

Article

Identification Elements Symmetry in Teaching Informatics in Czech Secondary School during the Covid-19 Outbreak from the Perspective of Students

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Abstract: This article describes the research results aimed at distance education during the Covid-19 pandemic and closing schools and its symmetry with the classical state in terms of time, difficulty, and the mental and physical condition of students. An important aspect is therefore to maintain the symmetry of attitudes to teaching in face-to-face form and distance form. In terms of the eight-year gymnasium in the Czech Republic, students' attitudes to the teaching subject informatics were investigated. The main research questions in our study dealt with whether students felt equally balanced regarding the amount of tasks and time taken for home preparation during the Covid-19 outbreak compared with the time before the quarantine and their condition (both mental and physical) during the Covid-19 outbreak. The research was conducted using an anonymous questionnaire, which was answered by 110 out of 180 students. According to the results, it is evident that students felt that during the distance education, there are more tasks compared to face-to-face ones. Students also claimed to spend more time learning at distance education than at school. On the other hand, they agreed that the self-education schedule is suitable for them. In terms of the questionnaire, their condition (both mental and physical) was also evaluated, which was slightly above the average.

Keywords: covid-19; pandemic; online learning; distance learning; online assignments

1. Introduction

Education during the pandemic shall continue. The world has not been poised for the situation fully. Although distance learning was commonly used in teaching, especially at universities, before covid, it was often a combination of distance learning with traditional face-to-face teaching (hybrid learning) [1]. However, during the covid pandemic, most schools had to close face-to-face education completely and distance learning became the only form of education at all levels of schools [2]. All the schools in the Czech Republic have been closed since 11 March 2020. The informatics' teachers were much ahead. They mostly use a platform using advanced information systems for administrating submitting and handing in tasks and communication with students (Moodle, Google Classroom, or Microsoft Teams) [3–14].

A great problem for schools and at the same time a challenge for schools is to enable students not only to learn in distance form but also to maintain the symmetry of the quality of teaching and learning, attitudes, and feelings from teaching and learning in both forms of education (distance form as well as in face to face one).

The subject informatics has been taught in terms of freshman and sophomore years and the fifth and sixth years at the surveyed eight-year gymnasium. There is an optional seminar for informatics

and computing technique at the seventh and eighth class. Students interested in that field, who want to graduate from this subject, participate in this seminar.

The eight-year gymnasium in the Czech Republic is divided into the lower and higher instructional level. The lower instructional level corresponds with the sixth to ninth class of elementary school in the Czech context. The particular classes at the gymnasium are named by Latin ordinal numerals: primus, secundus, tertius, quartus, quintus, sextus, septimus, octavus (freshman, sophomore, third, and fourth years). The higher instructional level corresponds with the first to fourth class of the secondary (high) school. The particular years at the gymnasium are named fifth, sixth, seventh, and eighth years. There is a summary of the particular gymnasium classes in Table 1.

Table 1. Comparison of classes.

Gymnasium	Elementary/Secondary School	Age of the Student
Primus (Freshman year)	6th class of the elementary school	11
Secundus (Sophomore year)	7th. class of the elementary school	12
Tertius (Third year)	8th class of the elementary school	13
Quartus (Fourth year)	9th class of the elementary school	14
Quintus (Fifth year)	1st year of the secondary school	15
Sextus (Sixth year)	2nd year of the secondary school	16
Septimus (Seventh year)	3rd year of the secondary school	17
Octavus (Eighth year)	4th year of the secondary school	18

The questionnaire of the students' attitude to the teaching subject informatics was performed by a teacher who teaches the sophomore, fifth, and sixth year and seminars at the seventh and eighth year. There is a summary of the content of the curriculum during the quarantine in the following paragraphs.

2. Teaching the Subject Informatics

2.1. Sophomore Year

At beginning of the quarantine, MS Excel spreadsheet education was planned. There was basic operating of MS Excel, and work with cells and limitations. Furthermore, the MS Excel education focused on calculations and basic statistical functions (minimum, maximum, average, modus, median). The MS Excel education contained the If function, contingent formatting, and charts as well. During all the time, the students were making tasks and there was a final project included. With respect to the demand factor of the MS Excel education, all the lessons were performed on a pre-film basis. The basic algorithm development education followed after the MS Excel one. It was demonstrated in the Scratch environment. The basic HTML education was performed at the school year end.

