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Education Equity in Times of Emergency Remote Teaching: The Case of Slovenia

Alenka Lipovec, Blaž Zmazek and Igor Pesek

Abstract

During the COVID -19 situation, it was often warned that emergency remote teaching increases differences among students. Additionally, some empirical results in Slovenia indicate that the situation at schools in Slovenia was very diverse, leading to a violation of the equity principle in education. In this paper, we investigate teaching methods used by teachers in crisis teaching. The database presents 61 diaries of future teachers from the first grade of elementary school to the fourth grade of secondary school. The results show differences between mentor-teachers emergency remote teaching strategies. Differences are also statistically significant according to the educational stages. The results suggest that secondary school teachers have most effectively adopted and integrated different distance learning strategies into their work. On the other hand, some class teachers have not been as successful, probably also due to the students' distinctive characteristics. The primary purpose of this paper is to describe the Razlagamo.si learning environment, which can reduce differences by providing a common educational point for all Slovenian primary and secondary school students. Finally, we give some implications for physical re-engagement at school.

Keywords: emergency remote teaching, video explanations, teachers, students, educational stages

1. Introduction

The COVID-19 pandemic is a public health and development challenge, but it is also an opportunity. All stakeholders have a responsibility to ensure that we ground our efforts in human rights principles. The right to basic education is one of the fundamental rights; however, it is often violated. During the pandemic, the impact of e-learning becomes significant. In an emergency, many countries closed schools and switched to distance learning.

An absolute human right, education is the bedrock of just, equal, and inclusive societies and a key driver of sustainable development. Because of the disruption of the social contexts in classrooms and schools, students' relationships with peers, teachers, school leaders, and other staff and the familiar settings that support learning have been disrupted. More than 1.2 billion learners worldwide were affected due to school and university closures because of COVID -19. These nationwide closures are impacting over 60% of the world's student population. As a response

to the global education crisis, online emergency remote teaching (ERT) has been implemented. ERT should be considered a temporary solution to an immediate problem. ERT is described as a quick shift from the face-to-face or hybrid teaching of instruction to completely digital education due to external factors (COVID-19) and no time for preparation. Since it is prepared to respond to the emergency, its primary aim is not to develop a robust educational ecosystem but temporary access to instruction and instructors to provide support. Therefore, ERT is about delivery modes, methods, and media. The effectiveness of this measure is still under discussion [1]. Teachers should »in these times (and all other times) think about not only the content of their teaching but also the medium they use«. [2].

Despite the best efforts, teaching staff has not previously had to develop the specialist skills required to create and deliver online learning and are required to upskill very quickly, exacerbating the challenge of sustaining the rate of education and level of engagement. In addition, the COVID-19 outbreak exposed a significant variation in educators' readiness to use technology to support learners at a distance. The gap was noticed in the international context [3, 4] and the Slovenian [5].

An Australian study [6] confirms that the impacts are particularly evident in the early years, critical years for learning, and vulnerable students for whom learning loss is challenging to recover or students from culturally and linguistically diverse backgrounds. These losses are often due to families' lack the physical spaces, technology, and other resources to support learning at home. Additionally, many parents and caregivers require the time to support their children's learning. We believe that similar conclusions could be drawn for the Slovenian context.

In this paper, we will focus on providing equal opportunities for students in times of closure of the schools in Covid 19 in Slovenia.

In the following, we first describe the results of the combined qualitative-quantitative study examining teaching practices conducted by Slovenian teachers in the first COVID-19 wave. The research questions in this part were

- which ERT methods were used for teaching mathematics from 1st to 13th year of schooling, and
- do ERT methods differ according to the age of students?

In the discussion section, we describe the Slovenian response to (as results show) a highly diverse situation, the site www.razlagamo.si. In conclusion, we offer some tips for re-engagement at schools.

2. Methodology

Using a non-experimental causal methodology of pedagogical research, we will investigate teachers' teaching methods during crisis teaching.

