

During the educational process during the pandemic condition, the student and the teacher should answer some basic questions: What to teach? How to teach? Where to teach? When

to teach? How long to teach? Advantages and disadvantages of used teaching methods and tools, etc. It is appropriate for the students to be placed in the centre (cantered learning), divided into small groups of 4 to 6 students. Each task/project should be divided into stages, and at each stage, the staff and number of students in the group will change. For example, if a group consists of 12 students and has an assigned innovation project, which can be divided into three main stages. For the first stage (basic level) the students should be divided into 2 groups with 6 members. For the next stage (middle level) the students should be divided into 3 groups with 4 members and for the last stage (end level) the students should be divided into 4 groups with 3 members. The main idea is: that during the educational process the teacher and the tutor as a group facilitator can divide the students and allocate them into appropriate groups according to the student's interests, knowledge, and skills.

Figure 11. Curriculum and professional development correlation.

The main characteristics of personal and professional development are shown in Fig. 11. Cognitive skills are necessary for study, learning, remembering, and thinking, such as critical thinking, problem-solving, logical analysis, and decision making. Work ethic and responsibility aim to establish norms of ethical and professional conduct in all aspects of their future professional activity. Creativity supports finding innovative solutions and developing students' creative thinking. This development skill assists in finding solutions to everyday challenges and taking risks to achieve the set goal. The knowledge gained during the education process provides an opportunity to consider and make effective decisions in the analysis, planning, management, and successful implementation of the project. This can be achieved through communication skills, listening skills, digital literacy, etc., as presented in the works of Crawley et al. (2014) and Reimers et al. (2020).

Achieving the set goals and solving the formulated tasks requires concrete actions and the creation of organizational conditions for their implementation. This is achieved through the development of leadership skills, thus influencing the individual members of the team to direct their efforts and successful implementation of the project.

5. Conclusion

The use of advanced teaching methods and tools for online higher education enables an effective online learning process in a pandemic condition. It was found that using appropriate tools for digitization of the educational content and assessment of the students simultaneously with the presentation of the educational content with attractively prepared presentations creates conditions for personalization of the learning process, supports creative thinking, and

increases the interest of students and teachers in general.

This will lead to the improvement of the achieved results (graduated) and change of the traditional classical methods with new innovative ones in which the interaction between students and teachers is built based on new information and communication technologies and the use of social networks (Facebook, Twitter, etc.). All of these require a rapid transformation of the educational system in higher education following the requirements imposed by the Covid-19 pandemic.

Acknowledgement

This work is partially supported by the EC Project 2020-1-PL01-KA226-HE-096196, project title: "Holistic approach towards problem-based ICT education based on international cooperation in pandemic conditions".

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