Learning Management Systems for Hybrid Teaching Models in Primary Schools in Serbia during the COVID-19 pandemic

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Abstract

Before the Covid-19 pandemic, the use of Learning Management Systems (LMS) had not been mandatory nor regulated at the primary level of education in the Republic of Serbia. After the Government decision on suspending face-to-face classes, the Ministry of Education obligated schools to implement a combined (hybrid) teaching model based on digital technologies. The aim of this paper is to analyse the quality of frequently used LMS for implementing an effective hybrid teaching model in primary schools in the Republic of Serbia, with regard to the current educational policies. The quality analysis was conducted based on the ELQ criteria. The research results indicate that the sampled LMS meet the set criteria, and although mandatory, the set criteria are not sufficient pre-condition for implementing the quality hybrid teaching in primary education.

Keywords

Learning Management Systems, Hybrid Teaching Model, Covid-19 pandemic, Distance Learning, Educational Policies

1. Introduction

Learning Management Systems (LMS) such as: Moodle, Canva, Talent or Google Classroom are applied in different scope and quality, depending on the type and level of the educational system that uses them, i.e. their goals and characteristics, as well as the technical and personnel capabilities of the institutions.

In the educational system of the Republic of Serbia, at the level of primary school education, the use of these systems had been neither mandatory nor regulated until the Covid-19 pandemic started. Due to the outbreak of the pandemic and the declaration of a state of emergency and the Decision of the Government of Republic of Serbia on the suspension of classes [1] in higher education institutions, secondary and primary schools, classes in the form of video lectures lasting 30 minutes were organised and publicly broadcasted via the Radio Television of Serbia (RTS). Alongside video classes, the accompanying activities for the schools, teachers and students were all organised by the Ministry of Education, Science and Technological Development (MoESTD). In this way, the continuity in the education of students and the work of educational institutions was preserved, at the achievable level and in accordance with the circumstances of the health crisis in which the entire society and the educational system were at that time. Via television channels and multimedia internet platforms, video lectures with certain interactive elements were broadcast for primary and secondary school students. At the same time, the schools organised follow-up educational work for their students in line with the provided instructions of MoESTD, in accordance with the available digital devices and tools, as well as the level of digital competences of the teachers at the given moment. In cooperation with the Office for IT and eGovernment of the Republic of Serbia, an internet location was established (*rasporednastave.gov.rs*), where the schedules of television video lectures were available; a link to the national platform for online learning built on the Moodle LMS, called *My school* (*mojaskola.gov.rs*) which, in addition to televised video lectures from RTS, also offered the possibility for interactive work through tests for self-assessment of students' knowledge, as well as recommendations for establishing

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online communication between teachers and students, i.e. software solutions and instructions. Furthermore, MoESTD issued a *Manual* [2] which instructed the necessary adjustments to the school work organisation should include, i.e. the application of a certain learning model in primary schools in order of health preservation and accordingly, promotion of the LMS application within the existing teaching organisation. New organisational approaches to the implementation of distance learning in the period of crises were designed in accordance with the knowledge about the current level of digital maturity of institutions, the level of digital competences of teachers, opportunities and while taking into the consideration the short deadlines. For periods when schools had to move to a total distance learning model, organisational guidance was also provided, which took into account the resources and level of digital maturity of the school and student capabilities [2].

The aim of this work is to detect which most frequently used LMS are in primary schools during Covid-19 pandemic, and then to analyse the quality of most frequently used LMS for implementing an effective hybrid teaching model in primary schools in the Republic of Serbia, in regard to the current educational policies. The analysis of the quality of the applied LMS as well as software solutions and tools in the national school system during the pandemic within the hybrid model of primary school teaching in the Republic of Serbia is planned based on first seven ELQ (e-learning quality) criteria.

The question of the quality of the implemented hybrid teaching in primary education rests on the quality criteria of the LMS, but also opened the questions of the digital competencies that are part of the complex professional competencies of teachers and the importance of digital maturity in schools.