The database consists of 61 records from practice diaries submitted by future teachers after two and a half months of condensed pedagogical practice (April, May and June 2020). We have concentrated on the journals for the subject mathematics.

While working from home, the students carried out the practical training in an adapted form so that the instructions for preparing a report/diary were also modified. One of the nine points in their diaries relates to their teacher-mentor emergency remote teaching practices. The students were asked to find out about the teacher's style and working methods.

Their answers were used to determine whether the teachers:

- gave written instructions (by email, in virtual classrooms, etc.),
- used video lectures (their own or from others),
- held video conferences to explain content,
- checked and evaluated knowledge
- solved learning problems expressed by the students etc.

In Slovenia, a self-contained instruction system is applied, where the primary teacher (so-called class teacher) teaches all school subjects until 5th grade (10–11 years old students), including mathematics. We will call this period educational stage I, followed by stage II from 6th to 9th grade, where a subject (mathematics) teacher teaches students. In stage II, teachers are educated as double-subject teachers (e.g., mathematics major and physics major, mathematics-major and history major...). Finally, at stage III (secondary school level), only a single-subject teacher (only mathematics major) is licenced to teach.

The diaries of condensed pedagogical practice submitted by 24th June 2020 were analysed. The diaries were written by students of three programs: 1st cycle program Primary Education (stage I teachers), unified master's study program Subject teacher (stage II teachers) and 2nd cycle program Educational Mathematics (stage III teachers). At the educational stage I 71 students submitted diaries, and 34 (49%) diaries were included in the analysis, as the required information could be derived from them. We analysed 10 (83% of all) diaries at stage II, and at stage III 18 (75% of all) diaries were included in the analysis. Thus, in total, 61 diaries were included in the analysis.

The data were analysed using patterns of common reference to relationship issues. With the use of narrative analysis, each diary entrance was first determined predominant form of teacher-mentor ERT practices. Analysis was done using thematic analysis in six phases: familiarising with the data (transcribing, reading and re-read the data while simultaneously noting initial ideas), generating initial codes (systematic coding of interesting features of the data and collating data according to the codes), searching for themes (collating of the codes into potential themes), reviewing themes (checking of themes against the coded statements and the data as a whole), defining and naming themes (refining each theme and generating clear definitions for each theme), producing the report (providing extracts for each theme to illustrate the participants' accounts and comparing themes and extracts with relevant literature).

3. Results

We first present the results of qualitative analysis in **Table 1**. Then, to give voice to participants in the qualitative analysis, we add excerpts from diaries. Finally, the information about the educational stage addressed by a quote is provided in brackets.

In future teachers' diaries, it was usually possible to detect which method was predominant in teacher-mentor teaching. However, most records contained several methods.

In the following, we present the frequency of remote working methods perceived by students during the condensed internship. The results can be found in **Table 2**.

