THE EXPERIENCE OF A NEWLY IMPLEMENTED ONLINE LEARNING PLATFORM FOR MEDICAL STUDENTS

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Abstract:

INTRODUCTION: In the context of the current public health emergency, an adequate adjustment imposed a transition from a conservative approach to medical education to online teaching and interaction. E-learning also brought advantages to the students, which were assessed in this survey in order to learn how to keep and benefit from them in the future.

METHODS: the data was collected through a questionnaire which included general data (gender, year of study) and the self-perceived progress. Specific questions addressed the quality of the teacher-student communication, or the advantages e-learning offered, while the platform's functionalities were analyzed through a five-point scale.

RESULTS: Among the 536 respondents, 99.81% mentioned at least one feature used specifically in the online training that would be valuable to retain in the future. Students perceiving progress better than expected had a higher appreciation of the e-learning tools. Gender differences in opinion were only correlated with the standardization of the studying process. While time management was accepted as a main advantage, 25% of the participants considered the overall communication better than before. A major disapproval regarding online communication was encountered in years 3, 4, and 5, while the desire to continue the communication through the existing platform was the highest in the first and last year of study.

CONCLUSION: Even in a blended learning process, the digital delivery of medical training needs further improvement and adaptation in order to align with the fast-developing society and its expectations.

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Introduction

In the context of today's world, the position that e-learning has in regards to the conventional ways of education has become a highly debated topic among students and teachers. E-learning is inevitably part of the constant evolution towards a more extended digital society; properly used, it could serve all components (flexibility, experiential learning, and self-directed learning) of the concept of student-centered teaching (SCT), a prerequisite for developing the skills for the lifetime learning process necessary to keep pace with the rapid evolution of knowledge in the medical field (Matsuyama Y., 2019). The SCT in medical education refers more to the "how" knowledge is achieved and less to the *content* that has to be covered to obtain the diploma and further on the practice license (Spencer J.A, Jordan R.K., 1999) (Kandi V, Basireddy, P.R., 2018).

With a sudden interruption during the lockdown, up to date learning materials needed to be provided and flexible adjustment was expected from both the teachers and the students, in order-to-date learning materials needed to be provided, and flexible adjustment was expected from both the teachers and the students to align with the new standards. In institutions having a more conservative approach to their educational methods (Saekow, 2011), this switch created many issues that needed to be solved in a limited time period. Nevertheless, the rapid implementation of this transition gave the opportunity to evaluate whether certain features of this approach are worth keeping in the future in medical schools. Time constraints and (Schiekirka-Schwake, 2017) inadequate infrastructure are already recognized barriers for online medical education (O'Doherty, 2018), and, unfortunately, both have been faced during the pandemic outbreak. But training had to go on, and the pandemic sharpened the need to adapt to novel approaches and accelerated the transition to online communication. The lockdown imposed fewer physical interactions, more time spent alone and learning resources management on the students' side. Switching exclusively to e-learning gave teachers the opportunity to change from a presenter of the information to a facilitator and a resource person. On the other side, the participation

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of the students only in the virtual classes posed more responsibility on their shoulders. These characteristics of the teaching process have the potential to create a better environment for SCT if both actors (teachers and students) had the motivation and the engagement to change to a new paradigm, particularly if self-regulated learning (SRL) was encouraged and properly supported.

As lockdown compressed the time spent with their peers, teachers, and patients, learners were driven to experience more SRL. But SRL implies several steps to be attained in which motivation, clear and realistic personal goal setting, discipline, and the capacity of critical appraisal of the self-selected strategies for learning (in order to achieve a better performance) have an important role (Azevedo, 2012). A pre-pandemic systematic review of the implementation of SRL in medical teaching showed that it was not valorized enough and used to its full potential (van Houten-Schat, 2018).

Taking all the above into consideration, we conducted an online survey regarding the perceptions of the e-learning process to understand which changes were better valued by the trainees and which tools might facilitate a transition to SRL. In this article, we present the medical students' perception of the advantages of e-learning, considering that perception of progress reflects the achievement of their own learning goals.

