A STUDY OF USING GOOGLE CLASSROOM PLATFORM IN THE CASE OF A RURAL PRE-UNIVERSITY SMALL EDUCATION UNIT

Nicoleta MIREA, Cornelia-Victoria ANGHEL-DRUGARIN, Anca DRAGHICI

Abstract: The purpose of this study is to identify how satisfied users of the Google Classroom platform are, how effective it is to use it in the school learning process, and whether it can be used even after the restrictions imposed by the Covid-19 pandemic. Efficiency is treated from the point of view of the recipient of the message, the content, the means of communication, the format, and the time or duration of transmission of the messages or content. The study aims to provide information to be used in the implementation of the platform for online or hybrid learning.
Key words: E-learning, educational platforms, online communication, pandemic period, digitalization.

1. INTRODUCTION

Before the Internet came into our lives, universities and colleges around the world used offline resources for distance learning, such as CD-ROMs, pre-recorded sessions, satellite television or closed-circuit television. In the early 1990s, when the Internet became increasingly easy to use, a new possibility was created: use it in education [1].

New forms of Internet-based learning are emerging: online courses, hybrid courses, in which some participants are in the classroom, face-to-face, and another part participates in online courses that benefit from technological development and in which the main method of teaching is face-to-face, but online resources are used to increase the learning experience [2].

In the early 2000s, online education began to become a growing competitor to traditional education conducted only in classrooms. Increasingly, educators have begun to see the Internet as more of a learning and teaching tool than a repository of information [3]. Learning must continue to evolve, and technology, tools, and devices can help achieve this. Our world has become a place where you can quickly learn anything from anywhere, and in many areas, the experience gained is only a small part of our ability to assimilate and put into practice what we have learned.

The future of education is exciting but scary at the same time. In general, schools and education at all levels of professionalism (including, therefore, preuniversity) need to evolve to embrace new learning styles and technologies that can captivate students, while maintaining the integrity of knowledge in areas such as literature and history, which helps to create well-trained people. The basis of our efforts for change and digital transformation in education has also led to the development of an explosive information society, which is available in all branches of activity, both technological, financial, economic, social, and cultural.

As specified [4], in recent decades, but with an acceleration especially in the last two years of the pandemic crisis caused by the SARS-CoV2virus, the use of information and communication technologies (ICT) for educational purposes has become more than a necessity, being strictly related to special conditions for the safe conduct of school activities. The use of the Internet as a training means can be attributed to the increasing availability of the Learning Management System (LMS).

Today, when communication is globalized, the introduction of computers and the Internet

are the events that precipitate the emergence of a new paradigm in education; this is e-learning, respectively, *learning on the Internet*. It becomes obvious that as time passes, the Internet becomes the mediator of access to education and culture [5]. From an educational point of view, *e-learning* has gained several meanings. However, what seems universally valid and accepted is the theory that change is only constant in terms of digital transformation [6]. E-learning, as a direct result of the integration of technology and education, has emerged as a powerful means of learning, especially using Internet technologies. The undeniable importance of e-learning education has led to a massive increase in the number of courses and e-learning systems that offer different types of services. Thus, the evaluation of the e-learning system is vital to ensure successful delivery, efficient use, and positive impact on the actors involved in the learning process. Based on an intensive review of the literature over the past five years, a comprehensive model has been developed that provides a holistic picture and identifies different levels of success related to a wide range of determinants of integrating this powerful means of learning into our social, cultural, civic, and finally educational life.

In order to evaluate the pace of research in the field of e-learning, its development can be examined, for the last five years, through 7,948 articles that are refined in the Clarivate Analytics database, Web of Science Core Collection, of which 2,524 are open access.

E-learning is based on technology, hardware, software, and network infrastructure. Most e-learning environments today are web-based, meaning they are accessed using a web browser (using HTTP) over a TCP / IP network, such as the Internet or intranet (for example, a university campus network). Today's e-learning does not require special hardware or network requirements; in theory, it is necessary to have internet access and a computer or mobile device on which a web browser can run. At the same time, an institution that offers e-learning only needs server hardware and software and Internet connectivity; of course, they are sized according to the needs (number of students or learners who simultaneously access the system and the type and amount of materials broadcast).

