Digital propensity among academia members towards E-learning: a Romanian university case study

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Abstract. *The aim of our study is to study the propensity of teachers and students on the continuous use of digital resources post-pandemic, based on the experiences of the lockdown time. We discovered that this special transformation led to a "forced innovation" situation explained by a rethinking and reinventing of learning paths, as we intended to map this ongoing phenomenon. Our results show that UMPhST members have medium digital propensity level therefore have interest and initiatives to use E-learning systems after the pandemic. This study marks a starting point for developing a digital propensity index applicable in academic field.*

Keywords. Digital transformation; digital propensity; online education; Romanian university; COVID-19 pandemic.

1 Introduction

The pandemic with the new coronavirus (COVID-19) has affected higher education institutions worldwide. The measures taken by the authorities and implementations at organizational level led to rethinking the way university courses should be designed and delivered to meet the current required skills in the labor market in an increasingly digitized world. Government officials and researchers were concerned that the mass movement of people could contribute to the spread of the disease (Hâncean et al., 2020).

In recent centuries, pandemics (eg Spanish flu, SARS, influenza, etc.) were accountable for many changes in geopolitical and demographic aspects by changing migration, urbanization, trade and technology use patterns (McMichael, 2004). The COVID-19 pandemic generated an unprecedent education crisis (Education-International, 2020) that nobody expected. Educational institutions closure affected millions of pupils and students around the world, the effects of which have not yet been accounted. A few months after the outbreak of the new pandemic, it became clear that this crisis created by the coronavirus and its many consequences on all levels will extend over a long period of time, thus affecting our lives. The challenges created by COVID-19 will generate problems related to the well-being of all groups in society, both nationally and globally (Brooks et al., 2020).

Educational institutions are central points of social activities and interactions. During online education, activities based on social interaction are significantly diminished, which can affect the development of interpersonal relationships among children and young people (Adnan & Anwar, 2020).

In universities there are various devices available with innovative tools for teachers to initiate learning for students, which are a fundamental pillar of community development (Barr & Miller, 2013).

Romanian universities switched to online education in a very short period, using their own or purchased resources. This rapid transition from on-site to online education has been a challenge for both students and teachers. In contrast, once implemented, online education has proven to have some strengths, which can contribute to the revolution of the education system, at least in the case of higher education. According to a study conducted by Edelhauser & Lupu-Dima, (2020), most Romanian universities have

implemented E-learning platforms such as Moodle, or provided by Microsoft or Google. Thus, imminent actions for the digital transformation of higher education have been carried out, being considered opportunities to continue in a hybrid learning system, combining classical learning (face to face) with online learning (through E-learning platforms) or even at giving up classical education for certain study programs.

The recent transformations of our society will make a shift in the evolution of education, but the digital transition rely on the propensity of actors towards new technologies.

Thus, through this paper we intend to identify the digital propensity for using the E-learning solutions implemented during COVID-19 pandemic even after this uncertain period of the main actors involved in the educational process in a Romanian university: academic staff and students.

The term *propensity* is widely used when referred to the inclination of a person or group of individuals to act in a specific manner (Cambridge Dictionary, 2021). Regarding *digital propensity*, this is a growing in popularity expression that can be used in combination with digital literacy or digital maturity of individuals or digital maturity index to "*measures the degree to which people use or could use information and communication technology (ICT) in their everyday lives"* (Nasah et al., 2010; Seok & DaCosta, 2017a, 2017b) and this index could be correlated with many demographic variables or socioeconomic status (Haddon & Silverstone, 2016).

In the context of the COVID-19 pandemics, where online education was rapidly implemented as an alternative solution, we identified few studies on the digital propensity of academia members. Thus, we consider our study a starting point for providing a calculation model for digital propensity towards e-learning activities after this pandemic end that can be widely applied on the academic field. As an innovative approach, we defined six dimensions we considered important and sufficient for measuring digital propensity and, with the help of scoring method, we successfully determined the digital propensity score for academia members.

