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## **Classroom-based and Online-based Evaluation of Students and Comparative Analysis of Their Achievements in both Scenarios**

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**Abstract:** The COVID19 pandemic made a significant impact on every aspect of everyday life. Educational systems around the world applied different strategies in fighting the limitations imposed by their governments. Some countries opted to continue normal schooling while applying all epidemic measures, some opted for online schooling, some to tele-schooling and others applied combined regime of schooling. The educational system in the Republic of Serbia in the school year 2020/2021 was organized as a combination of standard classroom-based teaching with all epidemic measures and television-based distance teaching-learning. After the epidemic situation worsened, all schools shifted to online-based distance teaching-learning. In this paper we will explain the student evaluation process in both the combined regime of schooling and in the online distance teaching of mathematics in elementary school “Ujedinjene nacije” in Belgrade, Serbia. Also, we will introduce the mathematics teaching methodology and evaluation methodology applied in both cases. After that, we will compare the student achievements in both classroom-based and online-based evaluation and discuss problems we encountered during the evaluation in both scenarios. Finally, we will draw conclusions on evaluation methodology and obtained results and propose possible solutions to the problems we were faced with.

**Keywords:** mathematics teaching methodology, student evaluation, distance teaching-learning

### **Introduction**

The outbreak of the new corona virus in Wuhan, China in December 2019 became a world pandemic in just a few months (Mackenzie et al., 2020). The pandemic caused serious changes in every day life and affected economies all around the world. In an effort to combat the pandemic countries opted for isolation, quarantine or even curfews. Limiting social contacts and the number of people in enclosed spaces has severely affected educational systems worldwide (Li et al., 2020; Jackson et al., 2014). Some countries continued with normal classroom-based schooling while applying epidemic measures, some changed to online-based schooling, some opted for tele-schooling and others applied a combination of all these models depending on the epidemic situation in each community.

A sudden change in educational model has a severe impact on both teachers and students (Dhawan, 2020). Shifting from classroom-based to online-based teaching process requires a completely different set of teacher competencies which may not be met in a short period of time. Insufficient pedagogical knowledge, low level of computer literacy and inadequate training of teachers may lead to a lower quality of education offered to students in an online scenario compared to standard classroom based teaching (Kim et al., 2006). Inadequate online teaching methodology and low quality learning materials may lead to online classes with low student-teacher interaction. Consequently, this leads to low levels of student achievements, lower student self confidence and self esteem as well as lower levels of motivation. Low teacher-student interaction increases the

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feeling of isolation among students and limits the teachers' awareness of the problems students face when learning their course. Combined educational models are especially affected as they are constantly shifting from classroom-based to online-based distance teaching-learning based on the epidemic status in the country.

Evaluation process is also severely affected in the combined educational model because not all courses are evaluated the same. The evaluation process of courses that require some form of practical assignments is almost impossible in an online scenario. One strategy is to evaluate students only when they are at schools, but this may pose a problem if the epidemic situation worsens and online teaching model continues for a long time. Online evaluation requires a high level of computer literacy of both teachers and students and usually a dedicated software or at least a learning management system software which schools may not possess.

An effective mathematics teaching methodology in a combined scenario is presented in (Kuzmanović et al., 2021). Author in (Ruth Evangelin, 2020) explores the effect the online learning had on students during the COVID19 pandemic. Students' perspective on transitioning from classroom-based to online-based education during COVID19 pandemic is presented in (Alsoud et al., 2021; Jin et al., 2021). Author in (Kuzmanović, 2021) presents online teaching methodology, the effects online teaching-learning had on students' achievements as well as a comparative analysis of student achievements before and after switching to online education. Comparison of grades achieved by students in online and classroom based courses was performed by authors in (Sapp et al., 2005).

In this paper we will present mathematics evaluation methodologies for a classroom based and an online based educational model. Chapter 2 of the paper introduces the educational model applied by the Ministry of Education, Science and Technological Development of Republic of Serbia in the academic year 2020/2021. Also, we will introduce the mathematics teaching methodology and evaluation methodology applied in both cases. Next, we will analyze student achievements in both classroom-based and online-based evaluation. Finally, we will make a conclusion on the applied evaluation methodologies and propose solutions to the problems we faced.

## **Education and Evaluation Process**

The Ministry of Education, Science and Technological Development of Republic of Serbia opted for the combined model of education in elementary and secondary schools for the school year 2020/2021. The combined model comprised of the following:

- Each class was divided into two groups.
- Each group was subjected to a combination of traditional classroom based schooling and distance schooling.
- The groups would alternate between classroom based schooling and distance schooling daily.
- Optionally, if the epidemic situation worsened, the educational system would transfer to a completely online distance teaching-learning model.