It should be emphasised that there are different definitions of LMS. According to its basic characteristics, it is specialised software used for planning and implementing the teaching process in an online environment and involves enabling the interaction of all members, as well as ensuring the conditions for evaluating student achievements. Also, within the LMS, the planning of the teaching process includes, among other things, the creation of digital teaching content, the addition of educational resources, the design of various learning activities (assignments, workshops, forums) that foresee providing feedback, encouraging peer learning and providing transparent formative and summative assessments of student achievements [3].

Google Classroom was created in 2014 as part of the Google G Suite for Education package, which required registration of the institution. In 2017, Google made Google Classroom available to all users with a Google Account, which can be used to create online courses. The platform relies on Google tools, primarily on Google Drive where documents are stored, but also on other Google applications such as Google Documents, Sheets, Slides, questionnaires and various upgrades. This free platform allows teachers to build an online environment, where they can share materials, links, communicate with students, set assignments and evaluate their activity. A free Google G Suite for Education package was available for schools, which allowed the schools to manage and decide which Google services students could use, and it was supposed to provide a safer environment in terms of protecting the privacy and security which is important in a school environment. Google Classroom is a type of user-friendly platform for both teachers and students. All participants, both teachers and students, use it intuitively, which certainly affected the percentage of use of this platform.

During the pandemic period, the Microsoft Corporation provided schools with free use of a platform adapted for education - Office 365 for Education. The platform included Office Online (Word, PowerPoint, Excel and OneNote), one terabyte of OneDrive storage, Yammer, SharePoint, as well as other useful services such as Teams, which enables conducting a video conference which resembles a classroom. Although not many primary schools had been using the Microsoft platform before, it was widely spread at the University level - the services of this platform were used by over one hundred and ten teachers who are in the academic institution and students, and it had a set of different services that enabled teachers to collaborate effectively with students.

On the website for school support established by MoESTD, there were instructions for using the Microsoft Teams application, with which teachers could share the content of their screen with students through a group video call, as well as record the entire course of the lesson and make it available to all students from the corresponding study group. The platform could be accessed by millions of teachers in the world's leading universities, colleges and schools, it was available free of charge for computers and mobile devices; for those who had no other access to the Internet, free access to the platform was provided through the nationwide telecommunications operators. Also, video instructions have been prepared for teachers on how to use the video conference tool, namely: how to form a class and subjects;

how to schedule and hold a video conference class; how to distribute teaching materials to students; how to prepare an assignment and how to answer the assignment; how to review the returned assignments. Video instructions with guidelines were also made for the students.

Edmodo is a global educational network that was another available free software option, created in 2008, with the aim of connecting and cooperating teachers and students, sharing teaching content, sharing messages within groups, connecting teachers, sharing pictures and videos, recording activities in the calendar, forming a personal library with important web addresses, monitoring student work, publishing student work in one place, creating quizzes and surveys. Also, students' answers are processed statistically and automatically, which ensures immediate feedback. Teachers, students and parents have the option of opening a user account on this platform, through an administrator or email address. The research results on the use of the Edmodo platform during the Covid-19 pandemic show that it is effective and can be successfully used in a hybrid teaching model [9].

The Serbian Edmodo sub domain is accessed on the website *srb.edmodo.com*. This system has a user-friendly interface which is suitable for primary school students and is simple to use. On the national platform for online learning, there were no video instructions for its use, as was the case for the My Classroom TeslaEDU system based on the Moodle platform, The Institute for Improvement of Education of the Republic of Serbia prepared instructions for its use.

Moodle is a free online distance LMS with a professional and stable work environment for lectures and incorporates many pedagogical tools. The structure of Moodle supports many types of data, and is flexible for changing the appearance and functionality of an individual page or course. For this reason, it was used at many faculties in the Republic of Serbia. In this environment, students can interact both with their peers and the teacher, participate in polemics on the forum, use the interactive chat room, search and collect data, send their homework, take part in quizzes, use the wiki module and more. Also, it is available as the translated version in Serbian language. It is important to note that recently, trainings for school Moodle administrators from all primary and secondary schools in the Republic of Serbia have been conducted for the implementation of the Moodle LMS (90% of primary schools delegated participants); two iterations of trainings *Online and hybrid teaching in a digitally proficient institution* in which over 2,000 teachers, professional associates, headmasters and pedagogical advisors involved in the pre-university education participated; the online Instrument for Self-Assessment of Digital Competences of Teachers in Serbia Digikomp[2] was published, which was developed according to the Framework of Digital Competences - Teacher for the Digital Age 2019, the revision of which is planned in 2023; the *Digital School* program was started as a pilot project as well as *the Academy of Digital Schools*.