Our research is focused on a case study conducted on „George Emil Palade" University of Medicine, Pharmacy, Science and Technology of Targu Mures, Romania (UMPhST). As long as we could not identify a tested model in the Romanian literature regarding digital propensity, the aim of our research is to determine the *digital propensity level/score* registered by the academic actors towards the use of online education solutions even after the completion of the COVID-19 pandemic. Then, through a comparative approach, we identify the perspective of both students and academic staff towards adopting E-learning solutions for face-to-face courses for each Faculty.

The main questions of this research paper are:

- What is the digital propensity level/score registered by academic staff and students both at faculties level and university level?
- Which academic actors (academic staff vs students) register a higher digital propensity score/level and are more open for further use of E-learning facilities at face-to-face courses?

Next, we built a scoring model for measuring digital propensity of academia members towards further usage of E-learning solutions, combined with traditional courses. We then applied this scoring model to UMPhST, demonstrating that our model is suitable for further applications in the academic field. As far as we have knowledge, this study is the first such study applied nationally in academic field and can be extended to other fields.

The main findings of our case-study are that UMPhST members register a medium digital propensity level. This means that they have interest and initiatives to use E-learning systems after the pandemic, but they need more support from organizational perspective.

The paper is structured as follows: in section 2 we identified some of the most important challenges encountered during online education system implementation; in section 3 we presented our research methodology approach; in section 4 we underlined our research results; in the last section we concluded, emphasizing the need for further related research.

2 Online teaching challenges

E-learning activities become the core activity of educational institutions even for those who never practiced this before. A major impact was observed in Medical Education field, especially where the presence of students is crucial in hospitals and laboratories (Kumar et al., 2021; Prezotti et al., 2021). Other university programs were also influenced by the pandemic lockdown, but the educational institutions adapted to new challenges and had successfully implemented E-learning solutions to meet the new requirements in the context of a risky pandemic. Online learning and collaboration solutions implementation were the core activities for most of the education institutions' management.

During these times of uncertainty, higher education institutions around the world are moving to online learning programs or distance education. This indicates the alignment of skills that students should learn in the online format. Also, teaching staff need to organize the course content and learning methods according to the new way of teaching, so that students do not feel isolated during this remote learning process. Therefore, proper knowledge and skills of teachers as well as ICT equipment are required (Ali, 2020; Khan, 2020).

For some universities online teaching is not a novelty, unlike others, for which this form of teaching

was first encountered. The transition has been swift, and universities were faced with insufficient time to properly organize the online teaching process. Nevertheless, universities' management should focus on improving the quality of online teaching in these new circumstances.

For achieving the educational objectives during online learning, is assumed that teachers must quickly acquire proper digital skills in planning, implementing, and evaluating the performance of their students. Relevant training courses can help teaching staff to effectively implement the courses through electronic channels. Teaching staff training can improve student learning and facilitate the achievement of learning objectives of higher education institutions(Ludeman et al., 2009), with minimal impact on students' social behavior.

Regarding the academic life of students, it is important to have the different types of remote (home) infrastructure needed to ensure effective study; together with the ability of students to use the devices for online learning. Universities have developed a set of measures to standardize learning among students, regardless of their background, by creating financial support campaigns for students who do not have the financial resources to purchase electronic devices for online learning or by opening campuses to accommodate students in order to facilitate the learning process.

Universities, although faced with multiple challenges during this period of uncertainty caused by COVID-19, have complied and rapidly implemented a functioning education system at the institutional level. The immediate movement and the adaptation of the education system to the needs of the specializations of each Field of Study led to a good development of the didactic activities, thus being able to successfully conclude a university year. It was found that, once implemented, this online system can still be used to attract more students to the curricula already available. Moreover, our university (UMPhST) have already announced that they intend to organize new lines of study and / or distance learning courses for practitioners, and more (George Emil Palade" University of Medicine, Pharmacy, Science and Technology of Targu Mures, 2020). It follows that the current period has been a starting point for the development of online education, and universities can accelerate their response to lifelong learning for all stakeholders.

In this new context, an innovative way of interaction, communication and work arise between pupils / students (as well as their parents) and teaching staff. The challenges posed by the closure of schools and universities can also be seen as opportunities to learn and reshape traditional educational roles and practices.

