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The Effect of Students' Material Status and Zoom Fatigue on Their Perception of Emergency Remote Teaching Satisfaction and Remote Teaching Sustainability from the Perspective of Education Faculty Students in Serbia

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Abstract

The introduction of emergency remote teaching in university education during the COVID-19 pandemic was not a matter of choice, but an attempt to make education sustainable in times of crisis. However, some research, even before the COVID-19 pandemic, showed that digital inequality caused by the unequal material status of students could have an impact on remote teaching. Also, before the COVID-19 pandemic, some researchers pointed out a new phenomenon, Zoom fatigue, as an accompanying phenomenon of video conferences with potential harm to the physical and mental health of consumers. The aim of this study is to examine the possibility that material status and Zoom fatigue may play the role of a moderator in the attitude of students towards ERT. The sample included 148 students attending education faculties in Serbia. The data obtained were frequencies, percentages, descriptive statistics, χ^2 test results, t test for independent samples, ANOVA, and linear regression.The results showed that 13% of students find the lack of financial funds for the purchase of an Internet connection with high-speed data flow to be an aggravating circumstance. Moreover, it transpires that Zoom fatigue may play the role of a moderator in students' attitude towards ERT, particularly concerning the possibility of introducing remote teaching as a permanent form of teaching;in addition, certain aspects of students' material status, primarily monthly household income, were a significant predictor of Zoom fatigue level on the ZEF scale.

Keywords: digital divide; social inequality; COVID-19 pandemic; emergency remote teaching; remote teaching; Zoom fatigue

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1. Introduction

Although at first sight COVID-19 is a medical matter, the consequences left by the pandemic have a broader social and scientific meaning. Giroux [1] thinks that the pandemic also caused a political and ideological crisis among humanity, in which the effects of all the so-far-known individual, social, geographic, biological, scientific, and technical inequalities have been intertwined. Castells [2] asserts that liberal democracy has encountered "collapse", while Šuvaković [3] points, on the one hand, to its geopolitical consequences and, on

the other hand, to the development, expansion, and mass use of artificial intelligence (AI), which are manifested after its end. Observing not only the advantages but also the threats potentially produced by AI, Kissinger, Schmidt, and Huttenlocher [4] express concern for the future of humanity. Keeping in mind that education in capitalism is one of the main factors of social passing and, in particular, of pro-system socialization of a person [5,6], the crisis has been used for adapting to the global capitalism reality. Kaiser [7] even states that the global crisis of education has been deliberately and systematically directed (if not caused). The educational process actually reproducessocial inequalities, as emphasized by many [8,9], namely in a transgenerational manner (since cultural capital is created as early as the level of pre-school socialization), which is also spoken about by Breen [10], whereas a special role is played by culture as an expression of the hierarchically organized cultural order [11]. Digital technology seems to have been applied during the COVID-19 pandemic for remote teaching (RT) applied in the form of emergency remote teaching (ERT), but it was also the main factor in maintaining peace and order, emphasized by many authors at the very beginning of the pandemic crisis, including Serbian authors [12–15] and those from the Balkan region [16]. However, it was subsequently noticed that it also produced new social divides in social, economic, psychological, and family contexts [17–19], and in the field of education [20,21].

The subject of this paper is the examination of the relationship between digital inequity and inequality and social inequality in the context of digital education—precisely higher education.We focus on emergency remote teaching imposed by the COVID-19 pandemic, exploringt he difficulties at the physical and psychological levelthat students faced through the synergy of the pandemic's negative effects and its risk factors. On the one hand, we explore the imposition of ERT as an attempt at maintaining a new normality.

In Serbia, there were accredited study programs for RT before the outbreak of the COVID-19 pandemic, but their share in the total number of accredited study programs accounted for less than 1% of the total number in higher education [22]. Despite this, a large number of students in Serbia, like their professors, had not had any previous experience with the implementation of RT, so ERT (as a form of RT) was their first experience with the implementation of classes in a digital environment. Based on this kind of experience, students' attitudes toward the possibility of introducing and using RT as a common and sustainable model of teaching in normal circumstances in society were formed. If they encountered RT on a large scale in some other usual circumstances, it is reasonable to assume that their attitudes towards RT would be different. Such an experience with ERT determines their attitudes towards RT, and that is why we are discussing ERT as a teaching method.

This is the reason why transferring the entire educational system to ERT had a completely new dimension of unpreparedness in comparison to countries that had already had experience with ERT due to pandemics caused by other diseases, such as Korea or the USA, with entire study programs accredited for the implementation of RT conducted in non-pandemic circumstances. Some previous studies, both in Serbia and abroad, point to the lack of digital competencies among teachers [23–26] and students [27–31], considering it (apart from the absence of the Internet and devices caused by socio-economic inequalities) the main problem in ERT implementation [23,25,32].

Therefore, the main aim of our research was to establish whether and in what way the students' financial situation and the problem related to the use of digital technologies in the new normality caused by the COVID-19 pandemic were associated with the ERT experience. Students in education faculties were included in the sample because it is the only group of faculties that exists throughout Serbia, both in a large city such as Belgrade and in smaller towns in the north and south, in central, west, and east Serbia. Thus, despite

the smaller number of students in the sample, it enables including students with a different financial status, with different possibilities of accessing digital tools and ICT.

The main research questions are as follows:

1. Whether the students' material status contributes to differences in their preference for emergency remote teaching and attitudes towards the possibility of attending RT again.
2. Whether the students' material status contributes to differences in the Zoom Fatigue level during their attendance of emergency remote teaching.
3. Whether, based on the students' material status, their preferences for emergency remote teaching, and attitude towards the possibility of attending remote teaching again, it is possible to predict the Zoom Fatigue level during the implementation of emergency remote teaching.

1.1. Social and Digital Inequalities in Emergency Remote Teaching

As for defining remote teaching (RT), from which the method of emergency remote teaching (ERT) is derived, it should be noted that it did not always proceed through the use of the internet (which enables its synchronous form owing to the characteristics of the medium). It was first created by using postal correspondence in the USA at the beginning of the 19th century, and continued to develop through the use of mass communication electronic media (radio, television, and film), and only in the last quarter of the 20th century RT emerged through the use of the internet, most frequently but not solely, in higher education [32–35].

Having in mind this diversity of types of implementing classes, it is difficult to give a single definition of remote teaching. Bond, Bedenlier, Marín & Händel [36] state that as many as ten terms are used in expert interdisciplinary literature to denote the concept of remote teaching during the COVID-19 pandemic: online learning, e-Learning, distance learning, online teaching, online education, not specified learning, Internet Web-Based Learning, emergency remote teaching, remote learning, Computer-Based Learning, distance education. These terms are often used synonymously as well. However, the main difference is that the terms denoting remote teaching (distance learning, distance education, remote teaching) may also refer, particularly in the historical context, to the forms of remote teaching which are not electronically mediated (e.g., by postal letters) or, in case they are electronically mediated, it is with the aid of one-way communication, the use of electronic mass media (e.g., film, radio, and television). On the other hand, by stressing the online features and other above-mentioned terms, it becomes clear that this is teaching based on different internet platforms and tools, whereas it may proceed synchronously or asynchronously, since the nature of the mediating media is such that it allows but does not necessarily require vice versacommunication in real time. For the purpose of this paper, the terms RT and ERT are distinguished.

The term RT in this research implies the form of remote teaching realized electronically in the present and in our specific research, because the student population in Serbia is exploredonline. RT is generally intended for people who, due to the lack of time and money, cannot continue further specialization and education in a traditional way [37]. RT can be implemented synchronously and asynchronously, in line with the previously established standards and with a carefully devised structure, with a clear algorithm of implementation [37,38]. What is perhaps most important in the context of our research is that accessing RT is a voluntary decision of an individual and that the circumstances leading to it are different (lack of time and/or money, distance of the place of residence from the faculty, inability to balance studies with work and/or family duties, etc.).

In contrast, main characteristics of ERT are imposition (participants are not asked whether they can or want to participate (it is imperative to maintain the continuity of the educational system), improvisation regarding the manner of implementing classes (using available devices and programs), limited length (the basic idea of ERT is that it is a temporary, or interim stage in the implementation of teaching until conditions are created for returning to the traditional model), and extraordinary circumstances of participants themselves at the moment of the implementation of classes (in the given case, the COVID-19 pandemic: fear of becoming infected, health complications in the form of post-COVID syndrome and fatal outcome of the participants and/or their family members, restricted freedom of movement, loss of employment, inability to obtain necessities such as food and medications, limited possibility of treating diseases not directly connected with COVID-19, etc.) [39–45]. That is why other authors define other characteristics of ERT: that it is unplanned, under-developed, under-supported, rapidly delivered, and likely of lower quality [40,46–48]. Therefore, it is important to take into account that the ERT experience, as students'only experience with online classes, could directly affect their attitude towards overall RT. The formation of this attitude towards RT in the future was directly affected by participants' technical resources (devices, equipment, Internet connectivity, and digital competencies), the accessibility of which directly depended on their financial status.

