# QUALITATIVE INDICATORS IN THE E-LEARNING ENVIRONMENT

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**ABSTRACT**

Through preliminary analysis of the e-learning platforms authors have tested the presumption that during pandemics the quality of online teaching and accessibility of learning materials in online environment has increased. Relevant literature for the time period of pandemic points out numerous problems in teaching, but on the other hand technical and pedagogical advances in e-learning process for all stakeholders.
The research has been consisted of the quantitative indicators analysis within the e-learning system for the time period of several academic years (before and during the pandemic) and based on the survey on students EQF level 7 who already had some previous experience in e-learning at higher education level before situation with pandemic. The results indicate that students perceived very little increase in the quantity and quality of the learning materials. The research indicated a need for wider and further institutional support for teachers and students. The institutional support should encourage teachers in their motivation for achieving quality in e-learning performance regarding instructional design and also by building up their digital competences. The results have also pointed the fact that the models from the traditional environment, such as Course Quality Management model should be adapted and integrated in the e-learning environment in order to maintain quality assurance in e-learning performance.

## 1. INTRODUCTION

During the COVID-19 pandemics higher education sector has faced numerous problems and was forced to find ad hoc solutions. With the global closure of almost the whole educational sector, both school and universities (Kovalenko, O. E. et. Al., 2021), (UNESCO, 2020), teaching at higher education institutions did not stop. It was necessary to ensure the continuity of teaching literally overnight. Teachers had to move to an online environment and use the available tools, primarily videoconferencing systems, and teaching was mostly carried out using these systems at the beginning. E-learning or blended learning was in the majority of institutions and programs only and elective for teachers thus bringing only the highly motivated teachers into the e-learning environment. Those who have already used digital technologies and introduced e-learning in the teaching process had more easily designed teaching in an online environment that was already familiar to them. But those who resisted change faced a major challenge - which technologies to choose and combine and, at the end, how to use it (Banek Zorica, M. et. Al., 2021).

Pandemics has forced higher education institutions to shift their traditional teaching fully online. While large number of institutions had some sort of electronic learning environment these were not used as regular teaching environment. Therefore, instead of using e-learning the majority has started implementing emergency remote teaching and calling it e-learning. But there is a huge difference between those two concepts and for the general public, as Muthaprasad et al. (2021) "the questions about the preparedness, designing and effectiveness of e-learning is still not clearly understood. Thus, the question remain are teachers and students ready for the e-learning to take place.

Most of the universities and colleges were not prepared as they did not have any crisis strategies to act upon. The situation broadened the gap of technology affordance, and the digital divide was experienced more that in the pre-pandemic times. Institutions were struggling to support their employees and students with creation of guidelines, manuals, etc.

It is obvious that digital technologies will bring even greater changes in the next few years, from business processes to daily routines. Digital skills are becoming indispensable competencies that the labor market requires today. Education that prepares employees for this digital market is also changing attitudes towards 21st century skills development. The University, as the umbrella institution of higher education, is also expected to act proactively. Every university strategy presented today must have a clearly defined crisis response plan as well as a program and obligations for professional development of teachers for new ways of working for the process of evaluating students' knowledge and skills. As libraries are an infrastructure of education, then their transformation is necessary in accordance with the digital changes and the requirements of the digital concept of education.

Numerous papers published recently have been focused on the changes that the COVID-19 pandemic has brought into the education system, and most of them suggest a significant increase in digitization and quality of online teaching (Carvalho, P. 2022); (Zekanović-Korona L. et. al. 2022); (Salman, E. et. al. 2022); (A. Fornasari, A. et. al. 2022); (Mazzola, R. et. al. 2022); (Somolanji Tokić, I., 2022); (Alhazzani, N. 2022); (Ferragut, C. 2022); (Gonçalves, J., 2022).