3 Research Methodology

This paper represents the second part of a questionnaire-based research which has started in 2020 as a response to the Microsoft Teams platform implementation as the main E-learning platform of UMPhST. Our university is composed of five faculties, as follows: Faculty of Medicine, Faculty of Dentistry, Faculty of Pharmacy, Faculty of Economics and Law, Faculty of Engineering, and Faculty of Science and Letters. These faculties cover various fields of study, such as: medicine, business, pharmacy, social sciences and humanities. The data was collected through an online survey applied during the second quarter of 2020 academic year. The target group was consisting of 700 teachers and 10000 students regardless their study program or their university teaching cycle (bachelor's or master's). Our final sample is composed of 1489 responses of which 222 responses belong to teaching staff and 1267 responses belong to students.

The initial purpose of the survey was to identify the digital readiness of actors involved in E-learning implementation at UMPhST and found that after the first six weeks of the E-learning platform implementation the members of academic community already gained significant digital competences to cope with the online teaching system (Ciucan-Rusu et al., 2020). Beside digital skills of users identified in the study, we could assess their propensity towards online teaching activities in post-pandemic times.

The staring research instrument used was the questionnaire. From the applied survey we extracted key questions to form six dimensions in order to accurately express the level of digital propensity of academic actors for post-pandemic education by adopting E-learning solutions as complementary tool for face-to-face courses. To each question (dimension), the respondents could choose an answer marked from 1 to 5, where 1 means "total disagree" and 5 "total agree". The six dimensions (D) formed though this methodology are:

- *D1: The effort required in the E-learning system is significantly higher than in the classic one*; - we assume that the greatest the effort required for online education process is, the lower the enthusiasm to further use it for face-to-face courses in post-pandemic times. For this, D1 is an important dimension to measure digital propensity for online education solutions.
- *D2: The platform can be further used for collaborative work with colleagues in other projects*; - we assume that the generous collaborative space offered by big companies as Microsoft, Google or others, facilitates group projects or other collaborative works. For this, D2 is taken into consideration for digital propensity score/level determination.

- *D3: E-learning could completely replace face-to-face courses*; - this dimension was formed to understand the vision of students and teachers regarding future perspective of learning activities and included it in the digital propensity score/level calculation.
- *D4: The E-learning system can be adapted according to each field of study's requirements*; - this important dimension is considered for digital propensity score/level determination as it helps validating the responsiveness of E-learning system to user requirements. This dimension is considered to impact the most the overall digital propensity score of the faculties as some study of fields mostly require on-site activities like laboratories or clinical/pharmaceutical study trials.
- *D5: E-learning platform generally meets students / teachers' expectations*; - we assume that the higher the personal satisfaction of this type of education, the higher the propensity for continuing the use of E-learning systems for further teaching/learning activities. Therefore, this dimension is important for scoring the propensity.
- *D6: E-learning platform could be further used on face-to-face courses*; - we use this dimension as a control-dimension where we aim to validate the previous responses. This dimension will straight the previous results regarding replacement of face-to-face courses but would also express the readiness of respondents to combine the conventional and digital methods in further education activities. For this, D6 is also considered when determining the digital propensity score/level.

The most valuable outputs of this paper are considered the Digital Propensity Score (DPS) and Digital Propensity Level (DPL), as these outputs are unique, as far as we have knowledge, at least in Romanian academic literature. DPS was calculated as sum of means for each dimension, while DPL is defined as "low", "medium" or "high". DPS is calculated on dependence of each dimension and has values between a minimum of 6 and a maximum of 30, as follows:

$$DPS_i = \sum_{1}^{6} \overline{D}_i$$

where:

DPS_i = overall digital propensity score obtained for each academic actor (teacher or student);

i = academic actor (respondent: teacher or student);

$\overline{D}_i$ = the average score (between 1 and 5) obtained for each academic actor for each dimension;

$\sum_1^6 \overline{D}_i$ = the sum of scores of all six dimensions included.