My TeslaEDU classroom - represents a unified package of functional modules based on the Moodle LMS, localised in the Serbian language and provided by the MoESTD in cooperation with the Office for IT and eGovernment and one tech company. For the purpose of helping out the users of this system, the website *rasporednastave.gov.rs* contained instructions for: accessing the web and mobile application, for teachers and students respectively; attending the course; reviewing and completing tasks; taking tests; for students communication (from the web browser, as well as from the mobile application). Video instructions were provided for teachers on how to: assign courses and add class groups to a course; create and grade assignments; create tests; communicate and monitor student attendance. The Institute for Education Quality and Evaluation prepared the guidelines for teachers that should help the users with the above-mentioned system [8].

2. Application of the hybrid model of organising the teaching process during the pandemic

Professional instructions for the organisation and implementation of educational work in primary school in the school year of 2020/2021, represented an obligation and starting point for organising, planning and programming the entire educational work in schools in difficult conditions, in accordance with the law and regulations governing the plan and program of teaching and learning, as well as work models that should be applied in school year 2020/2021, depending on the epidemiological

[2]https://digikomp.ceo.edu.rs

situation. The instructions and hybrid models for organising the teaching process were developed taking into consideration the potential of distance learning, as well as the video lectures that were available through the RTS, as well as the possibilities provided by the hybrid teaching model.

In January 2021, the Institute for Education Quality and Evaluation, as an expert institution of the Ministry of Education, issued the document *Online and hybrid learning - long-term aspirations and short-term guidelines* [3], with the aim of providing an expert framework and support for a new school class organisation in the Republic of Serbia that consisted of terminological definition, technology implementation models and school work guidelines the second semester of the school year 2020/2021, for the period of time before the planned establishment of the Moodle system for managed learning in all schools. The terms used in this document for different teaching models are somewhat different from the terms used in the Ministry's *Manual* [2], so the following are mentioned here: online and hybrid teaching. In addition, this document divides and presents models of the implementation of educational work using digital technologies in the teaching and learning process, namely:

1. Working face-to-face at school with occasional use of digital technology in class;
2. Online teaching, entirely conducted via the Internet;
3. Hybrid teaching, which combines face-to-face and online teaching.

The guidelines given for organising hybrid classes were precise, with clear and detailed instructions for planning and organising classes and intended for both the school and the teachers. Compared to the other two models, the hybrid model was most often applied during the pandemic, combining the advantages of the other two enlisted models. Except in the circumstances of the state of emergency, it is also applicable in various different situations.

The most significant feature of hybrid teaching is that face-to-face teaching is enhanced with online learning. There are several models of hybrid teaching, depending on the different approaches and practices of teachers. For example, *the flipped classroom* is one type of blended learning that can be applied in hybrid teaching, in which students are asked to study independently with selected online materials that will later be used in face-to-face teaching for a specific activity.

The hybrid teaching model enables the effective integration of technology and the school curriculum. However, similar to some other approaches in learning and teaching, it is necessary that the hybrid model also follows the pedagogical principles in order to be effectively implemented in teaching practice. This implies that the teachers are educated to implement methodologies which ensure achieving the teaching goals [4].

3. ELQ model for quality assessment

In our work ELQ model was used in the quality assessment of the LMS that were regularly used in the Republic of Serbia. The quality assessment model was qualitatively adapted in order to assess the quality of used LMS as well as software solutions and tools in the national school system during the pandemic within the hybrid model of primary school teaching. It consists of ten quality criteria: learning material and content; structure of the virtual environment; communication, cooperation and interactivity; student assessment; flexibility and adaptability of the system; teacher and student support; competences and experience of teachers; vision and leadership of the institution; content resource allocation and holistic and process aspect. The criteria are not listed in the order of importance; however, fundamental differences exist among them which imply the aspects are ordered from the smallest elements in the learning process to the more organisational, systemic perspective [5]. The following is a description of the first seven ELQ quality criteria of the quality of online learning, considering that the analysis of the quality of the applied LMS in the hybrid teaching model in the Republic of Serbia was planned based on them.