EU guidelines for digital transformation that define competences frameworks such DigiCompEdu and DigiCompOrg that should improve the quality of HEI in the context of digitalisation e.g., DigiCompEdu with its proposed progression model intended to help educators understand their personal strengths and weaknesses, by describing different stages or levels of digital competence development have also been considered (Kampylis, P. et. al. 2015).

All the mentioned elements contribute to the e-learning process improvement regarding all stakeholders. Hence, the authors were interested in making a kind of milestone in relation to external guidelines and indicators as the reference point to the objective state of the art on one of the study programme.

Since certain higher education institutions even before the pandemic had to have license to conduct online and/or blended forms of teaching, meet and fulfil certain material, organisational and technical conditions, we have decided to conduct a short preliminary research to determine whether there really is any significant progress in the terms of the amount of published learning materials in the online environment and whether that material is perceived as the one with higher quality.

As emphasized by the (Kovalenko, O. E. et. Al., 2021) a recent study identified the high-impact principles for online education and among them are the important two: to conduct quantitative and qualitative research and evaluate current models of online teaching and learning, with a particular focus to their long-term sustainability; develop staff–teachers' capacity for online teaching, and professional staff capacity for supporting teachers and online systems (Zhu X. et. al., 2020). These two should be worked upon if we want to enable the sustainability of the e-learning or blended learning environments and enable digital transformation of higher education institution. Furthermore, we need to develop and apply indicators of the quality of the online courses and programs in order to obtain complete and objective information about its effectiveness. We also need to investigate the perceived importance that stakeholders' place on each of these quality indicators.

## 2. QA IN E-LEARNING ENVIRONMENT

Most higher education institutions experienced a shift from elective blended learning to crisis remote teaching. The question of instructional support and knowledge about the e-learning principles has arisen. The question of teaching quality assessment developed for traditional face-to-face environment has risen. Can we implement the same assessment designed for the traditional environment and what kind of results would we receive? Further step should be modification of those instruments and it testing in the fully e-leaning or blended learning environment.

The evaluation of the teaching and learning process is usually done by the quality control surveys which are a valuable tool in quality management. Quality control surveys are the first step that allows identification of areas of teaching quality which should be improved (Pavlina, K. et. Al., 2011). Major problem with existing quality management models is long quality control period, where surveys are usually conducted at the end of

semester. Because of this, improvement of teaching is experienced by the next generation and the students rarely receive any feedback about actions taken to improve the quality of teaching. The Course Quality Management model (Pavlina, K. et. Al., 2009) thus focuses on the continuous evaluation during the teaching period and enables the quality control at the lowest level, which is the level of teaching topic. It is a dynamic quality control, which allows improvement of teaching practices during course execution within the same academic year. Due to its dynamic quality control and easy adaptability in the e-learning context this model could help in improving the quality of the teaching in the higher education institution.

Our preliminary research has confirmed that in order to increase the quality of the learning content and teaching form the student's perspective we need to change the quality assessment. As quality management should integrate constant evaluation as well as evaluation of specific topics and should be further applied to all the stakeholders of the e-learning environment.

# 3. METHODOLOGY

The research was conducted based on the online questionnaire containing 15 questions posed to undergraduate and graduate students attending state founded or private studies. In the questionnaire, students were nominally offered a scale of 5 possible answers to rank their impressions, from extremely negative (grade 1) to extremely positive (grade 5). The questions were created in a way to get their general opinion and assessment on the effectiveness of different performance types regarding e-learning; 1) fully online via MS Teams or Skype etc., 2) in person – teaching in the classroom with support of LMS and learning materials (hybrid) and 3) in person - teaching in the classroom with parallel live stream via MS Teams or Skype. The quantitative and qualitative perception of these types were especially sought and compared for the time before and during the Covid 19 pandemic.

The questions in the survey questionnaire were formulated according to the quantitative-qualitative hypotheses on student perception for e-learning. Corresponding hypotheses were accepted or rejected using a t-test with 5% significance level.