The school year started with the combined model and a form of distance learning that was applied is tele-schooling. The national broadcasting company was used to broadcast classes to students around the country. The teachers had to strictly follow the defined plan of actions so that the students at school and those at home watching television lessons would follow the same materials. This proved to be a big challenge due to lack of feedback from students following TV lessons at home.

The combined model led to a much harder evaluation process. The teachers were advised to perform all assessments when the students were at school which leads to lengthened evaluation process and doubles the number of classes used for assessment. Also, alternating daily between classroom-based and distance learning allowed the students to easily calculate and evade tests, which further lengthened the process.

As predicted, the epidemic situation worsened and the educational system had to shift to a completely online distance learning model mid-term. In this model, the teachers had to conduct live online classes according to a predefined school timetable to the entire class. This model requires high levels of computer literacy from both teachers and students, modern equipment and high speed broadband internet connection. Evaluation of students in this model is also much harder, particularly for courses that require practical exercises.

Teaching mathematics in a combined scenario is a challenging task. For students to properly develop logical thinking and problem solving skills it is critical for them to have a high level of interaction with their teacher. In distance learning based on tele-schooling it is impossible to develop necessary levels of interaction with the students. In order to overcome this problem, the approach suggested by authors in (Kuzmanović et al., 2021) was fully implemented. The students at school were given lectures in the classroom, while students at home had to follow the same lecture recorded and rendered in advance with the help of a pen tablet, digital whiteboard and video processing software. This caused the students to develop a very high level of interaction with their teacher as well as not feel isolated when following lectures at home.

Evaluating students' levels of achievements is much easier in a combined scenario than in a completely online distance teaching-learning education model. The group of students in school will be called group A and the group of students at home will be called group B. In a combined scenario, the group A was given a set of mathematics problems to solve. Each student in group A had to solve the problems step by step on a piece of paper. Their work was later evaluated and graded. Group B students had to solve the same set of problems for self-evaluation. The next, the groups would alternate, so the group B students would do the real test at school, which was later evaluated and group A students would do the test for self-evaluation. The test for groups A and B had to be different, but comparably easy or hard. Each test comprised of five tasks to be solved. Two tasks were elementary level, two tasks were intermediate level and one task was advanced level of accomplishment.

In an online scenario evaluating students in such a manner is impossible. Using online quizzes is also impossible due to math problems rarely being a short answer type of question. Besides the correct answer, the entire algorithmic work to reach the correct answer is also important and has to be checked during evaluation. The evaluation procedure in an online scenario was organized in a manner similar to the evaluation process at school. The students were given a set of five problems to solve at home and were asked to photograph/scan their work and send it to the teacher in a predefined time frame. In order to avoid unfair academic behavior the students were required to keep their cameras turned on and be online the entire time during the test.

Both evaluation procedures presented above were performed in a mathematics course in the 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> grade in elementary school "Ujedinjene nacije" in Belgrade, Republic of Serbia. A total of 4 written test were given to students during the school year. Two of those test were at schools and two tests were given to students online. A comparison of students' achievements will be performed in the next chapter.

## Results and Discussion

The evaluation methodologies presented above were performed in a mathematics course in the 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> grade in elementary school "Ujedinjene nacije" in Belgrade, Republic of Serbia. Two written tests were given to children in the classroom and two written test were given to children during online distance teaching-learning. In each semester the children had one written test in school and one written test online. The achievements of 30 children from the 5<sup>th</sup> grade, 29 children from the 6<sup>th</sup> grade and 28 children from the 7<sup>th</sup> grade in both scenarios will be analyzed. In the Serbian educational system student grades are integers in range 1 to 5, with 5 being the highest grade and 1 being the lowest grade. Figure 1 shows the average score the students achieved across the tests.

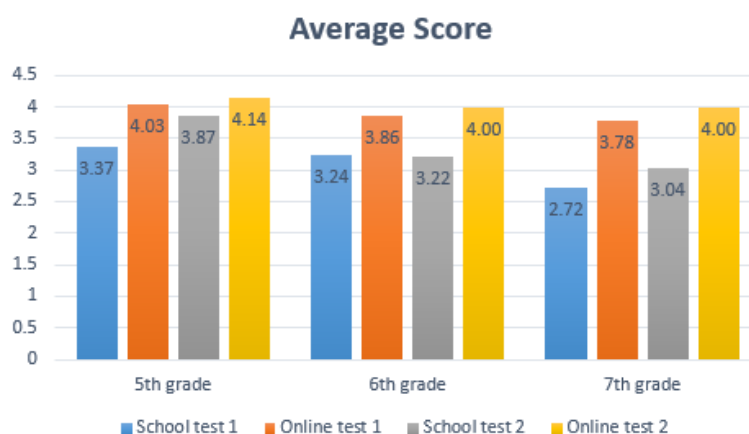


Figure 1. Average score in tests.