3.1. Material and content for learning in an online environment is "much more than a printed book, i.e. it represents a multimedia interactive environment in which the distinctions between content, virtual environment and teaching, as well as between learning and interaction, are lost" [5]. The material can be both printed and digital, but the selection, creation and adaptation

of content and learning materials are of utmost importance for the quality of learning in a digital environment. The material can be created by a teacher, a publisher or a group of experts, which is of highest importance when it comes to complex digital educational content. It should be noticed that teachers should be principally critical when it comes to the process of downloading existing materials from the Internet. The text can be transformed by software so that it can become an auditory media, or it can be transformed and enriched with additional illustrations and multimedia content by teachers, students or digital content creators. Considering the complexity and diversity of digital content, it is necessary to have quality standards of production, so that they can be used in different virtual environments and on different devices. Criteria that can be used to grade the application and quality control of content and materials for online learning are: guidelines for the selection and creation of digital content including clear pedagogical and technical criteria; guidelines for rights of use issues; application of the first two criteria and internal evaluation and improvement of elements in the first three criteria.

3.2. The structure of the virtual learning environment, in other words LMS, must be based on a pedagogical framework that implies an easy and structured way of finding information and quality communication with teachers and other students. The technical infrastructure should be of high quality, reliable, accessible and easy to use. In addition, modern learning platforms are being developed in the direction of multimodal communication and the integration of tablets and mobile phones. MoESTD set the multimodal communication as one of the most important conditions when it comes to the selection process of learning platforms in each school. The criteria that can be used for the implementation and quality control of the structure of the environment are: selection based on pedagogical needs; an environment that is of high-quality, consistent and harmonised with the technical infrastructure of the institution; internal evaluation, as well as modernization and improvement of the elements from the first criterion.

3.3. Communication, cooperation and interactivity are the main features of the learning process. Timely and efficient planning of these elements is of particular importance in online teaching. Communication in an online environment depends on the available infrastructure, the level of digital competences of teachers and students, as well as the teaching goals. Communication itself in an online environment can be synchronous or asynchronous. Online learning collaboration can be extended to open online communities, or secured and accessible only to students in a specific department within a LMS. Synchronous communication can be organised through communication channels and video conference tools between teachers and students. Synchronous communication is planned on a weekly basis within the guidelines for teachers, while certain interactive activities can be conducted among students only, without the synchronous presence of the teacher. When it comes to primary school, precise guidelines for teachers are given for weekly planning and also how to conduct synchronous and asynchronous communication with students. Criteria that can be used for implementation and quality control are: a clear strategy for communication, cooperation and interaction in accordance with pedagogical needs, available technology and human resources; implementation and evaluation; improvement of the first two criteria.

3.4. When it comes to assessing students and their achievement, there are significant differences between assessing students in face-to-face classes and in an online environment, later which has additional challenges related to student identification, proper formative and summative assessment, swift feedback etc. However, the way of assessing student achievement in the online environment can be diverse: by posting students' text works, through oral synchronous communication with the help of video-conferencing tools, through individual or group discussions, by posting digital materials by students, by giving tests... In the hybrid organisation of teaching, the assessment of student achievements is primarily conducted during face-to-face teaching, to avoid the shortcomings of online testing, but it is also possible to use testing in LMS, which provides various opportunities and advantages. Assessment of students in the online environment is a complex area, and more information about the

formative and summative assessment of students can be found in the available publication of the Institute for Education Quality and Evaluation [6]. The Criteria which could be used in the effective evaluation process of implementation and quality control are: strategy for objective, flexible and pedagogically based assessment; applied policy for plagiarism; protection in access and identification of students and evaluation; improvement of the first two criteria.

