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Investigating the Effects of Online and Flipped Classroom Approach during COVID-19 Pandemic

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Abstract – In an effort to prevent the transmission of COVID-19, governments around the world have closed universities and schools. Educational institutions needed to respond quickly and adapt to the new situation. Many of them have applied an online teaching model, but there were also some that have applied the flipped classroom model. This study investigates the effects of online and flipped classroom model, in 7th grade students. Empirical research was conducted in three elementary schools in Republic of North Macedonia during corona pandemic. The study lasted for two months and involved 167 participants.

The results showed that both methods have a positive impact on the students' learning motivation, attitudes, engagement, interaction, collaboration and general satisfaction. These findings suggest that the aforementioned teaching methods can facilitate the delivery of theoretical knowledge not only during emergencies (such as Covid-19 pandemic), but also during normal educational process.

I. INTRODUCTION

The COVID-19 pandemic has created the largest disruption of education systems in history, affecting nearly 1.6 billion learners in more than 190 countries on all continents. All educational institutions in Republic of North Macedonia were also closed on March 10, 2020.

To ensure learning continuity during this disruption to the traditional (face-to-face) teaching, most schools and universities were constrained to adopt the online teaching and learning models in a relatively short period of time.

This need for rapid shift to online learning revealed many problems in the education systems all over the globe but, it also revealed a deep gap in our overall approach to education.

Despite the rapid development of ICT, artificial intelligence (AI), robotics and electronics, and their application in various institutions and sectors [1-12] it seems that the schools have been under-resourced

and underfunded when it comes to the uptake of this technology.

On the other hand, this crisis has stimulated innovation within the education sector [13]. We have seen innovative approaches in support of education and training continuity: from radio and television to take-home packages.

In Republic of North Macedonia, the Ministry of Education and Science in cooperation with UNICEF and other partners created a new online-learning platform called EDUINO (Fig. 1), where pre-primary, primary and secondary school students can continue their education through video lessons, resources and a variety of games [14].

EDUINO is a web-based collective platform, created using the design thinking methodology as well as the principles of co-creation and collective action, involving more than 1200 teachers, educators and parents.

EDUINO offers more than 3000 video lectures on Macedonian, Albanian, Serbian, Bosnian and Turkish languages. All video lectures are divided and grouped by study year and subject. Each video lecture is covering micro-units of the study program accredited by the Bureau for Development of Education. During the spring semester EDUINO was the main channel of educational content delivery and this resulted in more than 2.5 million of video previews or downloads.

In addition, an educational program called TV Classroom has been broadcasted on the national television (Fig. 2).



Figure 1. EDUINO platform



Figure 2. TV Classroom project on national television

Despite these initiatives, many educational institutions and many teachers have become interested in how to best deliver course content online, engage learners and conduct assessments.

In the absence of systemic solution at national level, teachers started adopting new pedagogical concepts and modes of delivery of teaching, for which they may not have been trained. Teachers were also adapting to online education while keeping their students engaged and learning.

However, getting students to attend online classes does not guarantee their benefit from what is

presented [15]. Therefore, it is very important to find the most effective methods that will increase the learning efficiency of students.

The integration of flipped learning concept in online teaching is believed to add value to online learning during times of disruption to traditional teaching. It is believed that the combination of online teaching with flipped classrooms may improve the learning effectiveness of the online class.

This paper investigates the effects of online and flipped classroom approach under COVID-19 pandemic. The retrospective survey was used to determine students' motivation, attitudes, engagement, interaction/collaboration and satisfaction of two groups of students. One group was taught by synchronous online model, while the other attended flipped classroom. The research questions that we'll try to answer here are:

RQ1: What are students' perceptions about online teaching/learning during Covid-19?

RQ2: What are students' perceptions about flipped classroom approach during Covid-19?

RQ3: Are there any differences between the two groups of students regarding their motivation, attitudes, engagement, interaction/collaboration and satisfaction?

To answer these questions an empirical study was conducted. The research methodology, results and conclusions are presented in the rest of this paper.

II. ONLINE AND FLIPPED CLASSROOM MODELS

Online education is electronically supported learning that relies on the Internet for teacher-student and student-student interaction, as well as the distribution of class materials. Its primarily aim is to foster students to be independent at certain times and take responsibility for their learning. Besides, online learning should allow students to play a more active role in their learning because it focuses on personalization, which includes the ability to adapt to the level of learners' skills and collecting knowledge resources as mutual support [16]. Research has indicated that online learning is pedagogically promising approach, because it encourages deeper learning due to its self-paced and student-centered approach [17, 18]. However, the separation of the instructor from students in this type of learning is reported to cause a sense of isolation among students [19].

In recent years, another approach based on constructivism theory has been developed. Flipped classroom is an alternative pedagogical approach focusing on student-centered instruction that reverses the traditional classroom environment. In the flipped

classroom model, the delivery of content is usually obtained through online videos prepared by the teacher or a third party. Students' watch the assigned short instructional videos at their own time and pace prior to attending classes in which they participate in group activities or the teachers answer their questions [20]. This can be effective in making the learning process begins prior the class and engage the students to learn the content at a deeper level during the class [20, 21, 22, 23, 24]. With the flipped classroom, rather than relying on a singular model, the instructor should apply multiple approaches, such as group discussion, mini-lectures for review, or student questioning [25].