DPL is determined in dependence on DPS values. Based on classic scoring method (widely used in various academic fields), we fit DPS into three intervals in order to determine the level of digital propensity (see Table 1). The intervals defined by research team are:

- Scores (DPS) between 6 and 14 fit into the "low" level of digital propensity. If DPL is low, then the respondents do not have propensity to use E-learning systems for further educational activities.
- Scores (DPS) between 14 and 22 fit into the "medium" level of digital propensity. If DPL is medium, then the respondents have interest and initiatives to use E-learning systems in further educational activities.
- Scores (DPS) between 22, and 30 fit into "high" level of digital propensity. If DPL is high, then the respondents manifest a strong digital propensity for further educational activities and perhaps this category is fully prepared for digital changes.

Table 1. Digital propensity level evaluation

DPS	6<= DPS<=14	14< DPS <=22	22< DPS<=30
DPL	Low	Medium	High

Source: authors' own projection

The tools used during this research are as follows: Microsoft Forms was used to build and apply the survey among UMPhST students and academic staff, thus, collecting data through online channels from our responders; Microsoft Power Business Intelligence Desktop Application was used both to process the data and for data visualization.

4 Results and discussions

As our respondents are currently enrolled in study programs or are teaching staff from all faculties of UMPhST, we assume that our study results are relevant for all main study fields: medicine, engineering, humanities and social sciences. The percentage of respondents (students and teaching staff) are presented for each field of study in the second column of Table 2 (Faculty members in %). Table 2 presents the results obtained by a part of our questionnaire - dimensions previously described.

Table 2. Overview of the sample structure

Faculty	Faculty members	D1: The effort required in the E-learning system is significantly higher than in the classic one	D2: The platform can be further used for collaborative work with colleagues in other projects	D3: E-learning could completely replace face-to-face courses	D4: The E-learning system can be adapted according to each field of study's requirements	D5: E-learning platform generally meets students / teachers' expectations	D6: E-learning platform could be further used on face-to-face courses
Business and Law	**15,85%**	**3,81**	**3,88**	**2,35**	**3,91**	**3,99**	**3,70**
Teaching Staff	1,88%	4,29	4,14	2,21	4,11	4,25	3.89
Student	13,97%	3,31	3,61	2,48	3,70	3,73	3,50
Dentistry	**18,20%**	**3,66**	**3,79**	**2,19**	**3,19**	**3,92**	**3,41**
Teaching Staff	1,61%	4,04	4,00	2,00	3,33	4,13	3,46
Student	16,59%	3,27	3,57	2,38	3,04	3,71	3,36
Engineering and IT	**9,00%**	**3,93**	**3,90**	**2,18**	**3,13**	**3,51**	**3,39**
Teaching Staff	1,61%	4,50	4,17	1,92	3,25	3,71	3,63
Student	7,39%	3,35	3,63	2,43	3,00	3,31	3,15
Humanities	**5,65%**	**3,62**	**3,54**	**2,22**	**3,50**	**3,87**	**3,30**
Teaching Staff	2,22%	3,94	3,97	1,94	3,45	3,91	3,70
Student	3,43%	3,31	3,12	2,51	3,55	3,84	2,90
Medicine	**43,46%**	**3,33**	**3,81**	**2,17**	**3,36**	**3,84**	**3,53**
Teaching Staff	6,25%	3,78	3,90	1,81	3,34	3,86	3,59
Student	37,21%	2,88	3,72	2,54	3,38	3,83	3,47
Pharmacy	**6,51%**	**3,81**	**3,74**	**1,99**	**3,23**	**3,71**	**3,25**
Teaching Staff	1,14%	4,06	4,18	2,00	3,53	3,82	3,47
Student	5,37%	3,56	3,30	1,98	2,94	3,61	3,03
Overall	**100,00%**	**3,69**	**3,78**	**2,18**	**3,39**	**3,81**	**3,43**

Source: Authors' own projection

By analyzing the second column of the Table 2 we notice that a high percentage of respondents (43,46 %) follow a bachelor's or master's program within the medicine field of study, being followed by the respondents of the dentistry (18,20%) and of the business and law (15,85%), while the respondents from the humanities field of study register a percentage of only 5,65% of the total respondents that make up our sample. These percentages are representative for our study as they reflect the real distribution of the students, with the medicine currently having the most students enrolled, while the humanities field of study has the lowest number of students in the entire university.