Theme	Description	Future teachers' diary excerpt
Written instructions	The mentor-teacher guides the student's learning process with written instructions. The student receives written instructions through various channels (e.g., email, online classroom, MS Teams). The instructions include a more detailed explanation of the content and assignments that the student should fulfil to consolidate knowledge. However, the instructions are in static text format, which rarely contains links to various multimedia and interactive content.	Every Sunday, the mentor-teacher sent new instructions to the students (and parents) by email, which included a written explanation of the material, worksheets, and some pictures. I prepared the material myself, as the students were used to the system. (I) During the internship, the mentor teacher told me that some students are unresponsive and that work via video conferencing is almost impossible. Her teaching style is thus tied to email and resources in the online classroom. (II)
Synchronous video conference	The teacher guides the student's learning process with video conferences. Video conferencing follows traditional lesson elements but is adapted for distance learning in specific segments (e.g., shorter time, omitted parts that cannot be taught at a distance, a particular class contract regarding the rules of operation in a virtual environment).	Mentor-teacher had video conferencing with each class three times a week via Zoom. Students were able to ask questions regarding explained content in that and the previous week. (II) The professor told me that her lessons are conducted exclusively through videoconferencing. In the beginning, all students must say hello. Then she teaches new material and shows animations. In the meantime, she also calls students by name to answer questions. It was interesting that no one, neither the students nor the professor, has the cameras on during this videoconference. (III)
Asynchronous video explanation	The teacher guides the student's learning process with video conferences. A video explanation is a video that follows the principles of the method of explaining or the Socrates method. In video explanations (VE), the teacher follows a pedagogy that helps students critically reflect on their understanding of a particular issue with guided questions. VEs can additionally use multimedia tools (e.g., videos of natural phenomena), videos of virtual manipulators (e.g., virtual versions of experiments), or screencasting. Usually, a video explanation contains a combination of these elements.	The teacher prepared a video for essential concepts (e.g., fractions), which the students watched independently. She told me that it took 6 hours of work for a five-minute-long video. (III) Pupils learned from videos made by other teachers or videos on the internet. The teacher opted for this method because she did not have the technical skills to make recordings. She told me that she found it very difficult to find suitable recordings in Slovene. (II)

Table 1.
ERT methods for mathematics.

All teachers used written instructions. Two-thirds of the teachers used video conferencing when students had problems. The teachers identified the issues in the knowledge tests, the student themselves asked for help, or they were students with perceived learning difficulties. Among diary entries, we find the excerpt below. The quote indicates that not all those in need may have been helped. The names of the students are anonymised.

The teacher offered to help the students in class and explain the material to them, but none chose to do so. It seems that the students were embarrassed to need further explanations. (stage I).

	f	f%
A (Also) written instructions	61	100
B1 self-designed video explanations	6	10
B2 video lectures designed by another author	12	20
C1 video conferencing to explain the content	24	39
C2 video conferencing to check and evaluate knowledge	23	38
C3 video conferencing to solve learning problems expressed by the students.	41	67

Table 2.
 Emergency remote teaching practices.

The lowest percentage is observed in video explanations, where only 11% of teachers prepared their video explanations. Teachers also did not use video explanations from another author. In the following excerpt, the situation is partly explained.

First, my mentor confided to me her concerns about implementing distance learning. She was worried that her parents would not be able to cope with the learning content. When I offered her to make a video explaining the learning content, she flatly refused, arguing that she knew her class as well as her parents. (stage II).

The teachers used several methods for emergency remote teaching. Since they combined several different teaching ways, we checked how often a combination of methods occurred. Only written instructions (provided through various channels such as online classrooms, email, social networks) were used by 31% of the teachers. Another 38% of teachers used video conferencing for various purposes in addition to written instructions. Only 31% of teachers used written instructions as well as video conferencing and video explanations. Only three teachers (1%) used written instructions and video conferencing, and asynchronous video explanations.

As used methods ERT depend on the age of the students, **Table 3** shows the data separately by the educational stage. The letter coding used is explained in **Table 2**.

Additional analyses showed that up to 42% of the teachers at stage I used only written instructions. About one-third (30%) of teachers at stage II were using only written instructions, and only 17% of stage III teachers used only this method. At stage II most teachers used video explanations designed by another author (50%) and video conferencing for explanatory purposes (50%). At stage II, teachers used more videoconferencing for knowledge assessment and solving learning difficulties than their colleagues at stage I, but less than stage III teachers.

There are statistically significant differences for all forms of work except for written instructions (A), depending on the educational stage. We have used the Kruskal-Wallis test and obtained the following values for significance: $P_{B1} = 0.031$,

stage	A		B1		B2		C1		C2		C3		total	
	f	f%	f	f%	f	f%	f	f%	f	f%	f	f%	f	f%
I	33	100	0	0	5	15	4	12	3	9	18	55	33	100
II	10	100	2	20	5	50	5	50	4	40	7	70	10	100
III	18	100	4	22	2	11	15	30	16	89	16	89	18	100
total	61	100	6	11	12	21	24	39	23	37	41	66	61	100

Table 3.
 ERT methods by educational stages.

stage	II	III
I	B1: 0.048* B2: 0.195 C1: 0.099 C2: 0.239 C3: 1.000	B1: 1.000 B2: 0.035* C1: 0.000* C2: 0.000* C3: 0.040*
II		B1: 0.041* B2: 1.000 C1: 0.259 C2: 0.034* C3: 0.935
*P-value less than 0.05.		