However, things are not so simple. User management and authentication are required, user interfaces may be different, and there are issues with interoperability between the systems used. With the advent of the Web and the development of e-learning, e-learning or educational platforms have emerged that can provide a unique user interface appropriate to the needs of a course.

Today, there are many educational platforms available, making it increasingly difficult for the various institutions that offer education services to choose the one that best suits their needs. Furthermore, there is no universally agreed definition of what an e-learning platform is. This is a problem for both research and practice because without a clear definition, there is no objective frame of reference for describing, comparing and evaluating systems. Although there has been further development of educational or e-learning platforms in recent years, there are still many misunderstandings regarding the terminology used regarding the naming of software systems that facilitate or support online learning.

Therefore, different terms are used to name these systems, such as Learning Management System (LMS), Learning Content Management System (LCMS), Course Management System (CMS), Virtual Learning Environment (VLE), Managed Learning Environment (MLE), or Learning Support System (LSS). The use of the terms is inconsistent, most often depending on the people who use the term or the area in which the terms are used. Sometimes, the above terms may even describe different systems or are sometimes used interchangeably.

It is quite difficult to have a clear definition of the term educational platform.

The first definition could be considered 'a complete software package that supports some or all aspects of the training, delivery, and interaction of a course and allows all of this to be accessed using a network' [7]. For this term, there is no clear definition because it is vague (supporting some or even all aspects).

Regarding Google Classroom, the definition is accurate: it is a web-hosted service as an e-learning system [8] and is one of the Google for Education tools, launched on August 12, 2014. It was created to help teachers create and

distribute assignments to students without the use of printed documents and allows the creation of classrooms in a virtual space.

2. THE PURPOSE OF THE CASE STUDY

When using a social network, the first thing to consider is the target audience. The diversity of the public can be described as two sides of a coin. On the one hand, it can be positive to target wider market opportunities, but on the other hand, if it does not target the right type of audience, it is very likely that the information will arrive without effect [9]. Additionally, the target audience is active only at certain times. Therefore, it is always important to know when to post information.

To collect the data needed for the study, we used a questionnaire for students and an interview questionnaire for teachers. Both questionnaires were completed in printed form and online.

2.1. Student questionnaire

The questionnaire addressed to students has ten questions with items of true or false type and with questions with a selection of answers. When establishing the number and type of questions, we considered the fact that the students who are going to answer the questionnaire are from secondary education (grades V-VIII) and that they must be as short and clear as possible.

Through this questionnaire, our objective was to measure, in particular, the level of satisfaction of students with the use and learning to use Google Classroom, but also to measure its effectiveness in terms of them. We also aimed to measure the quality of information received by students and the communication between them and teachers, as well as the system and services. Several of the 22 Western Romanian students participated in this study.

From the analysis of the responses presented in Figure 1, we can highlight that there were no special problems with respect to the use of Google Classroom.
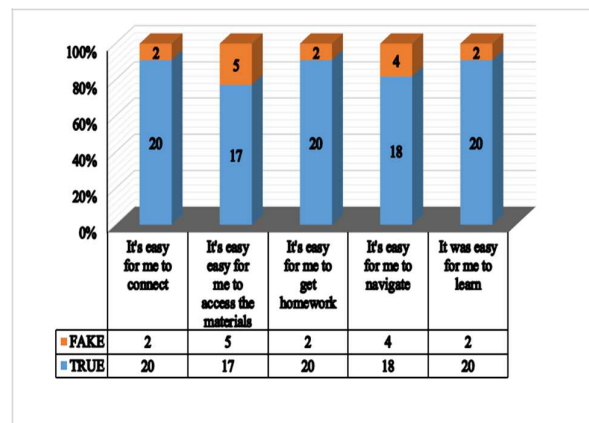

Fig. 1. How students perceive the use of Google Classroom

Thus, on the questions that had to be subject to ease in terms of using Google Classroom, a very high percentage answered that they had no problems in this regard.

Another important aspect is who of the students perceived the usefulness of using Google Classroom for online teaching.

Therefore, we noticed that more than 70% of the students responded that the platform is useful to them in the learning process.