Social stratification was observed through surveying students' access to the internet, which was the key condition for online remote teaching. However, worldwide research showed the existence of a gap among students regarding the accessibility of the internet and devices. This gap does not exist only in poor and developing countries, but the situation is much more complex, just as it was shown by the situation with education during the COVID-19 pandemic. In fact, it seems that the digital divide itself is much more pronounced at the internal national level than at the international one. This is evidenced by the research data about technical obstacles in ERT functioning during the COVID-19 pandemic, manifested in the lack of adequate technical infrastructure for attending lessons (devices, internet access, and also the internet flow speed), and insufficient digital literacy of all stakeholders. Namely, digital inequalities in reliable internet and device access were reported in the USA [49–51], Ghana [52], Mexico [53], Canada [54], Philippines [55,56], Pakistan [57], South African Republic [58], Indonesia [59,60], Brazil [61], Italy [62], Saudi Arabia [63], India [64], China [65], Russia [66], Yemen [67], and in Serbia [23,30].

The significance of technical barriers in remote teaching is written about by numerous authors [60,68]. Accessibility and familiarity with the use of technical infrastructure for following RT is a condition *sine qua non* for the functioning of classes in the digital environment [69]. Without it, it is impossible to speak of the ERT implementation in higher education, let alone of its efficiency. Without equal conditions in terms of infrastructure accessibility (the internet, devices and competences), it is impossible to speak of RT as a way of making education accessible to everyone, which should be one of the implicit assumptions since RT is a form of distance learning based on the use of ICTs, whose aim is to make education equally accessible to all those who want it, regardless of the obstacles in space and time (the "ideas travel instead of people"concept [70]), including the financial ones [22,71]. That is why the main postulate on which ICT-based learning is founded is prioritizing equality, quality, and accessibility for all learners [55]. However, as far as ERT is concerned, some studies even suggest that ERT not only failed to contribute to equal accessibility of higher education during the COVID-19 pandemic, but, on the contrary, it deepened and emphasized the existing inequalities [59,64,72,73] with the potential of creating new or continuing or strengthening old ones, while, on the other hand, some Serbian researchers obtained findings according to which "most respondents did not mention that

online learning could have further disadvantaged students from the socio-economically deprived segments of society" [74].

On the other hand, the accessibility of technical infrastructure is directly conditioned by an individual's material (and social) status. Excessive data costs present an obstacle to accessing onlineclasses, and internet connectivity is a significant factor influencing educational inequalities [75]. Rohs and Ganz [76] point out that an individual's ability to utilize their resources and opportunities, when it comes to online learning, is proportionate to their material status. On that basis, it may be concluded that the main cause of digital inequality and equity is social inequity caused by differences in the students' social and economic status, which further leads to the digital divide. The digital divide is a lack of equity in the access and use of ICTs [77] and may be reflected in unequal accessibility, digital competence, and disparate benefits of technology usage according to socio-economic status [59,72]. In contrast, the digital divide is associated with social and cultural capital and social mobility [78]. It might be a key reinforcing mechanism for future social and economic divide, mediated directly through the educational process itself, which leads to wealth and education intergenerational inequality [49,79]. One of the ways of additional reproduction of social inequality is also the lack of technical infrastructure and digital literacy of teachers and universities [23,61]. Namely, van Dijk [79] lists three factors that determine the degree of technology usage in a society:personal features (e.g., gender), social status (e.g., profession), and resources (e.g., finance), and are directly related to the digitization process in a society (motivation, accessibility, and development of competences).

1.2. The Negative Health Effects of Emergency Remote Teaching

As a consequence of the aggravated functioning of an individual due to numerous restrictions imposed because of protecting life and public health [3,18,22], a number of difficulties arose in terms of mental functioning and health. Many authors [69,80–85] stated that the introduction of ICT in university education might generally affect the quality of education, human relations, productivity, motivation, mental health, and other factors that are induced not only by the pandemic, but online learning, too. In the student population, the increase was reported in the problem of mental functioning during the COVID-19 period as one of the most important leading obstacles to the academic success of students, such as reduced motivation for learning [86], the feeling of loneliness [22,86–88], and disorders in the perception of time flow caused by working and learning in the digital space [89], while some of the difficulties among this population appeared for the first time, for example, Zoom fatigue. It was first mentioned by Bozkurt and Sharma [38], pointing out that during the pandemic, but also in the post-COVID world, a direct consequence of digitization would be digital fatigue. Digital fatigue was redefined as Zoom fatigue during the pandemic. It is both conceptually and psychometrically determined by the Zoom Exhaustion and Fatigue Scale (ZEF) [90,91] and refers to the phenomenon of feeling mental and physical exhaustion, anxiety, and fatigue associated with the excessive use of video conferencing programs, for any purposes and performed in any program similar with Zoom (or all programs used in the synchronous form of ERT). However, these problems are, through ERT, also connected with the matters of an individual's material status. Weak internet connection was evaluated as a stress factor [22], and it is a direct consequence of an individual's lower material status [92]. On the other hand, the higher the level of internet connectivity, the higher the level of students' participation in ERT [75].

2. Materials and Methods

Sample: In this research, a virtual exponential non-discriminative snowball sample was applied [93]. This type of sample has become frequent in social sciences, and by its

type it belongs to appropriate samples, i.e., those that are not founded on probability. The snowball sample is specific for the attempt at its objectivization through a large number of points from which the questionnaire is approached.

The sample included 148 students of basic and master's academic studies at all teacher education faculties in Serbia: Belgrade (with the departments in Novi Pazar and Vršac), Sombor, Subotica, Užice, Jagodina, Vranje, and Leposavić. The research covers only those students who, during their studies, at the time of this research, had the opportunity to attend both ERT because of the circumstances emerging with the beginning of the COVID-19 pandemic, and regular teaching. The previous study [22] about ERT implementation during the pandemic showed that only 1.6% of studentsin the education faculties in Serbia did not have a single lesson organized in this way, while about 35% teachers and assistants regularly had absolutely all lessons via ERT. The survey included ten male students; however, due to a large disproportion and pronounced domination of women in the total student population of teacher education faculties in Serbia of 91.14% [94], the comparison by gender was impossible (Table 1). In addition, the total number of female students in Serbia in 2023 was also larger (58.62%) as compared to the number of their male counterparts. A possible explanation for this disproportion in relation to the students' gender is the feminization of certain professions, primarily teaching ones, which definitely include those of educators and teachers. Moreover, these professions also provide immediate employment in government institutions, with clearly defined working hours, which ensures a safe job for female students in the future, with the possibility of harmonizing their available time between business and future family obligations.

Table 1. Student status of the sample (frequencies).

Level of Academic Studies		**Students' Status**		**GPA**			
Basic	Master's	Budget	Self-financing	6 to 7	7 to 8	8 to 9	9 to 10
86	62	113	35	9	47	59	33

Procedure: An online survey was conducted in May and June 2023, via the Internet [95] using a Google questionnaire as an instrument. The researchers delivered the link with the questionnaire to all teacher education faculties in Serbia, with the request to put it on their respective websites. In this manner, several dozen different entry points (links on the already existing student groups usually used by the students from their faculties for mutual communication or different social networks) in the questionnaire were provided. The survey was anonymous and voluntary and approved by the Ethical Committee of the Faculty of Education, University of Belgrade.

Instruments: The survey questionnaire consisted of a few sections:

1. Sociodemographic features: Gender and place of origin.
2. Matters regarding the students' status:Level of study, GPA, and students' status.
3. Matters regarding the economic status: Method of financing studies and monthly household income.
4. Matters regarding ERT: Preferences for ERTand the possibility of attending RT again.
5. Zoom Exhaustion and Fatigue Scale [91]: The ZEF scale is an instrument intended for assessing the respondents' fatigue intensity and the modality of their fatigue after attending remote teaching. The scale consists of 15 items, with 3 items for each of the five fatigue modalities: general, visual, social, emotional, and motivational (e.g., "I felt tired after attending the remote lesson"). Moreover, the overall result on the scale is also taken into account. The respondents gave answers on a five-point Likert scale (from "1 = Strongly disagree" to "5 = Strongly agree"). The scale reliability measured

by Cronbach's alpha in the original research was between 0.82 and 0.90 [91], between 0.70 and 0.91 [96], and between 0.87 and 0.92 [97].