Table 4.
Pairwise comparisons of remote working methods by educational stage.

$P_{B2} = 0.021$, $P_{C1} = 0.000$, $P_{C2} = 0.000$, $P_{C3} = 0.046$. We then used the Dunn-Bonferroni post-hoc method. The results of the pairwise comparisons are shown in **Table 4**.

Stage III teachers differ statistically significantly in several areas. For example, **Table 4** shows that they tend to use more strategies typical for distance learning (self-designed video explanations and video conferencing for different purposes).

On the other side of the spectrum are teachers at stage I. Both video explanations and video conferencing are statistically significantly lower than for the teachers at the other two stages.

4. Discussion

The results show that ERT methods used by Slovenian teachers were very diverse. Some teachers immediately switched effectively to distance learning. They prepared interactive materials, taught in video conferences, developed innovative ways of giving feedback and adapted lessons according to the specific needs of students. On the other hand, some teachers did not do so well. They needed more time. But there was no time during the pandemic. There was no time to train teachers to work with new ICT tools. There was no time for detailed instructions on how to work. That is why the spirit of solidarity came to life. Those teachers who knew helped colleagues who had not yet found themselves. Unfortunately, this assistance is by nature limited to smaller collectives (e.g., schools). Results suggest that secondary school mathematics teachers were more prone to adopt new ERT ways quickly. Indonesian secondary mathematics teachers faced a great challenge in using e-learning as a tool of instruction during school closures due to the COVID-19 pandemic. Their most significant barriers were at the student level, including student lack of knowledge and skill in e-learning use and their lack of access to devices and internet connection [7]. Similar barriers were also found in the Slovenian situation.

Our results are in line with a broad survey, the results of which were published by the Slovenian National Agency for Education [5]. In the study, more than 2200 Slovenian teachers were interviewed. In the subchapter on the organisation and implementation of distance education using digital technology in several places, secondary school teachers differ statistically significantly from elementary school teachers. However, this study does not provide insight into the differences between elementary school teachers. We believe that our results complement this aspect.

Nevertheless, [5] reports show that teaching was most demanding and stressful for elementary school teachers on the primary school level (educational stage I).

Moreover, they perceived less energy during distance learning than at teaching in the classroom. The most concerning fact is that only 2% of primary level teachers choose video lectures as the direct distance learning mode. The results also show that only around half of the primary teachers combined video lectures in the teaching process by adding written instructions. In addition, most primary level teachers think that they do not have a realistic insight into the achievements of students' goals at a distance. Students on the primary level also responded that they did not receive the teacher's explanations. Results revealed that explanations mainly were given to those students whose teachers have used video lectures or a combination of video lectures with written work instructions.

Based on the described results, we hypothesise that Slovenian learners were not treated according to the equity principle due to a lack of open educational resources (OER). There was an urgent need for an OER environment in the first wave allowing video sharing for all teachers and students. Therefore, a portal *Razlagamo.si* was established in Slovenia in March 2020 and is intended for mutual assistance in distance learning. The users are both students and (serving or future) teachers. It offers collected interactive materials for all elementary and secondary schools subjects and supports conversations when learners have problems. It was created on the initiative of all three faculties where University Maribor teachers are trained and result from voluntary work. More than 20 university teachers and more than 230 (serving or future) teachers take part. By the end of June 2020, the website's visitor counter registered more than 190,000 hits, about 800 video explanations were produced, and about 350 pupils and students were involved in supportive discussions.