Methods:

The survey started during the lockdown caused by the first wave of the COVID-19 pandemic in Romania (spring of 2020), when the entire medical training was moved online. This represented a major change for Carol Davila University of Medicine and Pharmacy students, which did not previously have an online platform to interact with. Before the COVID-19 lockdown, the whole teaching process was conducted on-site, with no online supporting platforms. Thus, when online platforms were introduced at the beginning of the lockdown, the experience changed for both the teaching staff and the medical students. Even though the lockdown was lifted midway through May, the second semester was completed online. Thus, the survey lasted until the summer holidays. The questionnaire was transmitted via social media, and all the medical students of the University of Medicine and Pharmacy Carol Davila of Bucharest were invited to participate. In order to identify the difficulty and the main differences in the learning process, six focus groups were organized. Students from the faculty of medicine were enrolled in the focus groups, and the questionnaire was developed based on the conclusions. The questionnaire development process and the feedback from the focus groups are explained previously in more detail (Vilceleanu BV, 2021).

General data (gender, year of study) and answers to questions about perceived progress, benefits of e-learning, quality of teacher-student communication, and the functionalities of the platform provided by the university were recorded.

The perceived progress groups were formed according to the answer to the following question: *"what is the self-assessment of your progress in medical education during the e-learning period compared to the progress you had presumed to obtain without the lockdown?"*; the first one included the respondents who "progressed as expected" (PAE), the second one the respondents who "progressed better than expected" (PBE), and the third one the respondents who "progressed less than expected" (PLE).

The factors that were considered candidates for having a degree of influence over the perception of the e-learning process were: gender, year of study, and the perceived progression in the medical training. When evaluating the quality of interaction between teachers and students, the answers to the following questions were found relevant:

"What are the advantages of e-learning in supporting your effort to become a doctor?" "Which were the most useful tools during e-learning that should be implemented in a blended learning process?". A separate question was dedicated to suggestions for the improvement of the platform (*"What are the functionalities you would add to the Google platform?"*), *"How did you perceive the communication with the teachers during e-learning as compared to the period of direct interaction?"* *"Do you find it beneficial to continue the communication with the teachers in a similar format to the Google classroom platform?"* Besides these questions, the functionalities of the Google classroom platform were scored on a five-point scale in order to appreciate their impact on the medical training.

The question related to the advantages of e-learning had 5 pre-established answers: better time management, going through the learning materials at his own pace, standardization of the training,

enabling the communication with teachers, and finally, preemptive preparation for the future online interactions with patients.

Concerning the tools provided by the platform, a list of preselected answers was provided (short videos presentations of clinical cases, clinical cascades, videos with role play of doctor-patient interaction, quizzes with requested answering before the class, none of those) followed by the possibility to add other tools, if considered.

The perceived level of communication during e-learning in comparison to the prior studying period had the following 4 options as answers: better than before, worse than before, as good as before, and no opinion to express.

In order to appreciate their preferred way of continuing the academic communication, students were provided 4 choices: the current method of communication (the tools provided by the Google class platform) is suitable and does not need any improvement, the current method is a good solution but should become more interactive, the online interaction should work as an auxiliary part to direct interaction and lastly, this is not an efficient solution and should be abandoned in the future.

The closing section of the study consisted of a 1-to-5 Likert scale assessment of the 4 functions that Google classroom provides with respect to their utility in medical education. We translated the marks as follows: 1 - not useful at all; 2 - useful to some extent; 3 - rather useful; 4 - very useful and 5 - extremely useful.

The functionalities evaluated by this set of questions were “the possibility of asking questions during and/or after class (Q&A)”, “the possibility of storing learning material (course storage)”, “the possibility to participate in a quizz and get feedback for their answers (Quizz)” and “the possibility of storing videos (video storage)”. Further on, we will describe them as Q&A, courses storage, quizzes, and video storage, respectively. The functionalities to be added to the platform were enquired using an open question.

Data was processed using statistical software (StaPlus:MacPro; SPSS), and a comparison between variables was performed using the χ^2 test. The significance threshold was set to 95%.