3.5. The flexibility and adaptability of online learning implies answers to various questions such as: where it is possible to learn; when it is possible to learn; what the pace is and how much time it takes students to learn; what is the language and style of the learning content and instruction; are there adequate adaptation methods used for students with special needs. It is essential to adapt the services of the LMS to the target group, when it comes to the mentioned characteristics. In this sense, precise instructions and recommendations were given for the use of the system in both hybrid and online teaching models in the Republic of Serbia. The criteria that could be used for measuring the implementation and quality control are: a strategy for enriching the characteristics of educational flexibility based on pedagogical foundations, student needs and requirements; implementation and evaluation; improvement of the first two criteria.

3.6. Support for students and teachers when using LMS affects the quality of the learning and teaching process. The support includes administrative and technical assistance for teachers, time allocated to support students in using the system and motivating students to use it, support and assistance for gaining Internet access, solving technical problems and more. The criteria that could be used to measure the level of implementation and quality control are: strategy for student support including technical, administrative and social support on request; strategy for supporting the institution, including technical and digital competence support on request, as well as the implementation of the first two criteria and the evaluation and improvement of all three previous criteria. The Institute for Improvement of Education has enhanced mentoring support for schools and teachers in planning and implementing the teaching process in a digital environment, which functions through an online system located on the National Education Portal (*www.portal.edu.rs/podrska*).

The qualifications and experience of teachers and associates for the use of LMS include a continuous system of support and professional development, increasing awareness of the use of new technologies, knowledge of how students learn with the help of different media and communication channels, a critical approach to new technologies and improving knowledge as well as the abilities for continuous improvement of the environment for online learning, and above all improving knowledge and abilities for the pedagogically driven use of new technologies. The criteria that could be used for measuring the implementation and quality control are: the strategy for the development of teacher and student competencies, as well as the implementation of the strategy and the evaluation and improvement of the strategy and its implementation.

When it comes to the remaining aspects of quality - the vision and leadership of the institution, the allocation of content sources and the holistic and process aspect - they are not discussed in this paper since they represent a more organisational, systemic perspective of the online learning quality, which can be a separate topic for analysis, within the analysis of educational policy and its application in the Republic of Serbia.

4. Quality analysis of the most frequently used LMS in the Republic of Serbia

For the purposes of this paper, the analysis of the quality of the applied LMS in the hybrid model of teaching in the Republic of Serbia was performed based on the above-mentioned seven ELQ aspects of the quality of online learning.

Data was obtained from official Informational Database of the MoESTD[7]- Dositej. Schools had the possibility to independently note down the title of the system in Dositej, in which the data is joint.

For the implementation of online teaching, which is fully conducted via the Internet, the MoESTD instructed in the *Manual* [2] that primary schools should use only one LMS per educational cycle, respecting the age of the students, as well as the guidelines for choosing the system: that access to content and activities should be possible at any time, depending on the program and pace of the user's work (24 hours a day, 7 days a week); that the system should be a closed virtual educational environment meaning it cannot be accessed by an unauthorized persons; that it should be accessible via Internet through various types of digital devices (computer, laptop, tablet, mobile phone...) regardless of the pre-installed operating system (Windows/Android/iOS/MacOS...); that it should be restricted to the Serbian language and/or the languages of ethnic minorities; it should enable the creation of digital content containing text, images, sound, video and links to verified web locations to which the teacher directs students; to enable uploading and downloading of basic files (text document, spreadsheet, multimedia presentation…); that it has built-in functionalities which enable communication between teacher-student and student-other students; to enable the integration of conference tools (sharing video, audio, screen) with the possibility of recording online lectures/content and videos that can be made available to all students on demand (VoD-Video on Demand); to enable teachers to create quizzes/texts or questionnaires to assess students' knowledge; to have the ability to store teaching materials and student works and to have the ability to integrate other digital online resources [2].

As a form of support, MoESTD has provided teachers and students with instructions for using the following systems and tools on the web location (*rasporednastave.gov.rs*): My TeslaEDU Classroom (based on Moodle LMS); Microsoft Teams, a video-conferencing tool within the Office 365 for Education LMS; Zoom application and Viber Community application. At that moment, these instructions were useful for teachers, many of whom were encountering the organisation of distance learning on a systemic level for the first time. The instructions were intended to help and support all participants in the teaching process – the teachers, as well as students, and their parents. However, other tools and platforms were also used, which were user-friendly and free, and thus are widespread and well-known, such as Google Classroom and Edmodo, which will be presented in the part of the paper on the solutions used at the level of the Republic of Serbia.