# 4. RESULTS

The first hypothesis was: "The number of courses in the study program that have some form of support for e-learning during the Covid 19 pandemic is significantly higher compared to the number of courses that had some form of support for e-learning before the Covid pandemic 19". With the aim of measuring students' perception of e-learning support before the pandemic compared to e-learning support they had during the Covid 19 pandemic, students were asked the following questions:

1. *Please, try to estimate the percentage of courses in the previous study years ending with 2018/2019 (in overall) where you had some form of e-learning support. Approximately how many courses in % were there?*
2. *Estimate the percentage of courses in previous academic years during the pandemic (2020/2022 in overall) where you had some form of e-learning support. Approximately how many courses in % were there?*

Respondents were offered following answers: *0-20% of courses, 21-40% of courses, 41-60% of courses, 61-80% of courses, 81-100% of courses.* If, the answers belong to 0-20% of the course, ..., 81-100% of the course, we evaluate numerically with grades from 1 to 5, the observed hypothesis can be written as H1: $\mu_1 < \mu_2$. More precisely, the corresponding hypotheses are:

H0: $\mu_1 \geq \mu_2$

H1: $\mu_1 < \mu_2$

As seen in the Figure 1. The majority of the students (N=8) chose the lowest response or 0-20% of the courses meaning they did not perceive there were many online courses. Only one student perceived that there were 81-100% of the courses while the rest of the responses has the similar number of respondents (N=3).
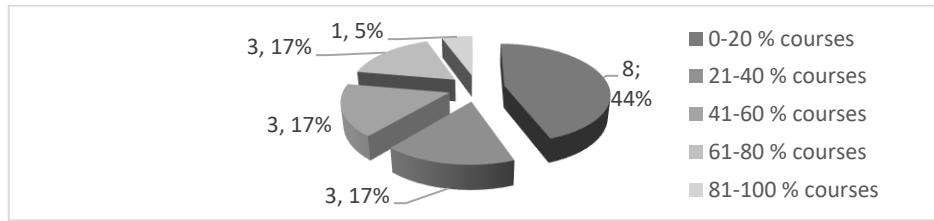
Figure 1. Distribution of students' answers on the 1st question

So when examining the next question (Figure 2) and the improvement on the number of courses we can see that the majority of the students (N=15) choose last two categories or the highest number of courses (61-80% of courses N=7; 81-100% courses N=8). Only one student chose 2nd option, and two students chose 3rd option.
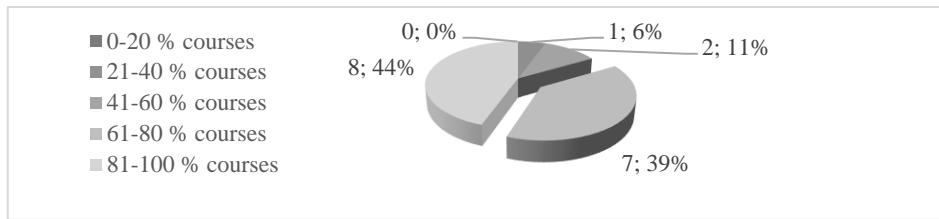


Figure 2. Distribution of students' answers on the 2nd question

If we compare the data of the observed sample on the number of courses that had support in some form of e-learning during the pandemic, where 15 out of 18 students declared that more than 60% of the courses had support, compared to the time before the pandemic, where only 4 of students stated that more than 60% of the courses had support, it is evident, according to the perception of the students who answered the above questions from the survey questionnaire marked 1 and 2 in the paper, that the number of such courses increased significantly during the pandemic. We will confirm this thesis with a t-test and significance level with a probability of 5% error at the level of the entire student population EQF level 7 who had some experience with e-learning before and during the pandemic.