Also, in the Table 2, if we take into consideration the field of study of the respondents regardless their position (student or teaching staff) by overall results, the replacement of face-to-face courses with online courses is the less rated dimension among the members from different fields of study, and the lowest grade is given by Pharmacy members. Other dimensions don't represent big differences but is significant for us to understand that Pharmacy members also rated the highest effort in E-learning system implementation. The same case is available for Humanities members, lowest score for replacement of face-to-face courses and highest for the effort needed for online courses. These results may be expected as Pharmacy and Humanities activities mainly consists in human interaction, conducting experiments or field of studies, which are hard to replace with E-learning solutions in this early stage of E-learning activities implementation. Figure 1 illustrates the innovative digital propensity score results for both teaching staff and students, calculated by applying the methodology described in the research methodology section. The results show us that the students are not as sure as teachers regarding integration of E-learning tools in classic courses or other UMPhST organizational activities, regardless the faculty. The highest score obtained is 196 achieved by teachers from Business and Law faculty.

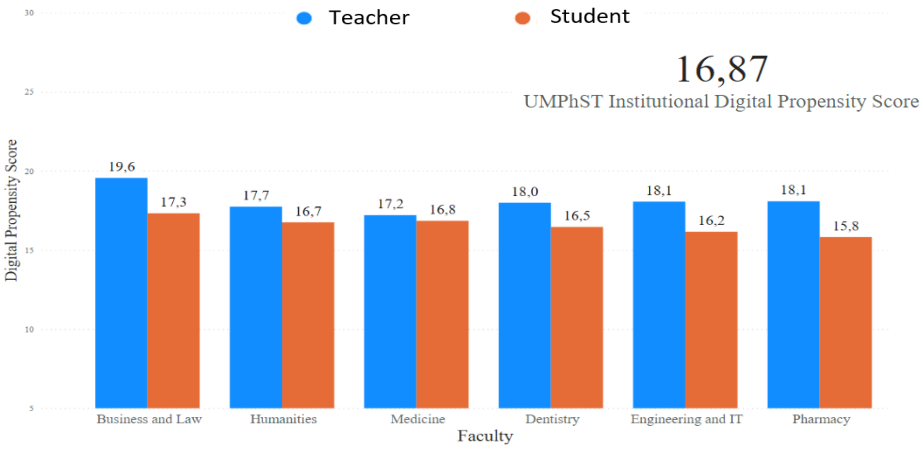

Figure 1. Digital Propensity Score
Source: Own projection

The lowest DPS is achieved by students from Faculty of Pharmacy of 15,8. Mostly of these students think that face-to-face activities are more efficient in order to prepare them for their professional lives, as they need to experience specific operation during their teaching activities like interacting with different drugs and substances (laboratory work) or interacting with different objects that help forming professional skills.

The DPS obtained at level of faculties like Engineering and Dentistry, where interaction is crucial in learning process, is also under the mean (university) score - 16,87 – but situated in the medium level of digital propensity. The same score we expected from medicine students, but despite the COVID – 19 pandemics, their practice did not stop, so they did not feel the lack of interaction like other students.

From results presented in Table 2 and Figure 1 (orange columns), we can assume that the students are undecided regarding using the digital solution in their daily learning activities, even if they did not consider they put a greater effort into online activities and even if they tend to like the idea of total replacement of face-to-face courses with online courses.

From Figure 2 it is noted a visible difference between students and teachers regarding responses for D1 and D3. While students are more likely to replace face-to-face courses with online courses, we found that teachers do not think the total replacement of traditional courses is beneficial for students as future professionals, thus minimum rating this dimension. Regarding the effort required in the E-learning system implementation perceived by Teachers is bigger than effort perceived by Students. This mean that transition to E-learning were easier for students than for teachers. This result may be expected as teachers put a greater effort in transforming their teaching content in a manner that is *online environment friendly*.