Results

A number of 536 respondents (75.19% women and 24.81% men) agreed to participate. The distribution according to the year of study is represented in Fig 1. There were 264 students who appreciated their progress as less than expected (the PLE group), 215 who considered it as expected (the PAE group), and only 57 who found their progress better than expected (the PBE group).

Fig 1. Distribution of the responders by year of study

The vast majority of students (99.81%) held an opinion that there was at least one benefit from the online learning; 265 students (49.44%) considered that there was only one benefit, 23.88% that there were 2 benefits, 19.03% that there were 3 benefits, 0.75% that there were 4 and 6.34% that there were 5 benefits of this type of training. Among all, 303 students mentioned as an advantage time management, 283 the possibility of learning at one's own pace, 108 the standardization of the training, 157 enabling the communication with teachers, 46 the preparation for future online interactions with the patients and 116 other reasons.

The possibility of better time management was acknowledged by 56.74% of the respondents but was significantly different by the year of study ($p = 0.02$). The highest percentages were recorded in the clinical years (58.33% in year 4, 60.71% in year 5, and 68.3% in year 6), and the lowest in the first (47.82%) and in the third year (44.79%) of study. The perceived self-progress was correlated with better time management thanks to e-learning ($p < 0.001$). There were 85.96% of the students in the PBE group who benefited from better time management when using e-learning and 67.9% of those in the PAE one. However, only 41.2% of those in the PLE group saw e-learning as a means of optimizing their time management.

The PBE students also organized themselves better to go through the learning materials at their own pace (80.70% as compared to 68.37% in PAE and 34.35% in PLE groups) ($p < 0.0001$).

Moreover, 108 students considered that e-learning contributed to the standardization of the training process, but there were major differences in opinions based on gender ($p=0.001$), year of study ($p=0.004$), and perceived progress ($p=0.003$). Generally, better standardization received the highest appreciation from men (30.07% vs 16.95%), from students in the second and in the last year of study (36% in the second year and 23% in the sixth-year vs 7.4%-18.75% in the other years) and by the PAE and PBE (26.51% and 24.56%, respectively) compared to the PLE group (14.12%).

There was a minority of students (46, corresponding to 8.63%) that considered e-learning as a preparation for future interactions with patients. The highest percentage was in the terminal year (19.56%), although the difference between all the years of study was not statistically significant. The students in the PLE group were the ones with the smallest percentage (4.2%, compared to the 15.79% in the PBE and 12.09% in the PAE groups, $p = 0.001$).

Concerning the tools provided by the platform, 377 students mentioned as useful the videos with case presentation, 277 the clinical cases cascades, 53 the recorded videos with role-playing, and 59 the quizzes to be answered before the class. Among them, 1 selected all the 4 options, 51 selected 3 options, 223 appreciated 2 options, and 197 only one option. Differences between PAE, PBE, and PLE groups are presented in Table 1.

Table 1. Distribution of the preferred learning facilities offered by the platform						
Training tool	PAE		PBE		PLE	
	No	%	No	%	No	%
Videos with case presentations**	171	79.53%	43	75.44%	159	75.44%
Cascade cases	122	56.74%	30	52.63%	125	47.35%
Recorded role play	22	10.23%	5	8.77%	26	9.85%
Quizzes to be completed before the class	20	9.3%	7	12.28%	32	12.12%
None**	14	6.51%	4	7.01%	45	17.05%

*** $p < 0.001$

Source: Authors

Sixty-four students answered that none of these tools were helpful. When comparing this latest category with the ones that had selected at least one of the tools, we noticed differences according to the perceived progress, with a significantly higher percentage (17.05%) of selection in the PLE group than in the PBE (7.02%) and the PAE (6.51%) groups ($\chi^2 = 14.006$, $p=0.0009$). No difference by gender or year of study was recorded.

Thirty-eight students proposed to add other tools to the platform. Among them, 18 proposed recording the courses, 9 asked for a more interactive platform and quizzes during the class, 3 considered that for the paraclinical investigations learning (ECG, radiology, histology), the online milieu is the most appropriate, 3 that the platform should be improved with functions to support self-learning; 6 only mentioned that they agree with all the specified methods and that all should be used in the future.