We will evaluate the corresponding answers from 0-20% of the course, ..., 81-100% of the course numerically with grades from 1 to 5, and based on the students' statements, we get the given average grades $\overline{x_1} = 2{,}22$, $\overline{x_2} = 4{,}22$, with associated variances $s_1^2 = 1{,}83$, $s_2^2 = 0{,}77$. To be able to perform a t-test we have to check the equality of standard deviations; therefore, we set-up hypotheses:

H0: $\sigma_1 = \sigma_2$
H1: $\sigma_1 \neq \sigma_2$

We want to confirm the hypothesis H0 with a significance level of 5%. We count:

$$F = \frac{s_1^2}{s_2^2} = \frac{1{,}83}{0{,}77} = 2{,}38.$$

As the $F_{0.05}^{(d)} = 2{,}67$ and $F_{0.05}^{(l)} = \frac{1}{F_{0.05}^{(d)}} = \frac{1}{2{,}67} = 0{,}37$ we conclude: $2{,}38 = F \not< F_{0.05}^{(l)} = 0{,}37$,

regarding $2{,}38 = F \not> F_{0.05}^{(d)} = 2{,}67$, i.e., $F$ is neither in the left nor in the right critical region, therefore we accept the hypothesis H0 – therefore, at a significance level of 10%, the standard deviations are equal. Now, we can perform the corresponding t-test. For that purpose, we count

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} = \frac{(18 - 1) \cdot 1{,}83 + (18 - 1) \cdot 0{,}77}{18 + 18 - 2} = 1{,}3,$$

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{2{,}22 - 4{,}22}{\sqrt{1{,}3 \cdot \left(\frac{1}{18} + \frac{1}{18}\right)}} = -5{,}26.$$

Because $t_{0.05} = 1,69$, follows $-5,26 = t < -t_{0.05} = -1,69$, i.e. $t$ is in the critical region, therefore we reject the hypothesis H0, that is, we accept the hypothesis H1($\mu_1 < \mu_2$); we conclude, with a significance level of 5%, according to student's perception, the number of courses that have some form of support for e-learning during the Covid-19 pandemic is significantly higher compared to the number of courses that had some form of support for e-learning before the Covid 19 pandemic. Furthermore, by comparing the quantitative indicators of the number of courses in the subject study that list and/or have access to literature within the e-learning system, i.e. generally have published teaching materials, it's evident that there were incomparably more such courses during the Covid-19 pandemic. We can conclude that students' perception was that there were more e-courses offered to them.

Next, we focused on the learning content and student's perception of the quantity and quality of the published materials offered to them through the e-learning system. This was important to gather feedback if students' felt they had enough materials to be able to study and learn in the similar matter as in the face-to face environment. On the observed sample, we examined students' perception of the number and quality of published teaching materials before and during the Covid-19 pandemic. To evaluate the amount of teaching materials offered to them, the students were asked the following question:

3. *Is there a difference in the amount of published teaching materials in the e-learning systems before and during the pandemic (you are free to estimate)?*

They were offered following answers numerically marked 1-5: *Significantly less was published; Less was published; Everything remained about the same; More was published; Significantly more was published.* Hence, according to the quantitative indicators, we set-up hypothesis: during the Covid 19 pandemic, more or significantly more teaching materials were published in the e-learning system compared to the time before the Covid 19 pandemic. As previously, we marked the offered answers, numerically in order from 1 (Significantly less was published) to 5 (Significantly more was published), the observed hypothesis is $\mu \geq \mu_0 = 4$.

More precisely, the hypotheses are:

H0: $\mu \geq \mu_0$
H1: $\mu < \mu_0$.