Variables:

Independent variables in the research were the following:

1. Place of origin: Whether before starting university studies, the student lived in a city, a suburban settlement, or a village.
2. Level of studies: Bachelor's (4 years long, with 240 ECTS) and master's (1 year long, with 60 ECTS).
3. The range of the achieved GPA in the following categories: 6–7, 7–8, 8–9, 9–10 (at Serbian universities, the lowest pass mark is 6 and the highest is 10).
4. Students' status: Onthe state budget or self-financing.
5. Type of financing the costs of studying: financed by family members; the student works and finances the costs of studying on his/her own.
6. Monthly household income: Much below average (under RSD 65,000), below average (RSD 65,000–90,000), average (90,000–130,000), above average (130,000–170,000), much above average (more than RSD 170,000). The starting basis for this categorization was the amount of the median salary in the Republic of Serbia of RSD 63,954 in April 2023, which means that 50% employees earned up to the above-mentioned amount [98], while the median pension was between RSD 20,000 and 25,000 [99]. However, having in mind that in Serbia there is still a trend of multigenerational common households, which is a characteristic of transitioning societies in general [100], it is also possible that the household was able to increase its income in a different manner. Some of the members of multigenerational households were able (via social subsidies by the state, or self-employment in their private or family business or agriculture) to acquire additional income in the amount of approximately ½ of the average monthly salary. The above-mentioned categories were formed under the assumption that at least one family member earned RSD 25,000 as a median pension.
7. Preference for ERT: The question refers to how much the students generally liked emergency remote teaching (I did not like it at all; I saw it as a necessary evil; I liked it very much).
8. The attitude toward the possibility of attending RT again: The students answered the question in which circumstances they found it acceptable to attend RT again (never, in extraordinary circumstances, to introduce it as a permanent form of teaching).
9. The question regarding difficulties brought by the introduction of ERT to students in terms of their economic position: On a five-point Likert scale (from "1 = Strongly disagree" to "5 = Strongly agree"), the respondents assessed the following statement: "What I minded in ERT was the lack of financial means for buying enough internet with a sufficient flow speed".

Dependent variables:

The dependent variables in this research were the overall score and five subscales (general fatigue, visual fatigue, social fatigue, motivational fatigue, and emotional fatigue) on the Zoom Exhaustion and Fatigue Scale.

Data processing methods:

The data were processed in the program SPSS 22.0. More specifically, frequencies, percentages, descriptive statistics measures, χ^2 test, t test for independent samples, ANOVA, and linear regression (method ENTER) were used for data processing.

3. Results

3.1. Descriptive Statistics of Variables

In our research, regarding the parameters of the students' status, slightly more students of basic studies were included, whose tuition costs were financed by the state and who achieved above-average results during their studies (Table 1).

In our sample, most students financed their studies on their own. In addition, monthly earnings of the households in which the students live are mostly average or belowaverage (Table 2).

Table 2. Material status of the sample (frequencies).

Method of Financing Studies		**Monthly Household Income**				
financed by family members	the student works and finances the costs of studying on his/her own	much below average	below average	average	above average	much above average
44	104	32	24	45	29	18

The largest number of students liked ERT, but would attend RT again only in case they have no possibility of choice, i.e., in emergency circumstances such as pandemics, wars, natural disasters, and risky social events (Table 3).

Table 3. Distribution of preference for ERT and possibility of attending RT again (frequencies).

How Much the Students Liked ERT			**In Which Circumstances Students Found It Acceptable to Attend RT Again**		
I did not like it at all	I saw it as a necessary evil	I liked it very much	Never	In extraordinary circumstances	To introduce it as a permanent form of teaching
44	38	66	11	103	33

On the other hand, a smaller number of students—19 students (13%)—reported the lack of financial means for purchasing a sufficient amount of internet with fast data flow as an aggravating circumstance in attending ERT (Figure 1).

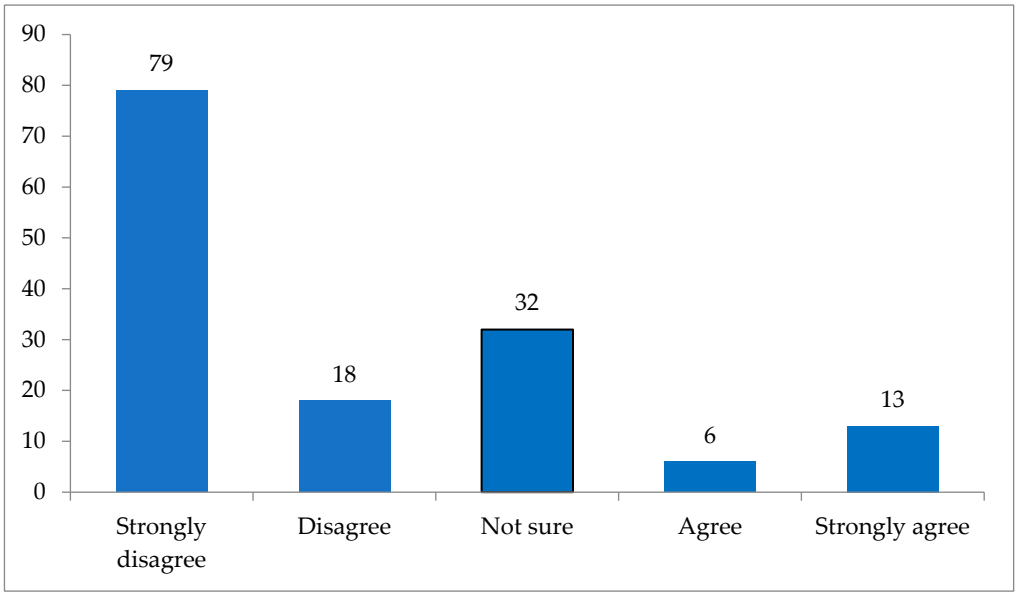

Figure 1. The opinion about poorer internet flow due to the lack of financial means ("In ERT, I minded the lack of financial means for purchasing enough internet with sufficient flow speed") (frequencies).

Table 4 shows the basic data (Cronbach's alpha, mean, and standard deviation) for the ZEF scale. Given the obtained values, it may be concluded that the level of ZEF among the education faculty students was relatively low, since the highest values were obtained on the subscales of general and visual fatigue, and even they were at the average level of the measuring scale (the total average score for the entire scale was 2.33). On the other hand, emotional and social dimensions of fatigue were the least present among the students.

Table 4. Reliability and descriptive statistics of ZEF subscales.

Scales	α	M	SD
General fatigue	0.83	2.58	1.19
Visual	0.89	2.57	1.26
Social	0.85	2.16	1.17
Motivational	0.87	2.35	1.21
Emotional	0.91	2.14	1.14
Total	0.97	2.33	1.09

3.2. Material Status, ERT, and RT

Speaking of the interrelations of the variables determining the socio-economic status and the students' status and attitudes towards ERT, it transpires that there are statistically significant differences. A statistically significant difference was obtained between the place of origin and ERT preference (χ^2 = 12.942, df = 2, p < 0.012). The students from rural environments did not like ERT (Figure 2).

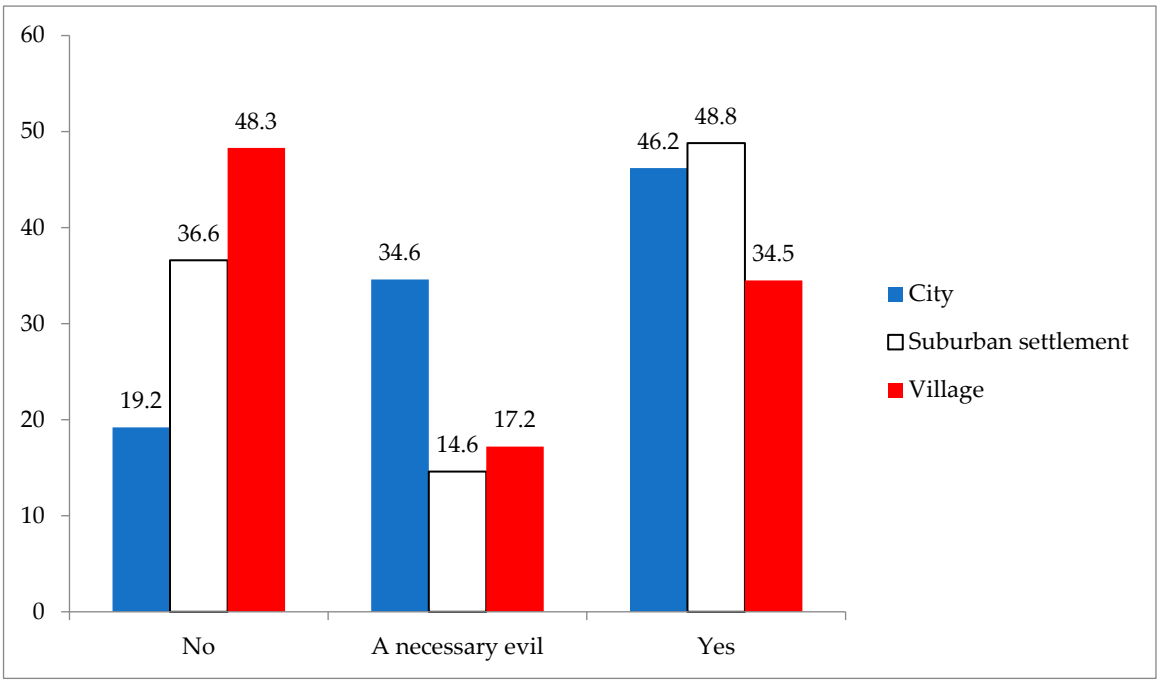

Figure 2. The relationship between ERT preference ("How much did you like ERT: I didn't like it at all; I see it as a necessary evil; I liked it very much") and the students' place of origin (%).