Flipped classroom method allowed teachers to observe how well the students managed with given tasks, or if they needed more exercise with certain topics. It also allowed more possibilities for one to one interaction with those students who seemed to need help, encouragement or positive feedback, in order to be able to continue with more demanding topics.

III. METHODOLOGY

Methodology that is used in this study is based on Input-Process-Output (IPO) model paradigm (Fig. 3).

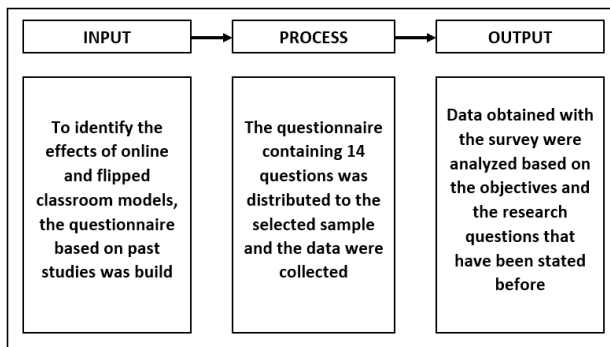


Figure 3. IPO model used in the study

According to Cohen and Bailey [26] input factors are factors that can be manipulated to change the process and the result. These factors can be input at the level of individuals, groups or the environment [27]. In our IPO model, in this phase, we have developed the questionnaire based on previous research. A total of 14 questions will be provided in the questionnaire where participants are required to answer all the questions that have been provided (Table I). A five-point Likert scale is used for scaling the responses of the questionnaire items. The reliability of the questionnaire was also performed on 10 participants to test the Cronbach alpha. The coefficient reliability for the questionnaire was $\alpha = 0.81$, which is above the suggested value of 0.70.

We believe that this value is suitable for the purposes of the current study.

TABLE I. QUESTIONNAIRE ITEMS USED IN THE STUDY

<i>Construct</i>	<i>Item</i>	<i>Question</i>
Overall satisfaction	OS1	Generally, I am happy and satisfied with this online/flipped learning experience.
	OS2	I preferred online/flipped classroom over conventional teaching.
Interaction/ Collaboration	IC1	It was helpful to collaborate with my classmates by sharing ideas and commenting.
	IC2	The process of discussion was helpful.
	IC3	The interaction between the students and the teachers was helpful.
Learning Motivation	LM1	I feel motivated and use my own initiative to collect the materials about this course content, in an online/flipped classroom.
	LM2	The way the class is taught draws my attention.
	LM3	I became a more active learner in the online/flipped classroom.
Learning Attitudes	LA1	I had to work harder in this course.
	LA2	Learning activities in this course are helpful for me.
	LA3	I had sufficient ability to learn and comprehend the course content.
Learning Engagement	LE1	I participated more in group discussions in the online/flipped classroom.
	LE2	I spent more time and effort than usual on online/flipped classroom learning activities.
	LE3	I devoted myself more to the class activities in the online/flipped classroom.

The information processing is an important characteristic in completing tasks and problem situations [28]. In the "process" phase, a questionnaire containing 14 questions, was distributed to the selected sample and the data were collected.

The output or the outcome is the result of the process. It is usually defined by how far the goal is achieved [29]. The data, collected from questionnaires, were analyzed based on the objectives and the research questions that have been stated before.

A. Participants

Students from three elementary schools located in three different regions in Republic of North Macedonia (East, South-west and North), form 7th grade, were included in the study. The total number of participants was 167 students of which 89 were female (53%) and 78 were male (47%). Two classes from each school were involved. One class was taught by synchronous online model, while the other

attended flipped classroom. All students attended the “Math” course.

Synchronous online model means that the teacher and the students interact in a specific virtual place at the same time. In our case, the synchronous online classes were performed using Zoom videoconference application. Classes were scheduled a few days in advance to keep students informed in a timely manner.

The flipped classroom model was conducted as follows: 7 days prior to class, the teacher delivers short instructional video, for the content that should be taught in the class. The videos, for this study, were provided through the EDUINO platform [14]. Students were required to watch the assigned video before the live class, and to make notes about the content they watched. They were also encouraged to use a variety of collaboration tools during this phase. During the in-classroom learning activity, students presented their notes, asked questions and participated in active discussion with teachers and their classmates.

B. The study and data collection

The study took place in three elementary schools in Republic of North Macedonia, from 1st of April till 1st of June. The last days of the school year (from 1st to 10th of June) was reserved for completing the questionnaires and gathering the feedback. A pre-designed Google form questionnaire was used to collect desired data. The link of the Google form was sent to the students by e-mail. A total of 156 questionnaires were collected, representing a return rate of 93%. All received questionnaires were valid and were used in this study.

Data were collected on students’ learning motivation, attitudes, engagement, interaction/collaboration and general satisfaction, all measured by the self-report questionnaire.