The least positive response was that of increased learning motivation, where only a percentage of the 30% of students answered that by using the platform, the motivation to learn increased (Figure 2).
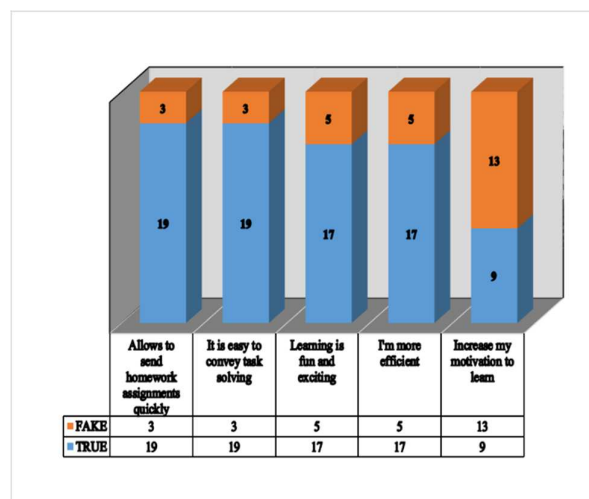

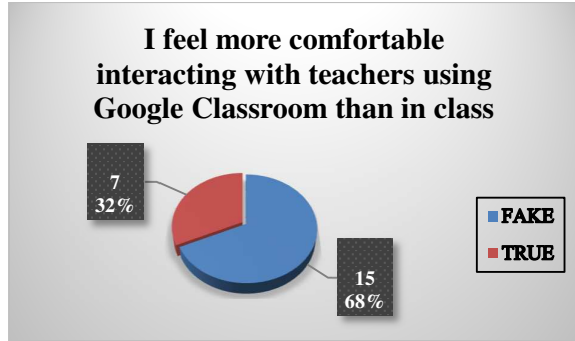**Fig. 2.** The usefulness of using Google Classroom perceived by students

I feel more comfortable interacting with teachers using Google Classroom than in class

7
32%

15
68%

FAKE
TRUE

Fig. 3. The usefulness of using Google Classroom perceived by students

Google Classroom allows me to interact effectively with teachers and colleagues
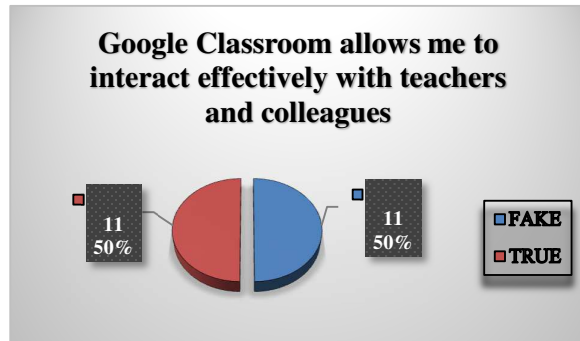
11
50%

11
50%

FAKE
TRUE

Fig. 4. Interaction in relation to teachers towards the face-to-face teaching method

A special role in the teaching-learning process using online platforms is how communication is achieved. Figure 3 shows that only 32% of students are more comfortable interacting with teachers through Google Classroom than in face-to-face classes.

Regarding the interaction with classmates and teachers using Google Classroom versus the traditional learning system, face-to-face, the result was equal, 50% (Figure 4).
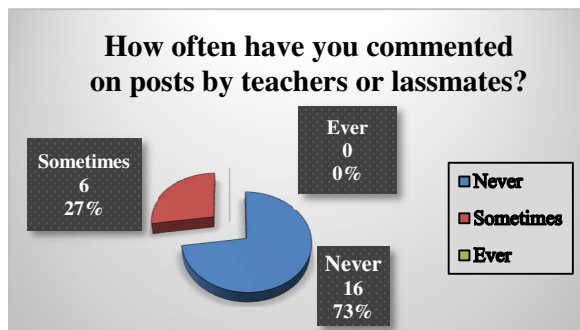
How often have you commented on posts by teachers or lassmates?