A statistically significant difference was obtained between the type of students' financing and ERT preference (χ^2 = 7.130, df = 2, p < 0.028). The students who paid for their studies on their own liked ERT on a substantially larger scale (Figure 3).

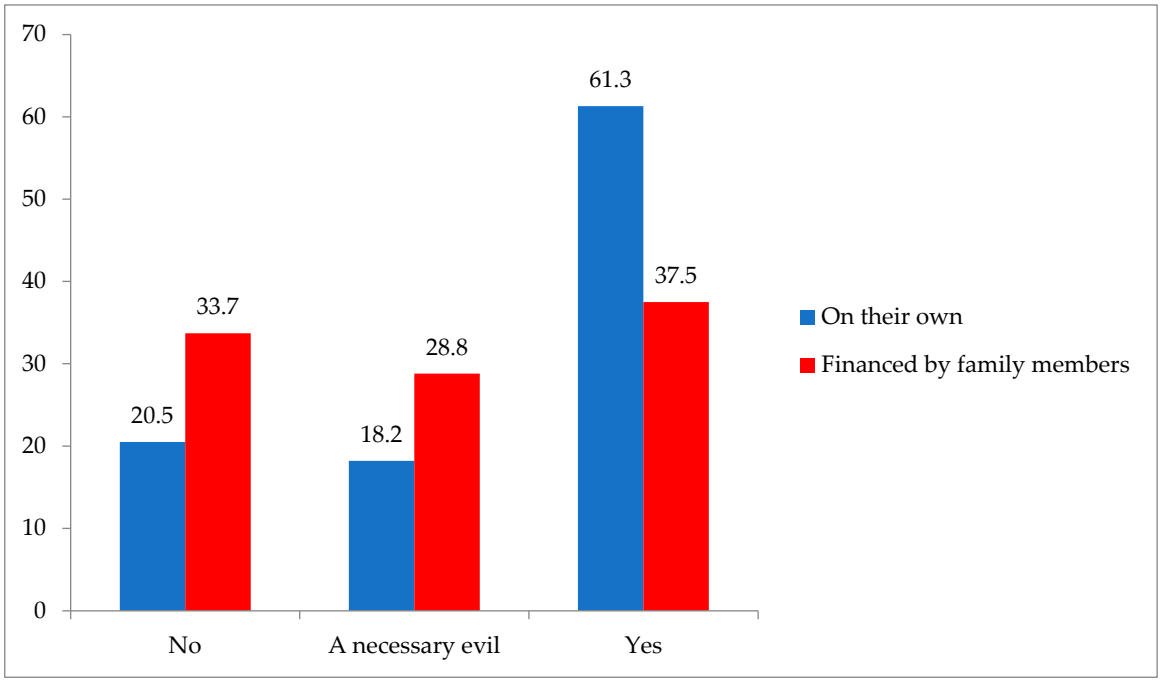

Figure 3. The relationship between ERT preference ("How much did you like ERT: I didn't like it at all; I see it as a necessary evil; I liked it very much") and the type of students' financing (%).

A statistically significant difference was obtained between the type of students' financing and the opinion about the possibility of attending RT again (χ^2 = 8.947, df = 2, $p < 0.011$). The students who pay for their studies on their own were much more in favor of RT becoming a permanent form of teaching (Figure 4).

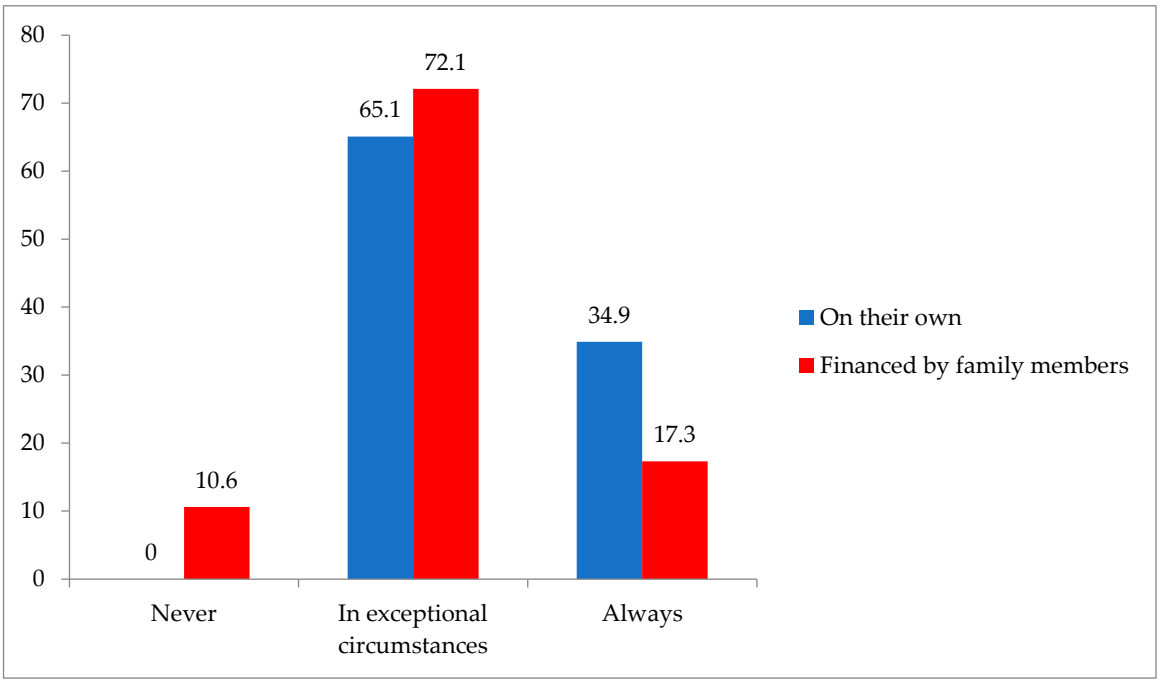

Figure 4. The relationship between the opinion about the possibility of attending RT again ("When would the reintroduction of ERT be acceptable: never; in exceptional circumstances, e.g., pandemic, war, natural disasters, etc.; always") and the type of students' financing (%).

3.3. Material Status and ZEF During the Attendance of ERT

Speaking of the relationship between ZEF subscales and independent variables, it can be seen that there are only several statistically significant differences on the subscale of general fatigue as compared to the scores of the ZEF scale. ANOVA showed statistically significant differences were found on the subscale of general fatigue as compared to the students' average ($F = 3.145$, $p < 0.027$). The students with the lowest GPA manifested the lowest level of fatigue on the ZEF scale (Figure 5).

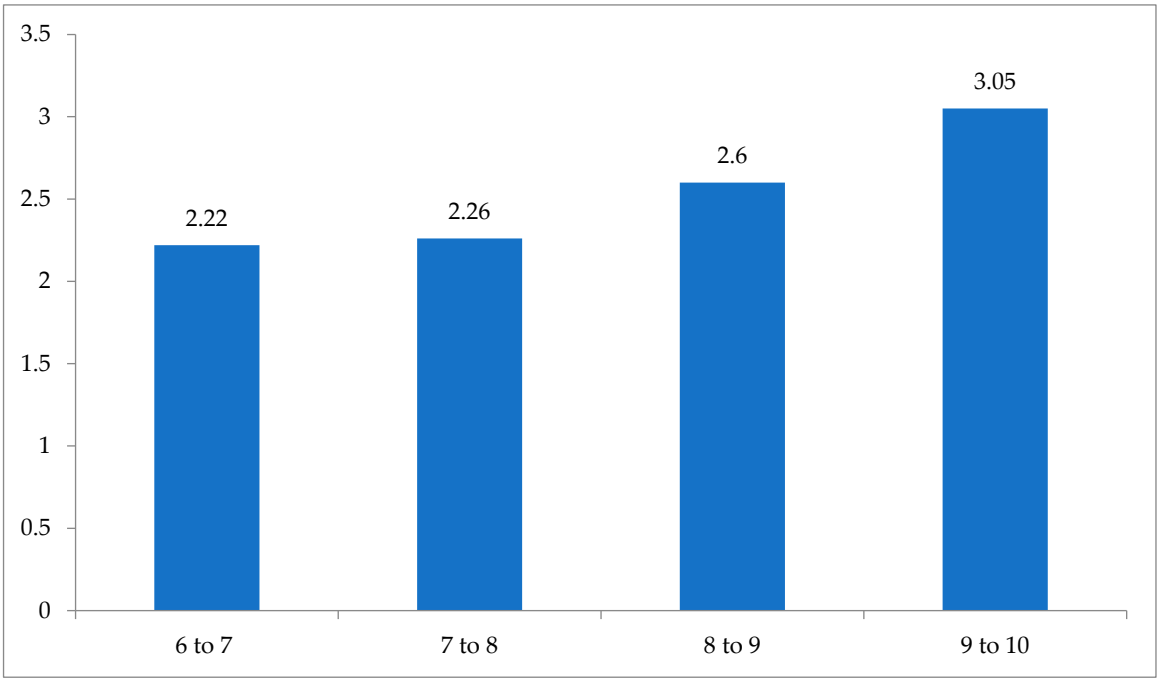

Figure 5. Scores of general fatigue on the ZEF scaleas compared to the students' GPA during studies.