2.2. Fifth Year

At beginning of the quarantine, the MS Word text editor education was prepared. The students also worked on the final project for some time. Consequently, basic presentation skills were quickly recapitulated, including PowerPoint, and then students continued with the project again. Thereafter, work started on MS Excel. Extension and deepening of subject matters learned at the sophomore year was achieved. Plus addition to the education extension regarding contingent tables. All that was instructed by means of video-tutorials which teacher had filmed. Then graphics came in. Firstly, a particular theory was explained, and consequently the graphics education was focused on vector graphics, and several tasks were performed in terms of vector graphics. There were tasks focused on basic vector elements and tasks focused on advanced copying and assembling particular elements. A final project followed.

2.3. Sixth Year

At the beginning of quarantine, the education of databases was completed and only the final project was left. Then, immediately, an extensive part focused on the basic concept of the programming field followed. Basic algorithm development was explained by means of flowcharts. With the flowchart education finished, basic programs were overwritten into the Python programming language. The basic programs included the Hello World program, the addition of two numbers, the division of two numbers, including following the division by zero, i.e., by means of the IF condition, and also an advanced way by means of the WHILE cycle. A program of a cycle with a designated number of repetitions, i.e., the FOR cycle, was presented. The Python programming language was selected because of its simplicity during the programming education. This chapter was intended for programming beginners. At the end of this chapter, programming Windows applications by means of the C# programming language were presented.

2.4. The Informatics and Computing Technique Seminar in the Seventh Year

The informatics and computing technique seminar at the seventh year is intended for advanced programming education. It focused on the Internet sites. The education is performed in the HTML, CSS, JavaScript and PHP languages. During the period of quarantine, the programming language PHP was completed. However, it was necessary to present web graphics over the Internet during the period of quarantine. It focused on the SVG language, which is a Scalable Vector Graphics intended for creating vector graphics on the web. An education on programming desktop applications followed. The basics of programming were quickly repeated, and an advanced education on the Python and C# programming language began.

2.5. The Informatics and Computing Technique Seminar in the Eighth Year

The informatics and computing technique seminar in the eighth year is aims to repeat and deepen all attained knowledges and help prepare for the informatics school-leaving examination.

3. MS Teams

Microsoft Teams is a tool for complete distance education, including video conferences. Microsoft Teams represents a center of the teamwork in Microsoft 365. See Figure 1. It connects people, content and the tools needed for the team to cooperate better and more effectively. Microsoft Teams allows communication in terms of the contributions of all the team (class) and private chats. Thanks to OneDrive being integrated directly into the environment, it is possible to share files. An advanced on-line OneNote notepad intended for further cooperation is also integrated in Microsoft Teams. Microsoft Teams can also submit tasks and create tests through forms, which are automatically corrected. At the current adverse time, which does not allow personal meetings, the important part of Microsoft Teams is integrated video conferences and scheduled on-line meetings. In addition to this, Microsoft Teams are directly and easily accessible through the 365, which contains a lot of other applications including Microsoft Office. Another advantage is its ability to be used on a computer as well as tablets and mobile phones of all platforms. Microsoft Teams are also most suitable for distance education. That confirms the great increase in Microsoft Teams usage. [15–17] Before the education limitation, there was a daily access of 20 million [18–20], and two months later there was more 75 million daily accesses [21]. Similar platforms to MS Teams include Moodle and Google Classroom.



Figure 1. MS Teams [22].

4. Students' Attitude to Teaching Informatics during the Covid-19 Outbreak

During investigations of students' attitudes to teaching informatics during the Covid-19 outbreak, Forms was selected from the online Microsoft Office 365 office package, which was free of charge for schools. The education, submitting, and evaluating tasks were performed by means of Microsoft Teams.