Figure 1 clearly shows a significantly higher average grade in online evaluation compared to standard classroom based evaluation across all classes. The difference between average grades is the lowest in the 5th grade and the highest in 7th grade. This can be attributed to the course of mathematics being easier in the fifth grade than in the seventh grade. Also, younger students are less likely to cheat or display any other form of unfair academic behaviour. Figure 2 shows the distribution of the grades across the tests in every class.

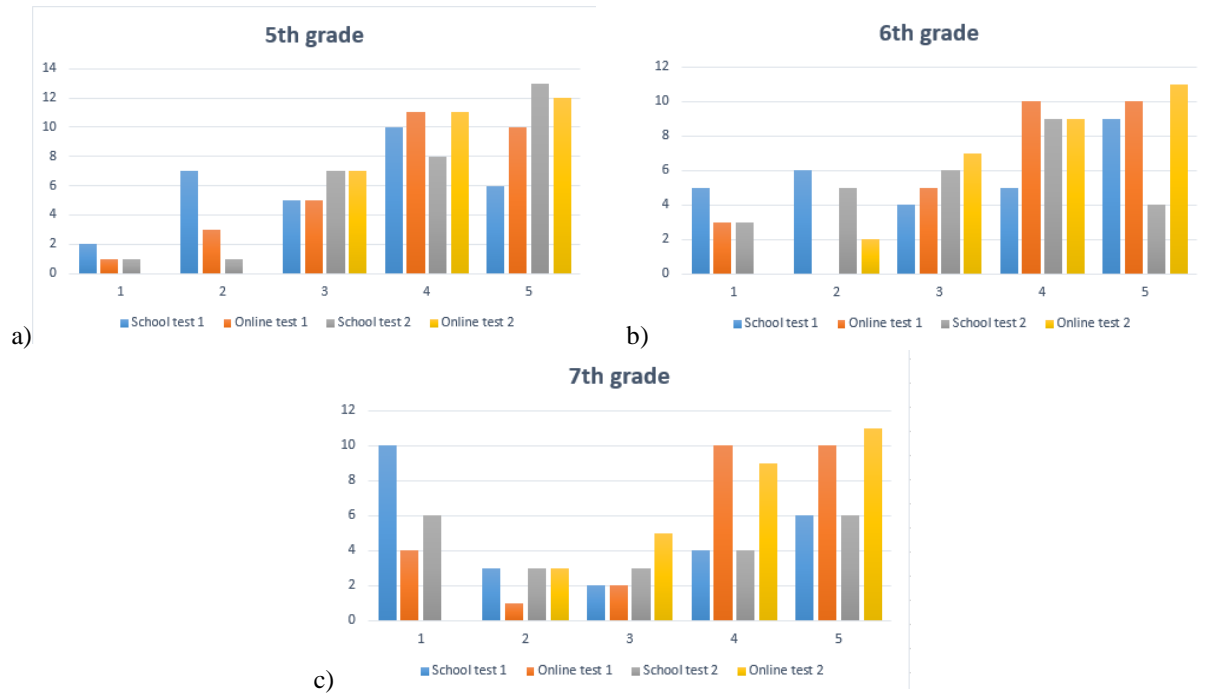


Figure 2. Distribution of grades: a) 5th grade b) 6th grade c) 7th grade.

Figure 2 shows that the distribution of grades has changed significantly in online testing. Regular classroom based evaluation procedures follow uniform distribution, while online tests are left skewed, thus favoring higher grades. This may be caused by the students feeling more relaxed at home and being exposed to lower peer pressure, thus achieving more. Also, it may be attributed to unfair academic behaviour because the teacher does not have any insight whether the student has any help from behind the camera or if the student has learning materials behind the camera. Teachers inability to fully assess and assure equal exam taking conditions for every student leads to the online test results being valued less in the final grade.

## Conclusion

In this paper we present evaluation methodologies for assessing students' achievements in both combined and online teaching models. The presented methodologies were applied in a mathematics course in elementary school "Ujedinjene nacije" in Belgrade, Republic of Serbia. A total of 87 students from 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> grades were evaluated by the presented metrics. The results of evaluation showed that the students got significantly better grades during online evaluation. Also, the distribution of the grades was changed. In the classroom based evaluation the distribution was uniform, while in online evaluation the distribution was left skewed, thus favoring higher grades. This raises a question on the objectivity of student evaluation results in an online scenario and motivates further research on designing evaluation methods suitable for online distance learning. Using the presented methodologies it is advisable to value the results obtained in classroom based evaluation more than the results obtained in the online evaluation. Online evaluation should be valued lower due to inability of the teacher to make sure that the student did not cheat, thus making the online grade not an impartial numerical measure of students' achievements.

## Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPSS journal belongs to the authors.

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