ANOVA showed that there were also statistically significant differences on the subscale of social fatigue as compared to the students' place of origin ($F = 3.480$, $p < 0.033$). The students from urban environments manifested the lowest level of general fatigue on the ZEF scale (Figure 6).

According to the T test for independent samples, statistically significant difference were found on the subscales of general ($t = 2.426$, $p < 0.018$), visual ($t = 3.990$, $p < 0.000$), motivational ($t = 2.019$, $p < 0.048$) and emotional fatigue ($t = 2.173$, $p < 0.034$), and in the total score of the ZEF scale (status $t = 2.423$, $p < 0.008$) as compared to the students' status. A higher level of general, visual, motivational, and emotional fatigue, and of the score on the ZEF scale was established among the students on the budget (Figure 7).

According to the *t* test for independent samples, statistically significant differences were found on the subscale of general fatigue ($t = -3.107$, $p < 0.003$). A higher level of general fatigue was established among the students whose studies were financed by their family members (Figure 8).

ANOVA showed statistically significant differenceson the subscales of general ($F = 3.087$, $p < 0.018$), visual ($F = 3.168$, $p < 0.016$), and emotional fatigue ($F = 2.571$, $p < 0.041$) on the ZEF scale as compared to the accessibility of studies, i.e., the possibility of studying and working at the same time (Figure 9). A higher level of general and visual fatigue was manifested among the studentswho worked and studied at the same time, but not of emotional fatigue.

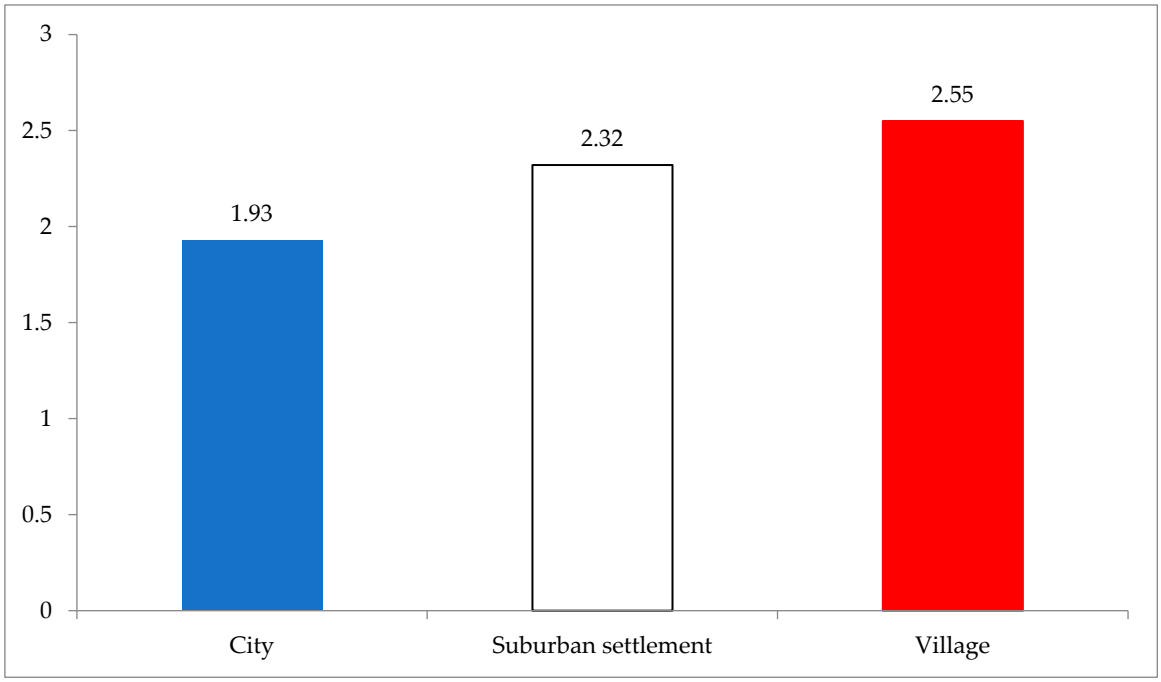

Figure 6. Scores of social fatigue on the ZEF scaleas compared to the students' place of origin.

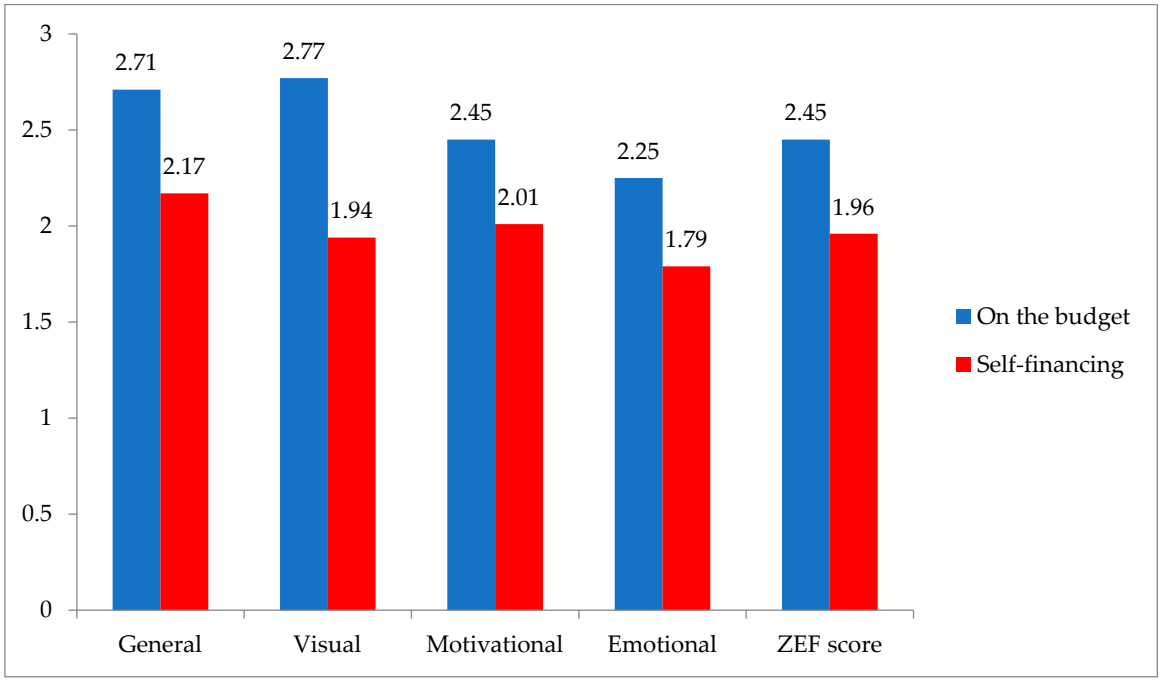

Figure 7. Scores on the subscales of the ZEF scale as compared to the students' status.

ANOVA showed statistically significant differences on the subscales of social (F = 3.282, $p < 0.013$) and emotional fatigue (F = 4.284, $p < 0.003$) on the ZEF scale when it comes to financing the costs of ERT attendance. The highest level on the subscales of social and emotional fatigue was established among the students who had a problem of afinancial nature in purchasing the internet with a sufficient flow speed (Figure 10).