4.1. Methodology

The research object consisted of finding the students' attitudes to teaching of the subject Informatics during the Covid-19 outbreak. The students were obliged to say what number of tasks they were given, and the time it took them to prepare for their education at home over a week compared with face-to-face study. They were also obliged to declare what bothered them in self-education and what change they would appreciate. There was also a space for notes concerning their conditions and how they were feeling during that time. At last, there was a space for any notes concerning the person of a teacher, and any wishes.

The main research questions in our study focusing on students' attitudes in secondary school informatics were as follows: Do students feel there was an equal balanced in the amount of tasks and the time taken for home preparation during the Covid-19 outbreak compared with the time before the quarantine? What was their condition (both mental and physical) during the Covid-19 outbreak?

That research was performed by means of Forms from the Office 365 office package and was an anonymous and voluntary activity with the permission of the school authority. It was submitted for each of the classes. The questionnaire looked like this:

Questionnaire Concerning the Distance Education of Subject Informatics—Class X

The questionnaire is anonymous

1. Amounts of giving tasks (1 star very little, 5 stars—far too much)



2. Time amount taking by home preparation for all the education during a week (1 star less than at school during a common week, 3 stars—the same at school, 5 stars—it takes multiple more time)



3. Is there something which bothers you at the self-study and would you appreciate to change?

4. Evaluate your condition (1 star—awful, 5—great)



5. Is there anything you would like to write down; for what would you want to ask me?

A questionnaire demonstration is in Figure 2.

A screenshot of a web-based questionnaire. The title is "Questionnaire Concerning the Distance Education of Subject Informatics – Class 5. A" in white text on a dark green background. Below the title, it says "The questionnaire is anonymous". The main content area is light blue and contains five questions. Question 1: "Amounts of giving tasks (1 star very little, 5 stars - far too much) *", with five star icons below it. Question 2: "Time amount taking by home preparation for all the education during a week (1 star less than at school during a common week, 3 stars - the same at school, 5 stars - it takes multiple more time) *", with five star icons below it. Question 3: "Is there something which bothers you at the self-study and would you appreciate a change? *", with a text input field below it containing the placeholder "Zadejte svoji odpověď.". Question 4: "Evaluate your condition (1 star - it was awful, 5 - it was great) *", with five star icons below it. Question 5: "Is there anything you would like to write down; for what would you want to ask me? *", with a text input field below it containing the placeholder "Zadejte svoji odpověď.". At the bottom left, there is a dark green button labeled "Send".

Figure 2. A questionnaire demonstration.

4.2. Results

A total of 110 out of 180 students participated in the questionnaire.

The answer to the first questions concerning the amount of given tasks (1 star—very little, 5 stars—far too many) showed that most answers gave 3 stars, i.e., average. A total of 63 respondents chose three stars. The second highest number of respondents gave with four stars, namely 31, as seen in Figure 3.

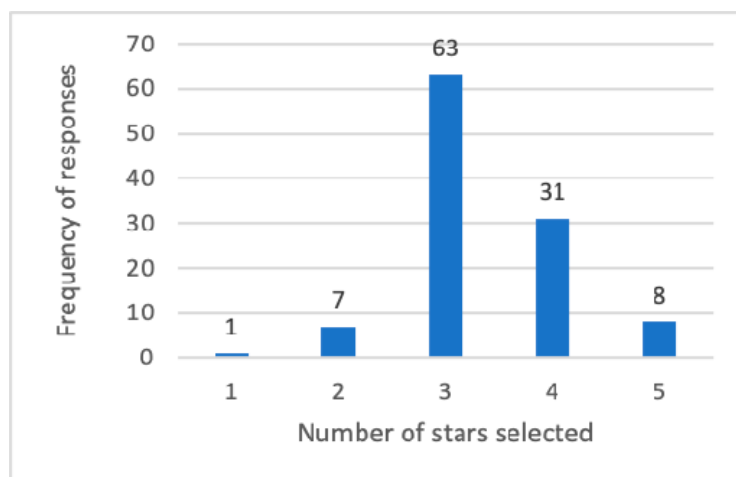


Figure 3. Amount of given tasks (1 star—very little, 5 stars—far too many).