Ever
0
0%

Sometimes
6
27%

Never
16
73%

Never
Sometimes
Ever

Fig. 5. Interaction with teachers and colleagues, using the message posting feature

In terms of communication, also, only 27% of the students sometimes commented on the posts

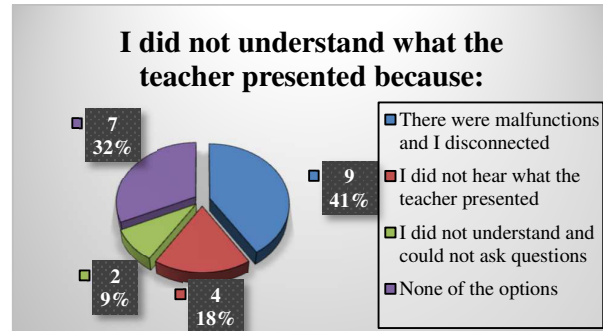distributed by teachers or classmates, while 73% of them did not comment (Figure 5).

I did not understand what the teacher presented because:

7
32%

9
41%

2
9%

4
18%

There were malfunctions and I disconnected
I did not hear what the teacher presented
I did not understand and could not ask questions
None of the options

Fig. 6. Malfunctions

Creating and receiving messages
Access to shared links
Performing tasks using the platform
Receiving results and feedback
Communication with colleagues
Communication with teachers
None of the options

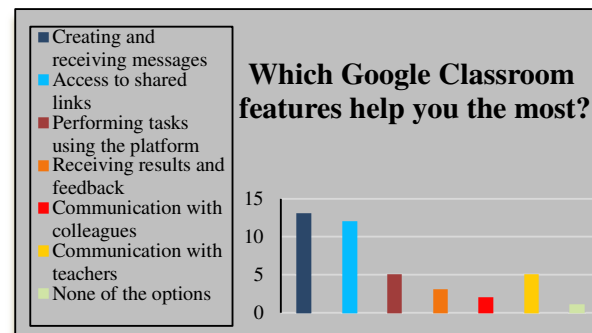**Which Google Classroom features help you the most?**

15
10
5
0

Fig. 7. Google Classroom features found useful by students

The biggest problem (Figure 6.) identified by the students was the quality of the services, the internet connection. This is caused by the weak signal or by the low coverage provided by fixed and mobile telephony networks. The answers show that there were no cases in which the students did not have the means to connect.

Regarding the features of Google Classroom that students have identified as useful (Figure 7.), the most popular is the one through which messages are created and received, followed by access to links shared by teachers. Although students consider creating and receiving announcements (messages) one of the most important features, communication with teachers and colleagues has a very small number of responses.

It can be concluded that communication was quite low when using the platform.

Regarding the use of Google Classroom for certain subjects, it is noted that most consider this platform to be more suitable for math, physics, and chemistry classes, followed by

Romanian and foreign language classes, and finally for the classes of educational sports. Students were asked which subject they liked the most and which subject they disliked how it went using Google Classroom. The results are presented in Figures 8 and 9.

Following the analysis of the results obtained, it can be concluded that there were no particular problems from the point of view of ease of use of the platform, most students being able to use the platform to access posted materials and receive homework.

There were also no connection or browsing problems. Some problems have been identified in terms of the transmission of tasks and solved topics.
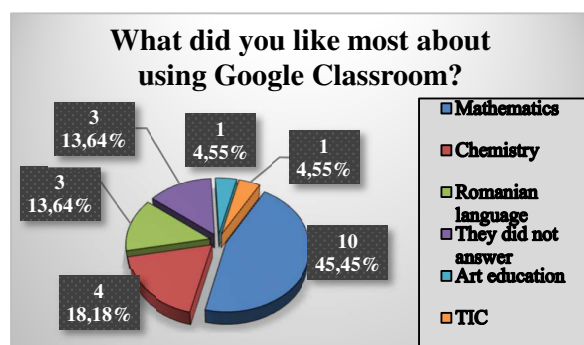

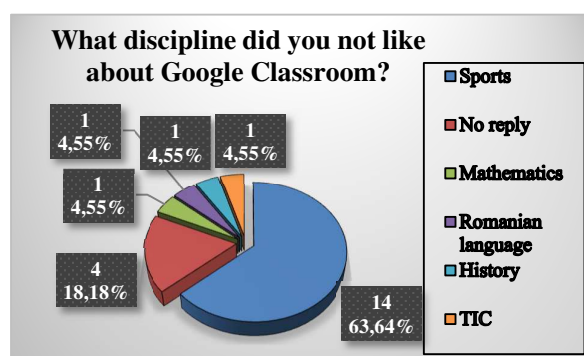**Fig. 8.** Favourite subject of the study

Fig. 9. Unwanted topics

As for the usefulness of the platform, it can help them solve tasks by receiving faster feedback.