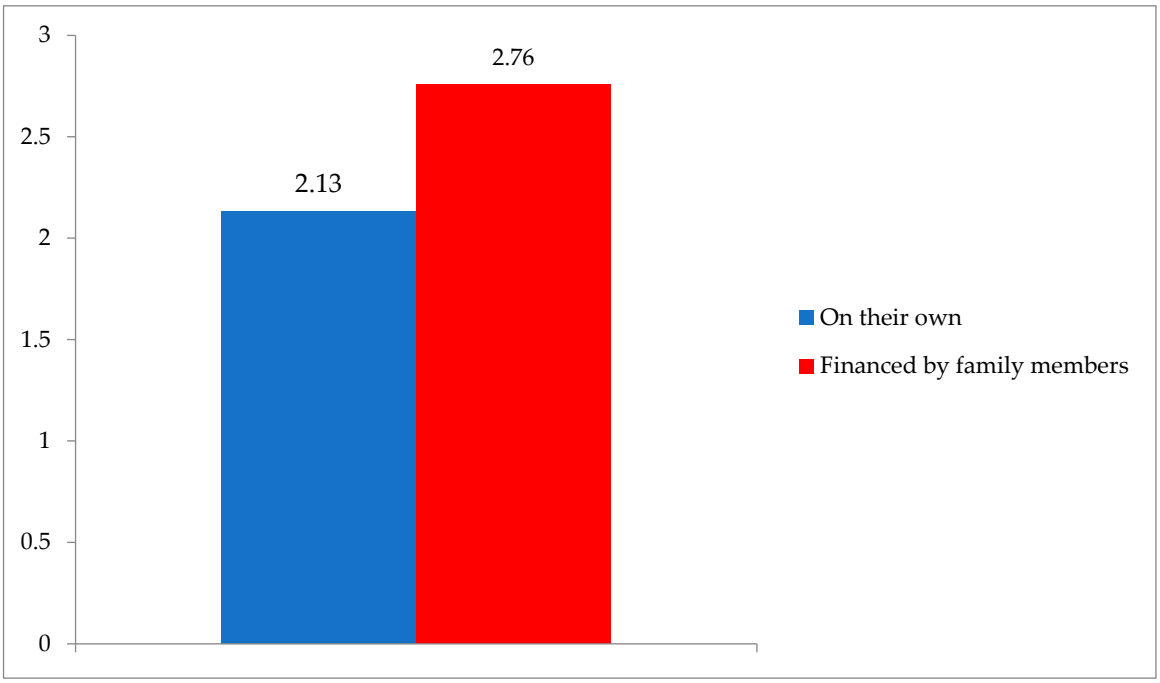

Figure 8. Scores on the subscale of general fatigue on the ZEF scale as compared to the type of students' financing.

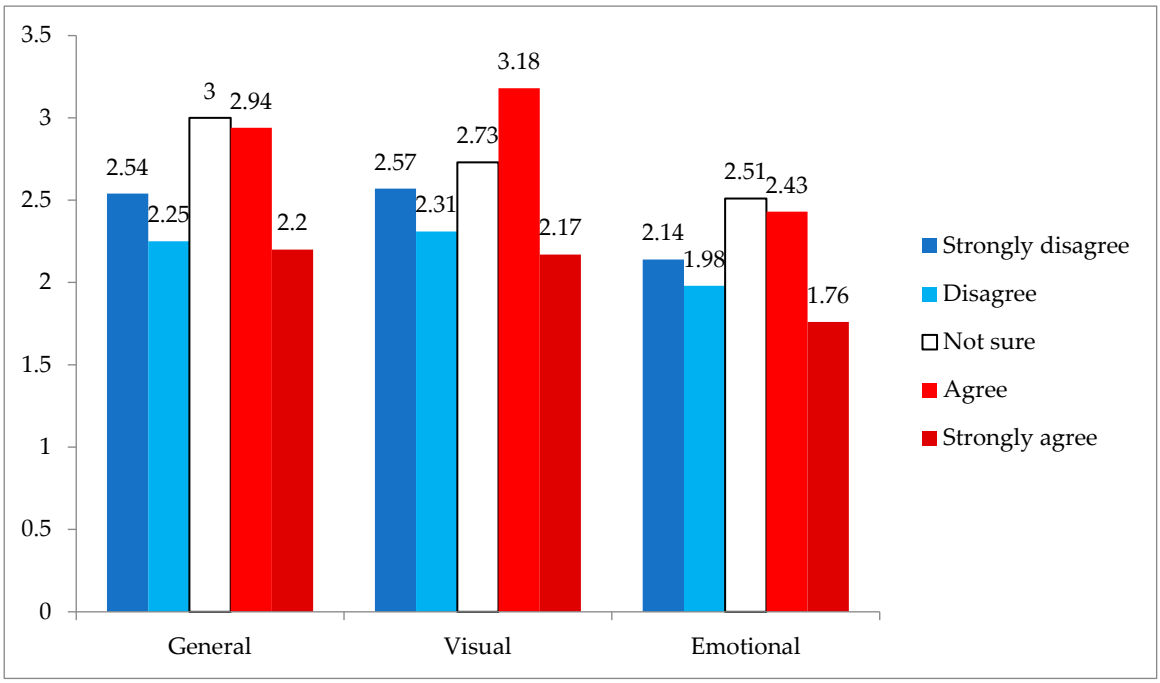

Figure 9. The relationship between the scores on the ZEF scale and the opinion about the possibility of studying and working at the same time, thanks to ERT introduction ("ERT ensured the availability of studying—I could work and study at the same time").

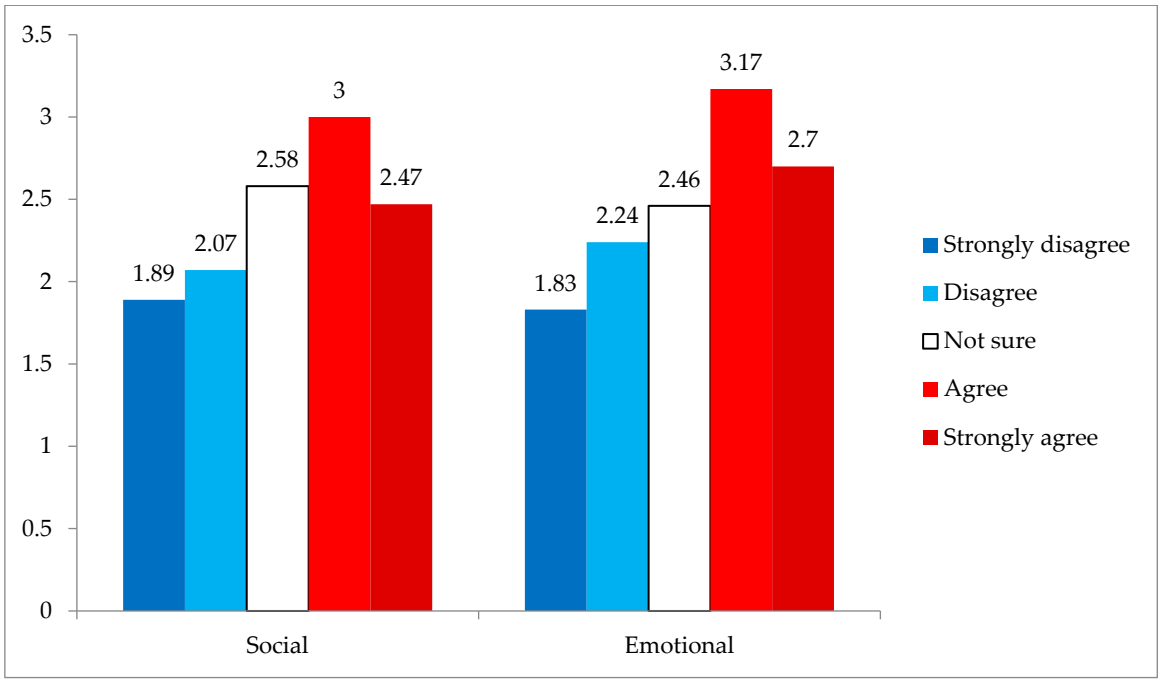

Figure 10. The relationship between the scores on the ZEF scale and the opinion about the obstacles in attending ERT due to the lack of financial means for purchasing the internet with sufficient flow speed ("In ERT, I minded the lack of financial means for purchasing enough internet with sufficient flow speed").

3.4. The Possibility of Prediction ZEF

Speaking of ZEF, it was shown that the students with a higher GPA, lower monthly household income, and with less preference for ERT had a higher level of general fatigue on the ZEF scale. The students on the budget who were against the possibility of attending RT again manifested a higher level of visual fatigue on the ZEF scale. The students with lower monthly household income who liked ERT less manifested a higher level of social fatigue on the ZEF scale, while the students with lower monthly household income had an increased level of motivational fatigue. The students with lower monthly household income and higher GPA, who while attending ERT encountered the problem of the lack of financial means for purchasing fast-flow internet and who were against the possibility of attending RT again, manifested a higher level of emotional fatigue on the ZEF scale. Speaking of the total score on the ZEF scale, the students with a higher GPA and lower monthly household income, who were against the possibility of attending RT again, manifested a higher level of fatigue (Table 5).