The support point consists of two elements: video explanations and support conversations. Both elements develop understanding, a distinctive feature of *razlagamo.si* compared to other similar material repositories. In the crisis, it has become clear that synchronous teaching (live lectures for all pupils or students at the same time) is not always possible. Therefore, the learner needs also an asynchronous (pre-recorded) explanation. Such video explanation allows him/her to manage his own time independently (e.g., when and how much time he will devote to learning with video explanation). It also allows and individualised material procurement (e.g., repeated playback of individual video sections). For this reason, *Razlagamo.si* offers video explanations and synchronous communication about problems in a group or one-on-one conversations.

A Video explanation (VE) is an educational video that follows the principles of the method of explaining. The method of explaining or Socrates method has traditionally been one of the most widely used teaching methods. It is also a relatively effective teaching method in various fields [8] and approaches to teaching and learning, including e-learning [9]. Delić and Bećirović [10] define the Socrates method as "pedagogy that helps students critically reflect on their understanding of a particular issue with guided questions". In asynchronous use of this method, the teacher usually lets the students think about the answer for some time after the question is asked and then offers some of the expected (correct or incorrect) answers. The Socrates method used in an asynchronous VE follows similar principles. VE can additionally use multimedia tools (e.g., videos of natural phenomena), videos of virtual manipulators (e.g., virtual versions of experiments) or screencasting. Usually, a VE contains a combination of all the above elements. The VEs are intended for a reversed (flipped) classroom approach [11] based on conceptual teaching. Several studies suggest that flipped learning positively correlates with academic students' achievements in secondary [12] and elementary school [13].

VEs are short films that present the essence of the concept the student is learning interactively. With a VE, we focus the student on the essential elements of knowledge. Besides, the student can expand their knowledge with the help of interactive

i-textbooks. VEs are contributed by active teachers from all over Slovenia and by students - future teachers from all three faculties. The added value of the Razlagamo.si lies in covering all compulsory subjects, except Slovenian language, both in elementary and secondary education. VEs have also been prepared for the general baccalaureate. There are also VEs by special education teachers, covering general psychological and unique education aspects such as learning, memory, motivation, etc.

It was shown that additional one-to-one support is necessary to build up high-quality knowledge, especially in mathematical and natural science subjects. The conversations occur in the MS Teams environment and represent asynchronous version of individualised teaching. Also, in supportive conversations, in which the student can find additional explanations, the future teachers' pay special attention to leading the students to solutions with tips and their activity. At the beginning of May 2020, the conversations covered more than 100 elementary and secondary school subjects, including music school topics. The specialised team also offers advice on general learning difficulties. Future teachers stem from different fields, from natural sciences and social sciences to psychologists and pedagogues.

Most VEs are for stage II. STEM fields are strongly dominated, especially mathematics and the highest number of VEs could be found for 12–15-year-old students [14]. Perhaps the STEM area is relatively better suited to teaching with videos. It is also possible that the subject area's specifics do not allow effective teaching without video explanations, or STEM teachers are more inclined to create videos than teachers of other fields. Whatever the reason, the study of videos for mathematics is vital for developing mathematics teaching, especially in the current situation where many schools are forced to work this way. More than a hundred mathematics topics (e.g., linear function, derivatives...) are offered for the entire educational vertical of mathematics, VEs are available in 63 (57%) topics. Mostly in topics that were in schools at the time of the COVID 19 lock-down. The Slovenian joint educational point Razlagamo.si is mainly in line with the recommendations of Chinese researchers [15] on how to ensure quality learning even during the outbreak of pandemic COVID -19. Additionally, it is in line with the system model MEET [16]. MEET is a system-oriented model [17] and provides a systematic model on planning, preparing, and evaluating response in an abrupt emergency as COVID-19 was.