Although students consider the feature of the platform useful for good communication, through the messages that can be created and transmitted, both with teachers and colleagues, they have not always used this option.

Another important conclusion is that students prefer the face-to-face teaching system to the online one; however, they do not eliminate the possibility of its continued use. They consider the use of the platform to be a useful time schedule.

Regarding the quality of services and the system, most of the problems that have arisen are mainly due to the Internet connection to the detriment of other problems.

2.2. Teachers 'Questionnaire

To collect data from teachers, we used an interview questionnaire. The questionnaire also aimed to measure the teacher's level of satisfaction with using Google Classroom in the teaching process and its effectiveness from their point of view.

This questionnaire identifies problems related to the use of the platform by teachers, even after the end of the current conditions of the health crisis. Consider the measures that should be taken to improve the conduct of classes using the online teaching system, to create conditions, and provide better software and hardware systems to support it.

15 teachers from rural areas of western Romania answered the questionnaire.

Teachers appreciated that the use of Google Classroom came to their aid in terms of organizing classes.

It offers the possibility of systematizing and selecting didactic content, having the possibility of publishing teaching materials, worksheets, and tests, so that they can be easily found.

During the classes, they had the opportunity to post different work tasks, which the students viewed, and then solved together, using the Google Meet and Share screen, the virtual whiteboard to send different messages, answering questions, solving different topics, and posting the solutions later.

The teacher-student interaction was mostly effective. Google Classroom provides better student feedback than other applications.

The communication mode is more efficient compared to other communication or collaboration applications; the most common comparison is made with WhatsApp.
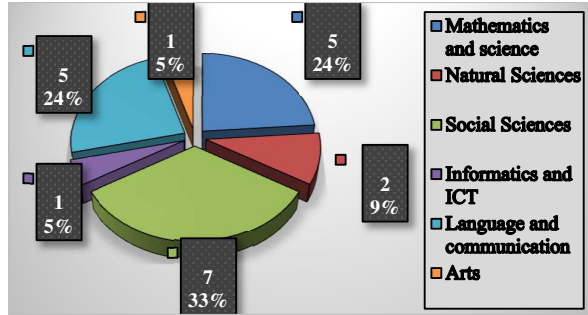
Fig. 10. Curriculum areas where the use of Google Classroom can improve the teaching and assessment process.

Fig. 11. Using Google Classroom after giving up the conditions imposed by the SARS CoV 2 pandemic

Following the analysis of the responses received to the question on the most useful method of communication that can be used to help teachers conduct classes, using Google Classroom, it turned out that it is the use of video conferencing. This was followed by using synchronous tools (email, newsletters, discussion forums, Wiki, blog, webcasting, podcasts), then the use of asynchronous tools (chat and instant messaging, opinion polls, virtual classroom) and face-to-face courses, workshops, seminars, the last place being individual face-to-face meetings.

To improve the teaching and evaluation process in the school using Google Classroom (Figure 10), it is observed that the first place is in the social sciences, followed by mathematics and science and language and communication, and the last place is in the natural sciences and computer science.

Teachers' problems during Google Classroom use were included in the interview questionnaire on platform use, communication with students, configuration of classes, classes and assessments using this platform.

Regarding the configuration of the teachers classes, none of the interviewed teachers identified the existence of problems.

Problems have been identified with the use of the platform and communication with students, mainly due to connectivity outages. These issues mainly concern the quality of Internet services, which are practically unrelated to the platform. Other problems were identified due to the different interfaces and ways of working between the different devices (laptop or PC, tablets, and smartphone) used to connect to the platform.
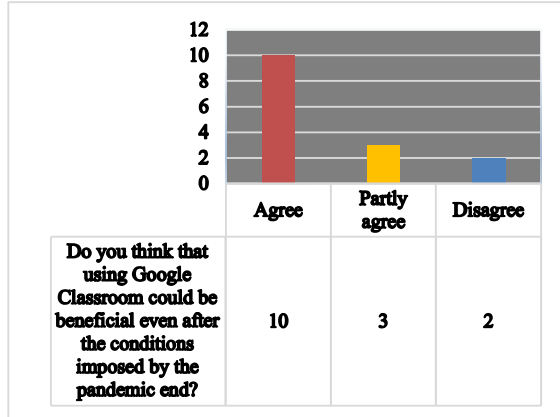
Regarding the conduct of classes, a problem was caused by the incorrect configuration of the students' user accounts. Because of this, students had the opportunity to disconnect from their meetings to Google Meet colleagues, and the possibility of reconnection can only be done by the one who disconnected from the platform.