Table 5. Predictors of the results on the dimensions of the Zoom Exhaustion and Fatigue Scale.

	R	R^2	Adjusted R^2	F	*p*	Partial	*p*
General							
GPA,	0.555	0.308	0.214	3.284	*0.000*	0.224	*0.014*
Monthly household income and						−0.193	*0.035*
ERT preference						−0.194	*0.034*

Table 5. *Cont.*

	R	R^2	Adjusted R^2	F	*p*	Partial	*p*
Visual							
Students' status and attitude toward the possibility of attending RT again	0.596	0.355	0.269	4.123	*0.000*	−0.196 −0.0248	*0.030* *0.002*
Social							
Monthly household income and ERT preference	0.531	0.282	0.186	2.940	*0.000*	−0.211 −0.181	*0.020* *0.047*
Motivational							
Monthly household income	0.552	0.273	0.176	2.810	*0.001*	−0.229	*0.011*
Emotional							
GPA, Monthly household income and the opinion about the difficulty in attending ERT due to the lack of money for purchasing the internet, and attitude toward the possibility of attending RT again	0.56	0.321	0.228	3.432	*0.000*	0.186 −0.200 0.234 −0.249	*0.044* *0.030* *0.011* *0.007*
ZEF total score							
GPA, Monthly household income, and attitude toward the possibility of attending RT again	0.553	0.306	0.209	3.169	*0.000*	0.202 −0.207 −0.188	*0.029* *0.025* *0.043*

4. Discussion

The research included 148 students of the teaching faculties in Serbia, mostly female students, whose studying costs were financed from the budget, who financed the accompanying studying costs on their own, whose monthly household earnings were average or belowaverage, and whose GPA was very good (between 8 and 9).

The negative attitude towards the possibility of and attitude toward possibility of attending RT again was also accompanied by a higher level of Zoom fatigue, particularly its visual and emotional components, which is in line with the results reached by Petrović, Šuvaković, and Nikolić [23].The amount of household income was the most dominant factor of the material status, while the students' status was the most important factor leading to the emergence of Zoom fatigue. Household income had a negative effect on all aspects of Zoom fatigue except for the visual one, while the GPA was an important predictor of general and emotional fatigue, and total score, which indicates that more ambitious and better students remained equally hard-working in the altered circumstances of teaching implementation as well.

Furthermore, only 33 students (22.4%) were in favor of the possibility of attending RT again, which is in line with the findings of other authors [23,89] that the students do not think that RT may completely replace traditional teaching. This finding has also been confirmed in other research [72,101] that the students believe that traditional teaching is of better quality than RT, but not in the research conducted by Bilgiç [102], where 43% students would once again opt for ERT in the following semester. A positive attitude towards the possibility of attending RT again is expressed on a larger scale by the students

who cover their costs on their own. The reason for this is also the students' opinion that ERT is more stressful than the traditional form of teaching [103] and that it does not provide social interaction [22], although earlier experiences before the COVID-19 pandemic with RT also speak of students' unwillingness to change their environment in distance education as a barrier to the choice of distance education courses [68].

On the other hand, the level of difficulties in the mental functioning during ERT attendance, expressed by the score on the ZEF scale and its subscales, indicates that the level of Zoom fatigue among education faculty students was below average, in contrast to some other research studies [97]. The highest values were obtained on the subscales of general and visual fatigue, while emotional and social forms of fatigue were the least present ones in ERT attendance, which is in line with the results reached by Gerdan and Dünder [97].This may be seen in the context of the students seeing ERT as a form of maintaining social interaction, which they were deprived of due to the protection of public health [22]. The highest level on the subscales of social and emotional fatigue was established among the students with a problem of a financial nature when purchasing the internet with a sufficient flow speed. This may be explained by the fact that social distance and emotional loneliness emerging as a consequence of keeping social distance, as the main anti-pandemic measure [18], raise the intercepts of worry and tension about health issues, while at the same time increasing the students' cognitive efforts to adapt to the situation happening in higher education for the first time, so the transgenerational exchange of experiences was impossible. Social isolation has been proven to be a core predictor of students' stress in ERT [87], and in the case of the feelings of remoteness and isolation [57,104] and fatigue and burnout [105].

A higher level of general fatigue was reported by the students with a better GPA, from rural environments, whose studying costs were financed by their family members, while a higher level of general, visual, motivational, and emotional fatigue, and of the total score on the ZEF scale was manifested by the students who were on a budget. The reason for this lies in the fact that numerous financial benefits, such as financing studying costs, scholarships, and accommodation in the students' dormitory, depend exactly on the GPA. That is why poorer students are interested in learning as much as possible and obtaining the best possible grades in order to be entitled to these benefits and/or to keep them. Of course, the higher GPA is accompanied byalarger amount of effort, which in turn leads to larger fatigue, particularly in the conditions of the COVID-19 pandemic that brought a new form of economic uncertainty to students and their families. A higher level of general and visual fatigue was recorded among the students who worked and studied at the same time, but not of emotional fatigue.

General fatigue on the ZEF scale was possible to predict on the basis of GPA, monthly household income, and the attitude towards ERT: the students with a higher GPA, lower monthly household income, and finding ERT less appealing expressed a higher level of general fatigue, which is in line with the results reached by Smith and Haughton [106] that students find it difficult to remain focused during ERT classes, and by Bekova, Terentev, and Maloshonok [66] that students from low-income families were most likely to have technical and self-regulation problems and to lack skills required for effective remote learning.

The level of visual fatigue was possible to predict on the basis of the students' status and their attitude towards the possibility of attending RT again. The students on the budget and those who were against the possibility of attending RT again showed a higher level of visual fatigue.

The level of social fatigue was possible to predict on the basis of monthly household income and the attitude towards ERT. The students with lower monthly household income and those who found ERT less appealing showed a higher level of social fatigue, which is

in line with the results that social and emotional loneliness raised the intercepts of worry, tension, and demands and reduced the experience of joy during ERT [106,107].

The level of motivational fatigue was possible to predict on the basis of monthly household income: the students from the families with lower monthly household income had an increased level of motivational fatigue. Reduced motivation for learning also appears as an important negative effect of ERT [41,102,108,109]. Broadbent and Poon [110] explain it by the fact that embeddedness and interactions are crucial for motivation and retention in studies. An important function of every form of education is that it is also a form of socialization with peers and professors in the first place. The loss of the possibility of interaction also disturbs the process of knowledge acquisition since learning from peer groups constitutes nearly one-third of total learning that takes place in formal learning systems [21]. The presence of other students automatically creates a kind of social pressure and competition climate that motivates students to engage more seriously with studies, which is in line with the results reached by Smith and Haughton [106]. They also found out that an additional burden for the students was the lack of discussion of learning materials with classmates.

The level of emotional fatigue was possible to predict on the basis of GPA, monthly household income, the problem with the lack of financial means for purchasing fast-flow internet, and the attitude toward the possibility of attending RT again. The students with lower monthly household income and higher GPA, who while attending ERT encountered the problem of the lack of financial means for purchasing fast-flow internet and who were against the possibility of attending RT again, manifested a higher level of emotional fatigue on the ZEF scale. This may be the consequence of concern for the future and general health and economic uncertainty, both of individuals and their families, during the pandemic, which is in compliance with other research results [49,102].

The total score on the ZEF scale was possible to predict on the basis of GPA, monthly household income, and the attitude toward the possibility of attending RT again, which is in line with the results reached by Oducado et al. [96] that among the important predictors are the students' GPA and attitude towards ERT. The students with a higher GPA, lower monthly household income, and opposing the possibility of reintroduction of ERT showed a higher level of fatigue. Just as in the case of general fatigue, the explanation of these results lies in the students' competence for acquiring or keeping financial benefits during studies, since the number of students who are financed from the budget is limited, which also refers to the number of scholarship users and the accommodation capacities of student dormitories. The digital environment during the implementation of lessons, which was encountered by the majority of students for the first time and which tended to last several consecutive hours on a daily basis, called for additional attention and concentration (while numerous studies speak of the accelerated time flow in digital [23,24,111]), and of acquiring new knowledge and skills, both in the field of teaching material that is easily adopted, and of digital competences the students also had to master. Usual everyday hours-long stay on the internet and social media (as the characteristic of younger generations) was not of great use in this field [30,112].

The relationship between ERT preference and the attitude toward the possibility of attending RT again and ZF can be seen within the context of the Expectation Confirmation Theory. According to this theory, post-purchase satisfaction is achieved when expectation meets perceived performance [113]. The students with a higher level of Zoom exhaustion and fatigue, in combination with financial difficulties that limited their access to ERT, in the context of the COVID-19 pandemic which aggravated and made uncertain all personal, social, and material supports of an individual (physical, mental, social, and financial aspect of support), were not satisfied with ERT, nor did they consider this form of teaching

sustainable, and that is why they constitute further generalization of the attitude about remote teaching, formed on the basis of the ERT experience regarding all forms of online teaching, including RT. It means that other elements of the Expectation Confirmation Theory (expectation, performance, and confirmation) have failed in this case and that, in the terms of instrumental conditioning, the previous negative experience was generalized, even regarding the structured forms of online teaching.