The open question related to suggested improvements was filled in by 62 students; 28 of them proposed improvement of the interaction by either adding functionalities of the platform or by the extension of the usage of the existing ones. Whiteboard for drawing diagrams or charts, breakout rooms for group assignments during the class, utilization of quizzes during lectures, the possibility to store the students' questions, and the answers provided by the teacher were the most frequently

requested tools. The possibility to interact via the internet with real patients was suggested for practicing medical interviewing. There were 15 students mentioning that storage and organization of the teaching material should be improved by recording the lectures, uploading the training materials according to their type, subject, and date, or sending notifications to the students regarding the changes that occurred in the training materials. There were some proposals for monitoring the self-learning, such as the obligation to download and to open the teaching materials before entering the class with the possibility to register the ones that have studied the materials, assignments, and deadlines, a section for other academic documents that could be added by students. The other suggestions focused on a better organization of the classes. They referred to the interface used for making announcements, technical issues (simultaneous download of all the materials uploaded would be helpful) attendance forms easier to fill in. There were, again, differences only according to the perceived progress. From the 13 PBE students who filled in this question, the majority were looking for improvement in the interactive tools (76.92% of the ones filling in this question). Twenty-two students in the PAE group answered this item. They had an equal demand for supplemental interaction tools (40.91%) and the storage of training materials (40.91%). The 22 students from the PLE group requested an improved version of this platform better support to monitor the self-progress (88.89%) and a better organization of the classes (45.45%).

Overall, when listed as a possible advantage of e-learning, the communication between students and teachers during the lockdown was differently perceived in the clinical and preclinical years of study. Students in the clinical years saw less benefits in regards to communication with the teaching staff (<30% in each group, with a minimum of 20.64% in the fourth year; $p = 0.03$), because the switch from an in-person clinical activity to an online clinical activity might have blunted their experience of hospital training. In the PBE group, more than half of respondents (52.63%) noted that an advantage of e-learning is better communication with the teaching staff ($p = 2.18E-7$).

When comparing the perception of the communication during e-learning with the one before the lockdown, the highest number (210 students) answered that communication was not as good as it used to be before the pandemic, 147 students found the communication better than before, 130 like it, and 49 didn't have any formulated opinions about the issue. The associations between the perceived level of communication and the year of study ($p=0.03$), and the perceived progress ($p<0.0001$), respectively, turned out to be statistically significant. The biggest percentages answering that the communication level dropped were recorded from students in year 4 (49.35%) and year 3 (42.85%). The year 5 follows in row, since 37.5% are discontent with the interactions established with the university. For years 1 and 6, there is a similar distribution of the percentages of answers regarding the answers to this question. The biggest percentage of students who reported a better level of mediation with academics is encountered in the second year.

Subsequently, the association between the perceived level of communication and the perceived progress was analyzed. In the PBE group, there was a higher percentage evaluating the communication as better than before (49.12%) or similar to the communication they were used to (29.82%) than in the other 2 groups (41.86% and 27.44% in the PAE and 10.98% and 20.45% in the PLE group). Only 8.77% of the students in the PBE category were disappointed with the communication, which is less than the percentage of dissatisfaction appraised in any of the other two categories (23.26% in PAE and 58.71% in the PLE one).

The question inquiring about keeping the same tools (mainly provided by Google for Education platform) in order to interact and stay in contact with the university teachers resulted in the following distribution of answers: 10% preferred the current methods of communication and considered they did not need any improvement, 23% accepted them as a good solution if they could become more interactive, 55% thought the online interaction should work as an auxiliary part to direct interaction and 12% completely rejected it as a possible efficient alternative in the future. We correlated the results with the same variables as previously. The associations between this question and the year of study and the perceived progress were statistically significant.

While it is obvious that the option of combining the direct and the online interaction is generally accepted regardless of the year of study, the year 1 and 6 held smaller percentages compared to the others (44.9% and 43.47%, respectively) (Table 2). The first and the sixth years also had larger percentages of students agreeing to the current form of communication or to a more interactive version

(40.5% in the first year and 41% in the sixth year). At the opposite end of the spectrum, years 3 and 4 related to these options in a much smaller percentage (26.5% and 30.6%, respectively). Nevertheless, 34.14% of the students in year 6 asked for more interactive communication than any other year of study.