In the evaluation method that uses the platform, the identified problem refers to the performance of the tests. For some subjects, performing the tests is quite time consuming. To perform the tests, it is necessary to use extensions that must often be purchased. Extensions consume the resources of the devices on which they are installed, and even the resources of the Internet, making it difficult to use the platform. The questionnaire included a question about the possibility of using Google Classroom even after resuming the conditions imposed by the SARS-CoV2 pandemic (Figure 11). Teachers who partially agree have justified that the platform should be used if students are unable to attend classes for medical reasons or if this will be required by the school curriculum.

Teachers who agree have justified that the platform can be used for the following reasons.

- For students who are currently in an isolated area or cannot attend classes for medical reasons;
- Communicate with students outside of the class and send them various necessary materials;
- Because it provides quick access to information and can allow the use of

information available on the Web during classes;

- Because students can have access to the materials posted on the platform at any time.

3. CONCLUSION AND FINAL REMARKS

The advantages and disadvantages of using Google Classroom are the same as those of any learning management system, and they may change during the development or experience of using the platform by its users.

Anyone familiar with Google can learn to use Google Classroom quickly, and from this comes the first advantage: its ease of use. The school needs to be registered with Google for Education, and teachers have an assigned account, so they can create courses, share materials with students, assign assignments, homework, or take assessments with a few clicks.

One of the biggest advantages of Google Classroom is that it can be accessed from both computers and mobile devices, such as smartphones or tablets. There are applications that allow the use of Google Classroom on mobile devices on which iOS or Android systems are installed.

A great advantage is that it reduces the number of documents that a teacher or even students have to carry daily. Documents can be kept online and can be accessed using even mobile slides very easily. The only requirement is the existence of an Internet connection.

All course resources that are created or uploaded to Google Classroom can be shared with a virtually unlimited number of people and that once distributed on the platform can be easily accessed through Google Drive by students. Once a learning resource is created, a message is automatically sent to all students to whom it is addressed. In essence, when the respective resource has been published, a message is sent in the Stream tab of Google Classroom, through which students are warned about the publication of the respective resource.

The process of assigning tasks and homework to students is very easy and fast, with just one click. It is also very easy for the teacher to check who submitted the homework or task and who is still working on it. Deadlines can be established to solve tasks, assignments, or tests.

A great advantage is that it offers the possibility of sending immediate feedback to students, which makes it more effective, and immediate comments and observations have a major impact on students.

Most students have become increasingly accustomed to using modern means of communication and will therefore be much more open to using them in the learning process. Google Classroom gives teachers the ability to include videos and web pages in lessons and create group assignments. Teachers can also distribute learning resources or assign differentiated tasks to students in a class.

Although it does not excel at generating analysis reports on its use, Google Classroom offers teachers the opportunity to do some analysis of the data obtained from assessments to ensure that their learning objectives have been met.

In terms of accounts for teachers and students, it has a disadvantage because it does not allow access to accounts from other fields or to a personal account; it is necessary for users to have an account created in the domain of the educational institution.

One disadvantage is that it does not offer many interface configuration options. In essence, they are limited to the way the interface will look, and there is no possibility to add or remove certain features.

Another disadvantage of using Google Classroom is that students cannot share their documents with their peers unless they become the "owners" of the document and after setting up its sharing options. This can create problems because it may require more advanced knowledge of using the platform.

Given the advantages and disadvantages presented above, it can be concluded that Google Classroom can be used for online education, although it seems much more suitable for blended learning, which involves using the traditional face-to-face teaching system and using educational platforms.

The evolution and growing development of skills in the use of computers and mobile devices

in recent years has led to the emergence and development of more and more IT tools that are used in the process of teaching and assessment using the online environment. All of this has led to the development of more and more online learning platforms, platforms that have become increasingly familiar to both teachers and students, in general.