5. Conclusions

The presented results will have important implications for student learning and the development of e-resources. We firmly believe that the age of the students is essential when creating video explanations. Unfortunately, research that would provide insight into younger students' characteristics in this area is still in its infancy. However, since it could happen that schools will be forced to address ERT for some time to come, we believe that research in this area is also welcome. While we agree that distance learning is not a good solution for younger students, we recognise that such learning could last for some students. Therefore, we hope that this work will help teachers who decide to implement ERT through video explanation.

We conclude with the following recommendations for the resumption of school operations in autumn 2021, based partly on Brown et al. [6]. First, according to the strategy for physical re-engagement at schools should:

- Recognise that the necessary input from parents to support learning at home goes beyond the physical provision of resources.

- Where full-time reconnection of a significant number is not going to be possible for safety or logistical reasons, plan for a blend of online and physical presence.
- Encourage universal full-time on-site attendance for pre-school to year three.
- Utilise direct and personalised invitations to specific vulnerable school students and their families/carers to see those students attend school and complement this group with invitations to a balanced cohort of students to reduce stigmatisation of specific groups and 'normalise' attendance.
- Invest in targeted and personalised learner engagement for students who are not physically attending and who cannot access online learning, are not engaging in education, or are at risk of disengaging over the short and long term.
- Invest in and support teachers to manage the increased workload of teaching both offline and online by providing additional staffing on a short-term basis: teachers, teacher assistants, and social/youth workers
- Design professional teacher training for skills and expertise in the creation of non-school-based learning strategies, such as high-quality online content, lower technology radio, and television content.

Razlagamo.si was designed as an open educational environment. Several resources commented on the importance of openness [18]. As we can see from the literature, obstacles to e-learning can involve several problems [19]. Technology, access to the internet, and the lack of an e-learning and assessment curriculum and tools for effective student assessment limit what teachers can teach [20]. The motivation for online learning, confidence in e-learning technology, and teachers' attitudes towards online learning influence how and how much a student will learn. All these barriers need to be considered when faced with an event such as a pandemic. Due to the exceptional success of the support point, we decided that the point will remain active after the end of the crisis. The Razlagamo.si model is also useful when only a part of the student population is involved in distance learning.

Future lines of research are two folded. We will try to overcome the language barrier of Razlagamo.si materials. We will upgrade and improve learning materials, translate these materials using advanced machine learning models to English (pivot language), include materials into the Learning management systems (LMS), and explore new models for use in classrooms in an international environment. We are aware of the low acceptance of the technology by teachers, so we will prepare explicit Instructional Principles for distance teaching and learning in cyber-flipped classroom pedagogy and additional instructions for adapting the learning paths in the LMS to the needs of the students.

The second research track will focus on designing a taxonomy of video lectures. The taxonomy of video explanations will be designed to help teachers choose the appropriate video explanation for their students. We will define a list of attributes that quality video lectures should have and categorise features according to several criteria (i.e., pedagogical, technical, needed for machine translation purposes...). We will summarise the various characteristics into several principles. Some principles are going to be more didactically oriented, probably the most important being the principle of interactivity, followed by the principle of generative activity, the principle of dynamic drawing and the principle of seductive details. Among the slightly more technical principles, which are also related to pedagogy, are: the

principle of the perspective of the recording, the principle of the teacher's visibility, the principle of the teacher's emotional state, the principle of the gaze guidance, the principle of subtitles and the principle of the live composite of the recording.

Many educational institutions face a fall semester 2021 that is either fully or partially online. Razlagamo.si is paving the road to engaging students with the content, providing collaboration, and creating community. The joint educational point will help teachers who prepare materials according to the principles of flipped learning even in a non-crisis situation (e.g., for sick students, student-athletes, students with another status).

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Author details

Alenka Lipovec^{1,2*}, Blaž Zmazek¹ and Igor Pesek¹

1 Faculty for Natural Sciences and Mathematics, University of Maribor, Slovenia

2 Faculty for Education, University of Maribor, Maribor, Slovenia

*Address all correspondence to: alenka.lipovec@um.si

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