We will test the hypothesis H0 with a significance level of 5%. Based on the observed sample (Figure 3.) the majority of the students (N=11) did not experience any improvements in the quantity of materials and chose the answer "Everything is approximately the same" while only the minority felt the improvements. Four students felt that there were more published materials while 3 students felt there is a significant increase in the published materials.
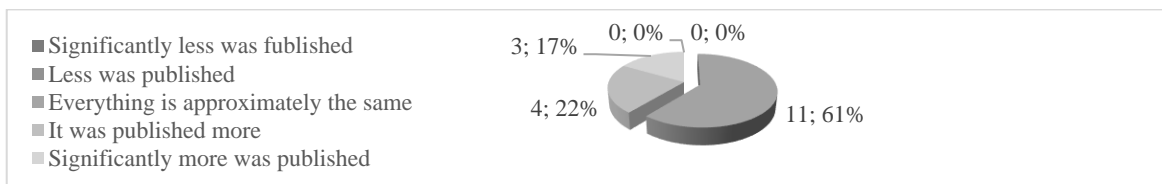


Figure 3. Distribution of students' answers on the 3rd question

Considering that the majority of the respondents, 11 out of 18 of them, answered (question 3) that the amount of published materials in e-learning systems during the pandemic remained approximately the same compared to the time before the pandemic, according to the students' perception, it is to be expected that the amount of published material in e-learning systems during the pandemic did not increase significantly. We will check this thesis at the level of the entire population with a t-test and a significance level of 5%.

According to the student's answers, we get an average grade $\bar{x} = 3.56$ and a standard deviation $s = 0.78$. As it follows:

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{3,56 - 4}{0,78/\sqrt{18}} = -2,39 < -1,74 = -t_\alpha,$$

we reject the hypothesis H0, i.e., we accept the hypothesis H1. Therefore, with a significance level of 5%, we conclude that, according to the students' perception, during the Covid 19 pandemic, no more or significantly more teaching materials were published in the e-learning system compared to the time before the Covid 19 pandemic.

Finally, we examined the students' perception of the quality of published teaching materials during the Covid 19 pandemic in relation to the quality of published teaching materials before the Covid 19pandemic. For this purpose, students were asked the following question:

4. *Is there a difference in the quality of published teaching materials and the quality of teaching in e-learning systems before and during the pandemic (your free assessment)?*

They were offered the following responses: Significantly lower quality material was published; Lower quality material was published; Everything else remained approximately the same; Higher quality material was published; Significantly higher quality material was published. We posit the expected hypothesis: during the Covid 19 pandemic, the teaching materials published in the e-learning system are higher or significantly higher quality compared to the teaching materials published before the Covid 19 pandemic. Again, we will mark the offered answers, numerically in order from 1 (Significantly lower quality material was published) to 5 (Significantly higher quality material was published). Now, the expected hypothesis is $\mu \geq \mu_0 = 4$. More precisely, hypotheses are:

H0: $\mu \geq \mu_0$

H1: $\mu < \mu_0$.

We have tested the hypothesis H0 with a significance level of 5%. On the basis of the observed sample, (Figure 4.) again the majority of the student (n=14) chose the everything remained and three students perceived that the published materials were of higher quality. Still, one student perceived the quality of the teaching materials of the lower quality.
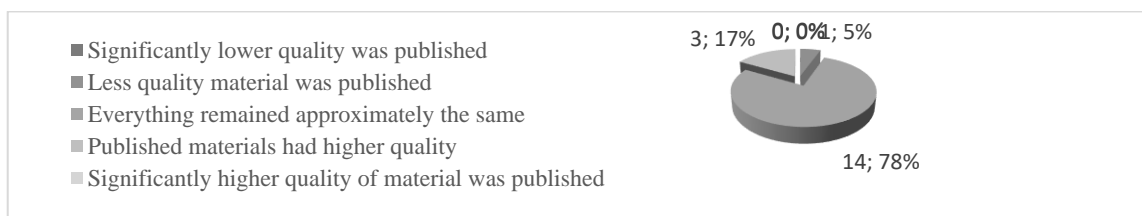


Figure 4. Distribution of students' answers on the 4th question

Similarly, both in terms of quantity and quality of published materials in e-learning systems during the pandemic and according to the perception of students who took part in the survey questionnaire and of whom as many as 15 out of 18 answered (question 4.) that the quality of the published materials in the e-learning system remained the same or that the published material had lower quality compared to the materials before the pandemic, again, it is to be expected at the level of the entire population that the quality of the published materials in the e-learning systems hasn't increased during the pandemic. We will check this thesis with a t-test and a significance level of 5%.