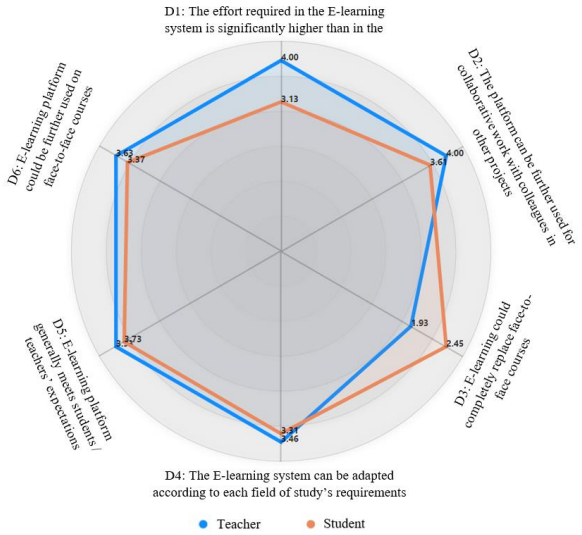

Figure 2. Representation of the six dimensions of Digital propensity of Teachers and Students
Source: Own projection

Regarding other dimensions of digital propensity of UMPhST members, noticeable differences cannot be observed. However, on average, all the dimensions except D3 - *replacing of face-to-face courses by E-learning*, are led by teachers.

The global digital propensity score of UMPhST is 16,87 from maximum of 30, this mean that we can assign a medium level of digital propensity to our institution.

5 Conclusions

The new context of distance learning has involved a continuous process/effort of adaptation on the part of all stakeholders. The connection between theory and practice for educational purposes is a process that requires time and experience. Therefore, the short time

of adaptation to the new learning conditions (both by teachers and students) and the low interaction between teachers and students will definitely make their mark on the professional development of students. These negative effects are not yet determined and cannot be quantified.

Through our research, we developed a scoring model for measuring digital propensity of both teaching staff and students towards further usage of E-learning solutions, combined with traditional courses. Through our case-study, we demonstrated that our model is applicable in the academic field.

Our paper shows that UMPhST members involved in certain study programs (e.g. Engineering or Business and Law) expressed a desire to implement digital solutions for teaching activities, thus supporting the idea of digitizing teaching activities. The score of 16,87 points which means that UMPhST members have medium digital propensity level therefore have interest and initiatives to use E-learning systems after the pandemic, but they need more support from organizational perspective. Our results are encouraging, as the questionnaire was applied at the beginning of the online teaching activities and the respondents were somehow at the beginning of their online teaching/learning experiences.

Our research marks a starting point for developing a digital propensity index and monitoring academic staff's evolution is mandatory in the next period. The results of our study can be used for developing strategies within the UMPhST to support *upskilling* of the members involved in E-learning activities for better understanding of technologies` advantages and possibilities.

We have found that teachers are more open to use E-learning solutions after pandemic because digital solutions, maybe not always are easiest way to teach, but it can improve student management process and facilitate transparency of learning activities. This could be one of the reasons why teachers tend to register a higher digital propensity score.

From dimensions' perspective, our findings show that teachers register a higher score when considering the effort made for online teaching, while students register a higher score when considering the total replacement of the conventional courses with online courses. For the remaining four dimensions, the results are similar for both students and teaching staff.

The model proved itself to be functional as a minimum viable method of assessing the digital propensity. Moreover, the results of our study may be useful to other educational institutions for evaluating their own online learning platforms, as our study analyses a well-structured survey that aims to assess the level of satisfaction and usefulness of E-learning platforms implemented in the context of the COVID-19 pandemic.

Limitations and Further research

Our study consists in developing a new digital propensity score method that can be applied in the academic field. We successfully identified and applied a scoring model for digital propensity in a case study that includes UMPhST academia members (teaching staff and students). Of course, we are aware of the subjectivity of the method applied as the main limitation of our research and, to ensure unbiased results, further tests are needed to refine the model. We will also test different scoring approaches and using other statistical methods in order to develop a viable method for digital propensity index determination. Next step for research team is to develop a digital propensity index that can be widely used by educational institutions.

During this research, several other future research directions were identified. First, it would be interesting to determine how successful online education was during the pandemic among UMPhST fields of study. and to promote the digitalization among the course content and student relationship management. Also, we could model a digital leadership profile to help decision makers to identify *digital champions* in own organization and ensure successful digital transformation.

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