As can be seen in the model in Figure 11, all the analyzed factors of forming the attitude towards RT sustainability in non-pandemic (and generally towards regular teaching) circumstances are interdependent and intertwined. The students coming from poorer families and smaller environments are under a larger economic pressure during their studies, which imposes having a high GPA and the status of budget students, since the degree of their family financial support is insufficient. On the other hand, for example, the employed students of master's studies earn more and improve their socio-economic status, in which they, just as the poorer students, are helped by ERT. However, this help is not unambiguous: poorer students with unfavorable demographic conditions at the very beginning may have a problem in terms of the lack of devices and insufficient amount of fast internet necessary for attending ERT, which may have an unfavorable effect on their grades and, thus, on their GPA, scholarships, and survival, or transfer to budget financing. The lack of devices and sufficient amount of fast internet necessary for ERT attendance creates obstacles in attending ERT, which may act as a demotivating factor for its attendance, preference, and attitude toward the possibility of attending RT again in any form.On the other hand, ZEF is a direct consequence of this form of teaching. This model potentially indicates the complexity of the analyzed problem and reveals only part of the puzzle of the future organization of RT at universities, based on the experiences during the COVID-19 pandemic, which is the main cause of the introduction of ERT.

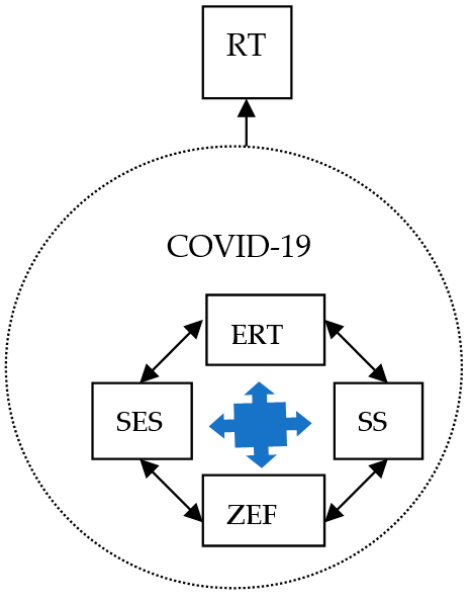

Figure 11. Model of interaction between ERT, Zoom fatigue, students' status, and socio-economic status.

On the other hand, it was not possible to make a comparison by gender because of the small number of male students enrolling in education faculties in the Republic of Serbia, although the previous research results pointed to the significance of gender differences in owning and handling digital equipment [114], and to the vulnerability in terms of mental health [44,88], e.g., the levels of ZEF in ERT attendance [91]. It would be interesting to make a comparison with the results concerning education faculty students in other countries

(modeled on the comparisons dominantly present in the fields of medicine and foreign language learning) and to compare the attitudes of the students from other scientific fields in the Republic of Serbia (who attended ERT in the pandemic period in bachelor's and master's studies) about these topics.

Moreover, although some research results suggested it, it transpired that there were no developmental differences in the attitudes towards ERT and ZEF in the developmental context operationalized through attending bachelor's and master's studies regarding digital literacy, which is in line with the results [115]. In addition, no differences were found in the attitudes towards ERT and ZEF in the developmental context regarding the level of stress during ERT despite various requirements and possibilities posed to the students by these two levels of studies, unlike other research [86,107], whose authors established that older students had reported a lower level of stress during ERT [107]. The results do not confirm the findings of Zagkos et al. [114], who established that stress caused by the digital and social divide was higher among younger students. However, the research results are in line with the results reached by Lee et al. [116], who did not find any difference in the level of satisfaction with ERT between these two groups of students.

Although some authors [61,72,102] suggest that the internet connection problem may be resolved by completely transferring ERT to an asynchronous form of teaching or by combining it with the synchronous one, as recommended by other authors, the question is at which price it is possible to do, having in mind that the synchronous form is the closest to the situation of F2F which takes place in the classroom conditions [23,109] and that there is a greater possibility of reducing the feeling of isolation and negative repercussions of keeping physical distance which in ERT turned into social distance [18], and that students in education faculties in Serbia emphasize exactly the lack of social interaction as the leading problem of ERT, in addition to digital inequality [22,23], and that they were able to attend both forms of teaching during the pandemic.

5. Conclusions

COVID-19 has already reshaped higher education in an unprecedented way. An important question is whether adaptations made during the crisis as temporary transitory mechanisms will become part of higher education forever and whether certain ERT solutions are sustainable in the long term within the context of achieving social justice in digital pedagogy, if ICT prerequisites have not been fulfilled, having in mind the relations between digital and social inequality. This is an important issue not only for students, but also for all stakeholders in the process of education (not only higher education), since many educators, teachers, and professors shared the same fate as their students regarding digital and social inequality. In Serbia, the teaching profession during the COVID-19 pandemic was among poorly paid professions, while teachers' salaries also varied depending on the number of classes and the faculties' own income, which is also one of the reasons why they did not have sufficient funds for the internet, devices, and improving digital competencies in the implementation of ERT. Higher educational institutions, on the other hand, relied solely on the existing resources in the realization of teaching: the existing IT staff simultaneously resolved the rising issues of ERT and IoT, supported only by commercial platforms and digital solutions in the implementation of ERT, both in synchronous and asynchronous forms of ERT implementation. In addition, the problem of sharing the internet and devices in large families and the difficulties in attending ERT because of having to care for the family members during the pandemic posed numerous challenges to students, teachers, and parents, including the issue of financial survival of the families with uncertain sources of income (while people's health and lives were constantly threatened).

However, it should not be forgotten that social inequalities precede and also remain as a consequence of ERT: long-term loss of knowledge can be further capitalized towards failure or other problems related to enrolling the following levels of education and, thus, adequate employment and success in the profession and income made in that way, which in the future creates opportunities for the reproduction of social inequality of the offspring and future generations and their lower quality of life. Therefore, we might conclude that the consequences of COVID-19 are numerous in all segments of life, such as ERT, and that they are here to stay. We need to find our way through collecting and analyzing data and experiences worldwideto make good solutions and creative ideas appear in ERT, sustainable in RT form.

Some of the future research about this topic might be directed towards other professions as well, particularly those with a gender balance, or STEM professions, which are still dominated by gender typification, especially in countries with a lower GDP, but with the application of RT and ERT. ERT was once again implemented in higher education in Serbia in the second half of 2025 because, during the students' protests lasting since November 2024, all faculty and university buildings had been seized, and the right to realize education was denied to the students who wanted to study, including the right to work of university professors and associates. Therefore, RT is being applied in Serbia once again, in its ERT version, and the acquired experience might be one of the directions of research in the following period.

The results of the presented research have a limited reach since the data were obtained solely from the experience of the female students of the education faculties. On the other hand, based on the experiences from previous epidemics, pandemics, and other natural disasters and social emergency circumstances, it is possible to find data that might contribute to the modeling of different protocols in establishing continuity of the educational process in order to overcome the loss of knowledge caused by the unpreparedness of educational systems worldwide to an adequate response in the pandemic circumstances, for each profession separately, especially regarding the simulation of various situations that might serve as a compensation for the inability to implement practical lessons, where the use of AI might be of great assistance.

In this context, ZF should also be seen as one of the possible consequences of the excessive digitization of everyday activities. It is not impossible that the further development of technology will lead to a more detailed clarification of the relationship between the synchronous RT form (not only video conferences, where this phenomenon was first observed) and ZF, and also to the discovery of new psychopathological phenomena resulting as a consequence of the man's biological predispositions not being in harmony with the requirements of the digital environment, having in mind that a high percentage of ZF variance is still unexplained both in this study and in most earlier studies. Furthermore, it should also be noted that the students' socio-economic status is a complex composite that is different not only at the individual level, the level of individual professions and social classes of a country, but also at the international level, and it is possible to be monitored via different parameters. That is why it is possible to replicate research by adding parameters within different social groups and worldwide, and to control multicollinearity of multiple socio-economic variables, and not only separatetheeffects of individual parameters.

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Informed Consent Statement: Informed consent was obtained from all the participants involved in the study.

Data Availability Statement: Data presented in this study are available upon request from the corresponding author. The data are not publicly available because they were collected solely for the purpose of scientific research.

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Abbreviations

The following abbreviations are used in this manuscript:

RT	Remote Teaching
ERT	Emergency Remote Teaching
ZF	Zoom Fatigue
ZEF	Zoom Exhaustion and Fatigue Scale
GPA	Grade Point Average
GDP	Gross Domestic Product

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