The online learning process can be defined as that process of distance learning, in an educational environment that is constantly evolving and based on collaborative principles, by combining traditional teaching methods with methods that are based on IT resources, to increase the individual performance of students. [10]

At the beginning of 2020, with the emergence of the global COVID-19 pandemic, it became increasingly clear that it is necessary to implement a system that allows the development of online learning.

Given these issues, more and more educational institutions have felt the need to adopt and integrate information and communication technology into the teaching, learning, and evaluation process, and this need has led to their attempt to implement a learning management system.

Taking into account that the 2030 year is not so far, a Working Group of the OECD Education 2030 project is collecting ideas and examples of good practice for making the learning framework actionable, as a global effort for education change. Information about the OECD Learning Compass 2030 will guide students to something new, different from the PISA assessments. [11]

This article describes the impact of using the platform in almost a year and a half since its implementation. Its main purpose is to identify how users perceived the usefulness of using the platform and what the problems were in terms of ease of use of the platform, communication between teachers and students, what features can be used to improve the learning process, and whether this platform should be maintained after the cessation of the special conditions that led to its use.

The use of Google Classroom in the learning process must be supported by the technical infrastructure. This requires the existence of devices capable of connecting to the platform (computers, laptop, smartphone, or tablets), but also a fixed or mobile Internet network that ensures a seamless internet with coverage in all areas where the platform is to be used. Through this, students will have permanent access to the resources that are posted on the platform and the communication is seamless.

This article highlights that it is not enough to use the platform to upload learning content or to distribute tasks and collect their solutions. The organizational, methodological, and training aspects of the didactic staff must also be considered. From a pedagogical point of view, if the platform is used to store only materials and information, its usefulness is limited.

From the answers given to the two questionnaires, the results showed that the platform was used fairly little for teaching activities that involve collaboration between students and that the platform was used more for content transmission.

The OECD Learning Compass 2030 might be the first step in this purpose of education and skills, and assessing the quality of the information source might be the second, because running a quality check is very important for a professional approach in the learning process.

Future work must take into account new learning systems and other important assets available in the society, such as senior experts. [12]

If we do a careful research on the *European Data Portal eLearning programme*, we will find a list of 16 short training sessions designed for anyone to discover more about open data. [13]

One of the most important modules (the last one, number 16) is about *achieving impact with open data.*

Open data is a relatively new concept. According to the European Commission, Open Data in Europe looks at three areas of impact: political, economic, and social.

In 2016, the highest scoring countries for political impact were Slovakia, Ireland, Bulgaria, France, and Greece, for the following indicators: impact of government efficiency and effectiveness, and impact of transparency and accountability. [13]

The economic and social impact indicators are based on environmental sustainability and

inclusion of marginalized groups and studies assessing open data of market value [13] which certainly leads to an entire e-learning industry.

Technology has revolutionized teaching and learning. These issues can be easily explored with the help of e-learning statistics [14].

- The worldwide e-learning market is projected to be worth $325 billion in 2025.
- In 2017, approximately 77% of US corporations used online learning, but 98% planned to incorporate it into their program by 2020.
- The US e-learning market is expected to grow by $12.81 billion between 2020 and 2024.
- E-learning increases retention rates by 25% to 60%.
- The corporate e-learning market could increase by $38.09 billion between 2020 and 2024.
- E-learning has led to an increase in income for 42% of US organizations.
- A survey of 2,500 companies found that those with comprehensive training programs have 218% higher revenue per employee and 24% higher profit margins.
- IBM saved approximately $200 million after switching to e-learning. The worldwide e-learning market is projected to be worth $325 billion in 2025 [14].

Future work will focus on creating new training programs for future teachers and understanding the need among students for learning and e-learning and all the benefits from it.

It is a time for change.

4. REFERENCES

[1] Fuller, D.; Rena, N.F.; Pearce, K.; Strand, S., *Internet Teaching By Style: Profiling the Online Professor in Educational Technology & Society* https://www.researchgate.net/publication/26391082_Internet_Teaching_By_Style_Profiling_the_Online_Professor (access on September 10, 2021).

[2] Horton, W., *Designing web-based training: How to teach anyone anything anywhere at any time.* New York: Wiley & Sons (2000).