The graph shows a “skewness” towards more given tasks. From the perspective of statistical significance, we formulate the null hypothesis that, on average, students would express a neutral attitude (three stars). Thus, we must reject this hypothesis in favor of a positive, one-sided alternative that students voted significantly higher (t -test, $t = 4.84$, $df = 109$, $p < 0.01$). Therefore, our data support that students believe they have more tasks compared with the time before the quarantine.

The second question concerned the time taken for home preparation for the whole education over a week. The scale of answers was following: 1 star (less than at school during a common week), 3 stars (the same as at school), 5 stars (much more than at school). It is evident from the results that the range of answers was connected with the scales 3 and 4. More accurately, 47 respondents answered that it takes them the same time (three stars), and 37 students gave four stars, i.e., suggesting that preparation for education over a week compared with face-to-face education took more time, as seen in Figure 4.

The graph shows “skewness” towards more time taken for home preparation for education over a week. From the perspective of statistical significance, we formulate the null hypothesis that, on average, students would express a neutral attitude (three stars). Thus, we must reject this hypothesis in favor of a positive one-sided alternative where students voted significantly higher (t -test, $t = 4.81$, $df = 109$, $p < 0.01$). Therefore, our data support the idea that students believe they spend more time preparing for their education over a week compared with the time before the quarantine.

The third question was “Is there anything bothering you at self-study and would you appreciate some change?” stayed open. Most answers were “No”, they did not want any change. There were frequent answers that students were well, everything was all right and this kind of education suited them. A few students complained of lots of tasks and the time spent, however, these were only individual complaints.

The fourth question was connected with subjective mental and physical conditions. There was a scale from 1 star—awful, to 5 stars—great. In this case, most responses gave three stars, with 45 answers. This suggests that there were normal conditions. The second highest number was four stars, with 33 answers. This result indicates that students were a little better compared with the time before the quarantine, as seen in Figure 5.

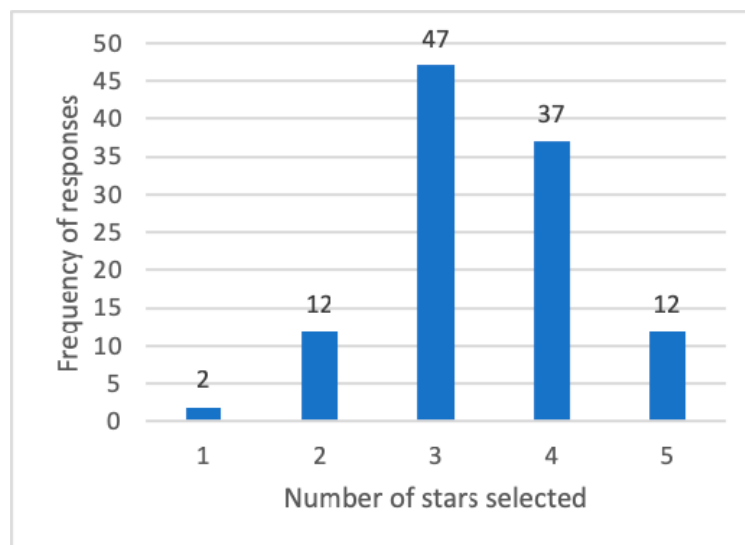


Figure 4. Time taken for home preparation for education over a week (1 star—less than at school during a common week, 3 stars—the same as at school, 5 stars—much more time).