5. Results

Based on the data obtained from MoESTD [7], which are shown in Table 1, four different LMS are chosen for the ELQ model based evaluation. Taking into account that the schools had the possibility to independently note down the title of the system in MoESTD's official Informational Database Dositej in which the data is joint, the data obtained does not provide the most accurate picture of the level and manner of use of a certain system and/or tool, which is the main disadvantage for the effective application of the ELQ model.

Table 1.
Representation of LMS in primary schools during the pandemic[3]

LMS or alternative software solution or video conferencing tool	Percentage of use (%)
Google Classroom	78.9
Microsoft Teams	9.9
Other system	7.2
Edmodo	2.4
Moodle	0.7
School's digital platform	0.3

From the Table 1, we can see that the majority of primary schools used Google Classroom (78.9%), Microsoft Teams was used in a significantly smaller percentage (9.9%), while the Moodle platform was used to a considerably smaller extent (0.7%) which indicates the level of digital maturity in basic education in the Republic of Serbia.

Assessing the above-mentioned systems indicated that all of them meet the mentioned quality criteria, but that does not speak for the quality of the implemented hybrid teaching. During the analysis of the MoESTD data [7], it was detected that the questionnaire for data collection was not precise enough, i.e. the school representatives entered the names of the systems used, without complete information, i.e. it is not specified whether the schools that used the Google Classroom used the Google G Suite for Education system or only the G platform on which they created the Google Classroom. It was also not specified whether they used the complete Office 365 platform or only MS Teams.

Based on the data obtained from MoESTD [7], the other most frequently used tools by schools for building a hybrid teaching environment were: Viber, E-mail, Zoom, Google Meet, Facebook, WhatsApp, as well as the school website. The use of the Viber Community application and service was enabled and that made possible the effective group communication and the exchange of information and materials. Also, for those who do not have another access to the Internet, free access was provided through the mobile operators. MoESTD has prepared short video tutorials for both teachers and students for this application.

6. Discussion

The question of the quality of the implemented hybrid teaching in basic education certainly rests on the quality criteria of the LMS, but also on the digital competencies that are part of the complex professional competencies of teachers. When it comes to the initial education of teachers on the topic of obtaining digital competences in the function of creating a stimulative and safe hybrid teaching environment, the results of earlier research indicate that at Teacher Education Faculties that educate future teachers, more attention is paid in comparison to non-teaching faculties that have teacher profiles. Furthermore, faculties also need constant social support and cooperation, as well as a well-coordinated system of professional development of teachers from their initial education during studies to continuous professional development during work [10]. The Education Development Strategy 2030 speaks in favour of strengthening the entire system, which indicates the strengthening of the institution capacity of the pre-university education, which can result in raising the quality of hybrid teaching environments that also include the use of LMS [11].

[3]The data of used LMS/software solutions in schools of the Republic of Serbia in the period of the pandemics, Ministry of Education, Science and Technological Development - subject number 07-00-00640/2022-01 date 14.07.2022.

7. Conclusion

We can conclude that all four analysed samples of LMS meet the quality criteria according to the ELQ model, which include: building content and setting up learning materials; the structure of the virtual environment; multidirectional communication, collaboration and interactivity; student assessment; flexibility and adaptability of the system; teacher and student support; putting into practice the teachers' existing experiences; implementation of the institution's vision and leadership; allocation of content sources and a holistic approach.

Fulfilment of the quality criteria of the LMS according to the ELQ model are necessary, but there are no sufficient conditions for building a safe and stimulating hybrid constructivist teaching environment. The digital competences of teachers, students and associates play a key role, as do other factors (number of students in the class, age of students, nature of the subject, technical prerequisites, preparation of parents etc.) that we must not ignore and that need to be thoroughly and in-depth investigated. Pandemic living and working conditions have intensified the use of hybrid teaching models in basic education in the Republic of Serbia, which has also influenced the educational policy, which increasingly recognizes the importance of digital maturity in schools.

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