[3] Burniske, R.W.; Monke, L., *Breaking Down the Digital Walls,* Albany, NY: State University of New York Press, (2001).

[4] Pisau, A., *Instrumente digitale pentru o învăţare online eficientă în contextul provocărilor societale,* Univers Pedagogic, 67(3), 44-49, (2020).

[5] Hutu, I.; Boboloaca, I., *Învăţare online; impact, avantaje, and accesibilitate prin aplicaţia moodle E-learning; impact, advantages, and availability by Moodle software.*https://www.researchgate.net/publication/340538801_Invatare_online_impact_avantaje_si_accesibilitate_prin_aplicatia_moodle_E-learning_impact_advantages_and_availability_by_moodle_software, 2004, (Access on September 20, 2021)

[6] Newman, D., *Top 5 digital transformation trends in education for 2020,* 2019 https://www.forbes.com/sites/danielnewman/2019/08/01/top-5-digital-transformation-trends-in-education-for-2020/?sh=17ac79d45739, (Access on September 20, 2021).

[7] Yefin, K., *Learning Management System Technologies and Software Solutions for Online Teaching: Tools and Applications,* Information Science Reference, p. 26 (2010).

[8] Martinez-Mones, A.; Reffay, C.; Torio, J.H.; Cristobal, *Learning Analytics with Google Classroom: Exploring the possibilities,* 5th International Conference on Technological Ecosystems for Enhancing Multiculturality, (p. 47). Cadiz, Spain, JAM,(2017).

[9] Anghel, C-V.; Drobot, L., Constantin A. *Aspects of Information Technology Education in University Environment,* Balkan Region Conference of Engineering and Business Education, 15-17 October, 2009.

[10] Croitoru, M.; Dinu, C.-N., A Critical Analysis of Learning Management Systems in Higher Education. *Economy Informatics, 16*, 5-18 (2016).

606

[11] OECD (2018), Education 2030, Learning framework https://www.oecd.org/education/2030-project/teaching-and-learning/learning/faq/, (Access on November 14, 2021).

[12] Pisla, D.; Nae, L.; Vaida, C.; Oprea, E.; Pisla, A.; Gherman, B.; Antal, T.; Riessenberger, K.; Plitea, N., *Development of a learning management system for knowledge transfer in engineering*, Acta Tehnica Napocensis, Vol. 64(3), pp. 361-368 (2021)

[13] European Commission (2021), Education https://data.europa.eu/en/training/elearning (Access on November 10, 2021).

[14] Cernev, B., *29 Astonishing e-learning statistics for 2021,* https://techjury.net/blog/elearning-statistics/#gref (access on November 10, 2021)

Studiu de caz privind utilizarea platformei Google Classroom într-o unitate rurală de învățământ preuniversitar

Rezumat: Scopul acestui studiu este de a identifica cât de mulțumiți sunt utilizatorii platformei Google Classroom, cât de eficient este să folosească această platformă în procesul de învățământ și dacă poate fi utilizată chiar și după restricțiile impuse de pandemia Covid-19. Eficiența este analizată din punctul de vedere al destinatarului mesajului, al conținutului, al mijloacelor de comunicare, al formatului și al duratei de transmitere a mesajelor și conținutului. Studiul își propune să furnizeze informații care pot fi utilizate cu privire la implementarea platformei pentru desfășurarea învățării online sau învățării hibride.

Nicoleta MIREA, PhD Student, PhD Student, Politehnica University of Timisoara, Faculty of Management in Production and Transportation, Engineering and Management, Research Center for Engineering and Management, 14 Remus Str., 300191, Timisoara, Romania, nicoleta.mirea@student.upt.ro, +40 787262208

Cornelia-Victoria ANGHEL-DRUGARIN, Senior Lecturer, Ph.D. Eng., Babeș-Bolyai University Cluj-Napoca, Department of Computer Science, 1-4 Piata Traian Vuia Str., 320085, Resita, Romania, cornelia.anghel@ubbcluj.ro, +40 731162025

Anca DRAGHICI, Professor, Ph.D. Eng., Politehnica University of Timisoara, Faculty of Management in Production and Transportation, Research Center for Engineering and Management, 14 Remus Str., 300191, Timisoara, Romania, anca.draghici@upt.ro, +40 744178210