The learning effects of the online and flipped classroom model were obtained through statistical and comparative analysis of the data.

Before starting the research, the researchers had a brief session with the participants, in order to explain the basic principles of online and flipped classroom pedagogy. They also gave the participating students an opportunity to experience a flipped classroom before they implemented it in their class, so they could have a better understanding of this pedagogy.

IV. RESULTS AND DISCUSSION

Table II shows the mean (M) and standard deviations (SD) of the two groups of students, for the

defined sets of questions (constructs). According to the findings, the average score of all constructs, for both groups, was above 3 which was set as a median score.

TABLE II. DESCRIPTIVE STATISTICS OF THE QUESTIONNAIRE BY CONSTRUCT, FOR BOTH GROUPS OF STUDENTS

Construct	Online		Flipped classroom	
	Mean	SD	Mean	SD
Overall satisfaction	3.6	1.18	3.8	1.06
Interaction/ Collaboration	3.31	1.27	4.08	1.13
Motivation	3.3	1.32	4.15	1.04
Attitudes	3.56	1.08	3.78	1.19
Engagement	3.63	1.14	3.75	1.12

As observed in Table II and answering to RQ1 and RQ2 of this research, participants were satisfied with the new ways of teaching (Fig. 4), and they preferred them over conventional teaching (Fig. 5).

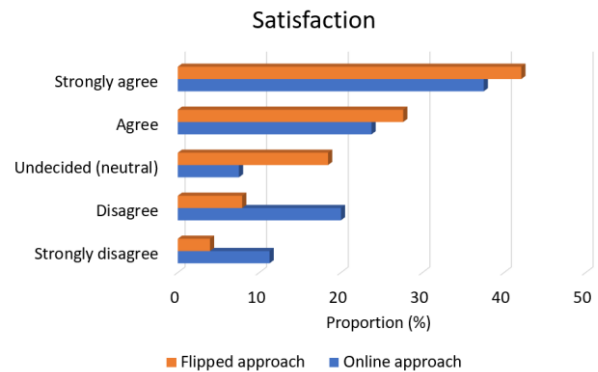


Figure 4. General satisfaction with both learning approaches

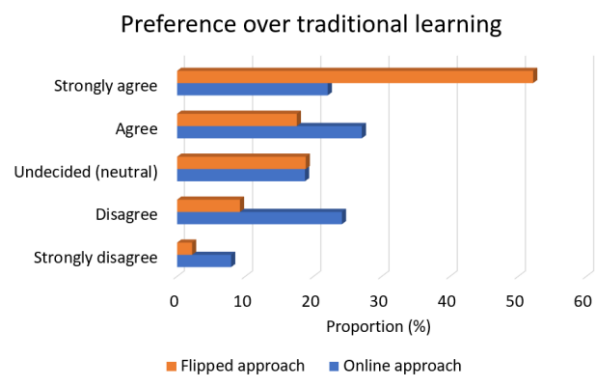


Figure 5. Preference over traditional learning

Both groups (the students who attended online classes and the students who attended flipped classroom) highly regarded the online and flipped classroom activities. They reported increased motivation and engagement, as well as positive attitudes during the new learning experience. This is

in line with the previous research, where positive effects on learning motivation [30, 31, 32], as well as on learning attitudes [33, 34] and student engagement [35, 36, 37] have been reported.

Regarding RQ3, we can state that there are no major differences in constructs, except for “Motivation” and “Interaction/Collaboration”, where significantly higher scores are reported by the group attended flipped classroom. This can be explained by the specific approach that the flipped classroom has.

There are two factors that influence motivation and learning: internal and external [38]. Internal factors are related to individual’s own capacity, while external factors are related to the learning environment and materials. Although we cannot influence the internal factors, we can still influence the external ones. Most of the learning difficulties that students face in the traditional school setting, are due to their passive role during the class. With the flipped classroom, the teacher-centered approach has been shifted to student-centered approach, enabling students to be active participants. Flipped classroom allows students to construct their own learning process and deepen their learning, through in-class activities, questions and answers and discussions. The interaction with others and the reflection of this interaction process in the individuals’ inner world is also important for the learning process [39]. So, interaction and collaboration can make essential contributions in increasing students’ learning motivation.

V. CONCLUSION

Technologies have changed the traditional way of education to the modern way of teaching and learning. Digital technology in education enables us to find new answers not only to what people learn but also to how they learn, where and when they learn.

This study aimed to examine the effects of online and flipped classroom approach on elementary school students, using the questionnaire. Analyzing the responses, it was concluded that both methods have positive impact on students’ motivation, attitude, engagement, interaction/collaboration and general satisfaction.

However, when it comes to students’ motivation and interaction/collaboration, as well as their general satisfaction, the flipped classroom was preferred by most of the students.

As a general conclusion, we can say that the aforementioned teaching methods can facilitate the delivery of theoretical knowledge not only during emergencies (such as Covid-19 pandemic), but also during normal educational process. Therefore, we

can strongly recommend the teachers to continue with these teaching methods even after the pandemic whenever and wherever possible.

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