According to the student's answers, we get an average grade $\bar{x} = 3.11$ and a standard deviation $s = 0.47$. As it follows:

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{3,11 - 4}{0,47/\sqrt{18}} = -8,03 < -1,74 = -t_\alpha,$$

we reject the hypothesis H0, i.e. we accept the hypothesis H1. Therefore, with a significance level of 5%, we conclude that, according to students' perception, during the Covid 19 pandemic, the teaching materials published in the e-learning system are not higher or significantly higher quality compared to the published teaching materials before the Covid 19 pandemic.

Limitations of the study is the smaller number of respondent as well as focus on one institution. Still, it shows that there is a difference between quantitative data and the students perception. We have identified the problem that should be further researched, and it should encompass various institutions. Furthermore, evaluation should take into account the institutional support for teachers, developing their motivation for participating in e-learning, as well as the continuous professional development of the teachers in the e-learning pedagogy and digital competences.

# 5. DISCUSSION

Starting from the presumption of increase in the quality and performance of teaching in the online environment during the pandemic period we conducted preliminary research of the e-learning platform and students' perception of the e-learning environment. In order to compare the efficiency and usefulness of the e-learning platform before and during the pandemics we have conducted short preliminary research on a smaller study program level 7 EQF/HKO.

We tested the quantitative aspects such as the number of courses and the amount of the teaching materials on the one hand, and the qualitative aspects such as student perception of the quality of teaching materials. For this preliminary research the following hypothesis were formulated and tested:

1. The number of courses in the study program that have some form of support for e-learning during the Covid 19 pandemic is significantly higher compared to the number of courses that had some form of support for e-learning before the Covid pandemic 19.
2. The amount of the teaching materials in the e-learning system in 2020/2021 has not significantly increased compared to the previous years.
3. The quality of published teaching materials during the Covid 19 pandemic in relation to the quality of published teaching materials before the Covid 19 pandemic.

The respondents were the students who have previous experience in studying before the pandemic. We have chosen a study program on the master's level that has a smaller number of enrolled students to gather better feedback and reliable responses from the whole group participating in the program. The number of respondents was N: 18 out of a total of 24 students enrolled. We were focused on their perception, i.e. whether they think that the number of published materials has really increased and whether these materials have better quality. An online questionnaire was conducted with numerous questions, only some of them have been presented in this paper.

Prior to the questionnaire, the analysis of the quantitative elements published in the e-learning system for the academic years before the pandemic 2017/2018 & 2018/2019 and after the pandemic in 2020/2021 & 2021/2022. The results of the analysis showed that the amount of teaching materials in the Moodle LMS e-learning system for that study programme has not increased significantly compared to the years before the pandemic. As students are not familiar with the information about total number of courses or the increase in the numbers it was interesting to see how they perceived the e-learning platform and its content. This could serve as a starting point for the analysis based on the objective and subjective evaluation or student perception.


# 6. CONCLUSION

According to the quantitative indicators, during the Covid 19 pandemic, the number of courses that had some form of e-learning support increased significantly. Despite that and also compared to the time before the pandemic, according to student's perception, the increase in publication productivity or significant impact on teaching materials production was not noticeable. In particular, according to the qualitative indicators, this have not resulted in newly published teaching materials in the time of pandemic that were higher or significantly higher quality compared to those published before the period of pandemic. Therefore, based on the conducted preliminary research, it undeniably follows that by increasing the number of online courses during the Covid 19 pandemic, quality of the teaching process and learning materials in the e-learning environment has not increased compared to the period before the pandemic.

In order to assess the quality of the e-learning content we need to integrate evaluation during the period of course teaching in order to get instant feedback from students. As the increase of the learning materials and number of courses is growing we need to develop guidelines and help both teachers and students in the process of evaluation setting out QA indicators for permanent monitoring.

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