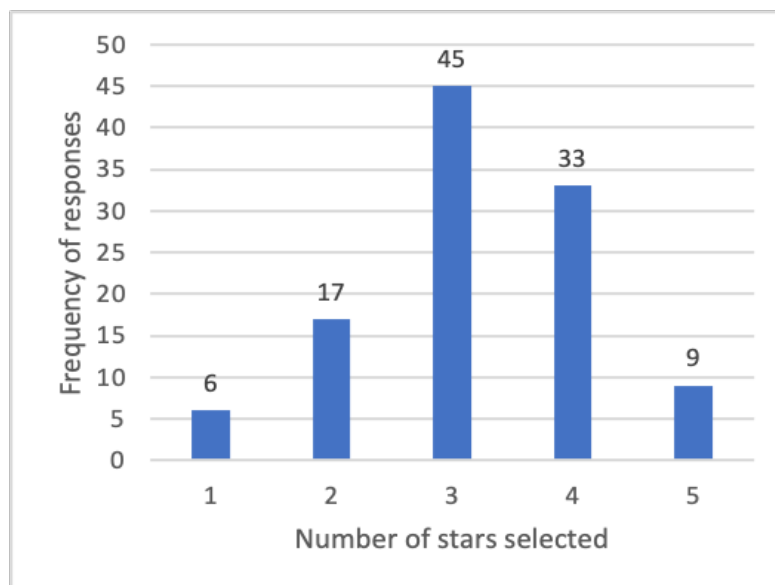


Figure 5. Evaluate your condition (1 star—awful, 5—great).

The graph shows a slight “skewness” towards better conditions. From the perspective of statistical significance, we formulate the null hypothesis that, on average, students would express a neutral attitude (three stars). Thus, we must reject this hypothesis in favor of a positive one-sided alternative that students voted significantly higher (*t*-test, $t = 2.13$, $df = 109$, $p = 0.017$).

The fifth question provided with the possibility for a student to write anything to the teacher or ask for something. In this case, most students did not write anything. A few students asked the teacher about her/his health and wished her/him good health, which was kind.

There was an interesting comparison of results evaluating the time amount and number of tasks.

For both, most answers are 3–5 stars. It is evident that the average appraisal (three stars) is the most common choice. However, more students chose three stars for the number of tasks where the

graph indicates greater kurtosis. On the contrary, the other scales where chosen more for amount of time, as seen in Figure 6.

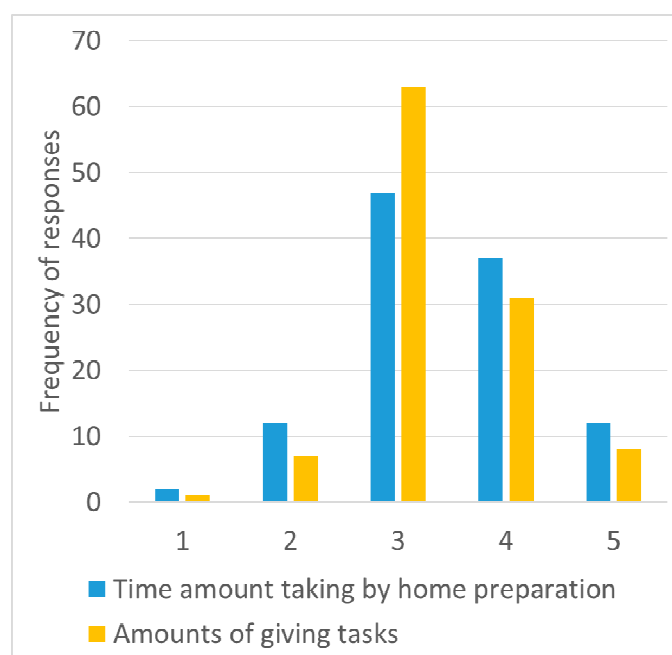


Figure 6. Comparing the amount of time with the number of tasks.

5. Conclusions

It is evident that students have managed distance education during this difficult, nonstandard time period. One of the advantages of this is represented by the fact that informatics students are working with an information system which supports distance education in principle. Therefore, it is evident that both the amount of time needed for distance education and the amount of work were comparable with face-to-face education. The students themselves, in open questions, have announced that this kind of education suits them.

The advantage of this work is in finding out the students' own attitudes during the Covid-19 outbreak. This is not a comparison of knowledge. Finding out the attitude of students is very important for the further direction of teaching in the period of distance education. Thanks to these results, teachers can also adjust their face-to-face education. For example, some elements of distance learning could be present in face-to-face education. These elements could be, for example, instructional videos shot by a teacher. These videos could also be used by sick students. The limit of this work is that the students' own attitude was determined for only one subject. A possible extension of this article would, therefore, be to carry out a questionnaire for other subjects. We think this article provides help in using online distance learning for other teachers.

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