Table 2. The willingness of continuation of teacher-student online communication by year of study

	Yes, but only to extend the face-to-face interaction and the practical training		Yes, but only if more interactive		Yes, as it is now, no need for improvement		I don't believe it should continue	
	No	%	No	%	No	%	No	%
year 1	31	44.92%	18	26.08%	10	14.49%	10	14.49%
year 2	45	60%	14	18.66%	10	13.33%	6	8%
year 3	58	59.18%	21	21.42%	5	5.1%	14	14.28%
year 4	90	57.69%	36	23.07%	12	7.69%	18	11.53%
year 5	32	57.14%	7	12.5%	12	21.42%	5	8.92%
year 6	36	43.9%	28	34.14%	6	7.31%	12	14.63%

Source: Authors

There can be obvious correlations by assessing the association between the opinion about the continuation with similar communication methods and the perceived progress made during pandemic. Thus, the current form of communication not being an option for the future was mentioned by 1.75% of the PBE group, 6.04% of the PAE group, and 19.31% of the PLE group. It is also worth mentioning that 33.33% of the PBE, 50% of the PAE, and 62.5% of the PLE thought that online interaction should be seen as a complementary part of the direct activity. Moreover, the students' answers which positively evaluated the communication followed the same trend: 29.82% of the PBE, 14.88% of the PAE, and only 2.27% of the PLE opted for preserving the current form of interaction, while 35.08% of the PBE, 28.83% of the PAE and 15.90% of the PLE resonated with making the online communication more interactive. The ranking of the facilities offered by the Google platform is presented in Fig 2.

Fig 2. Ranking of the facilities provided by the Google platform

Source: Authors

When correlating the utility of the Google platform with the predictors considered in this study, only the association with the students' perceived progress yielded statistically significant results (Table 3). The possibility of asking questions during and/or after classes was mentioned as extremely useful by 245 students. The two upper ranks of benefit (4 and 5 out of 5) were mentioned in the PBE (85.96%) and PAE group (over 79.06%), more than in the PLE group (68,18%). The facility of storing learning material received a maximum ranking from 83.25% of PLE, 92.98% of PBE, and 70.83% of PAE, being perceived as the overall most useful feature.

Table 3. Utility of the facilities of the Google class platform-dependent on the perceived progress in the medical training

	not useful at all		useful to the same extent		rather useful		very useful		extremely useful	
Courses storage*	No.	%	No.	%	No.	%	No.	%	No.	%
PEA	6	2.7%	6	2.3%	15	5.7%	50	18.9%	187	70.8%
PBE	0	0%	0	0%	1	1.8%	3	5.3%	53	93%
PLE	2	0.9%	3	1.4%	5	2.3%	26	12.1%	179	83.3%
Q & A**										
PEA	13	4.9%	20	7.6%	51	19.3%	80	30.3%	100	37.9%
PBE	1	1.8%	1	1.8%	6	10.5%	14	24.6%	35	61.4%
PLE	1	0.5%	9	4.2%	35	16.3%	60	27.9%	110	51.2%
Video materials storage***										
PEA	20	7.6%	29	11%	45	17.04%	59	22.3%	111	42%
PBE	1	1.8%	0	0%	7	12.28%	7	12.3%	42	73.7%
PLE	2	0.9%	10	4.7%	17	7.90%	49	22.8%	137	65.7%

* p=0.01; **p=0.009; ***p<0.0001

Source: Authors

For quizzes, all groups scored similarly, since the maximum rating was given by 51.16% of PAE, 56.14% of PBE, and 44.96% of PLE, and the minimum rating by 3.25% of PAE, 1.75% of PBE, and 7.95% of PLE. As for the rating of 4 or 5, the difference in percentages of the three groups was attenuated but still maintained the same hierarchy: highest for the PBE (78.95%), lowest for the PLE (67.05%), and with an intermediate value for the PAE 75.81%).

Even if the different perceptions of the utility of the quizzes did not reach the statistically significant threshold, the PBE and PAE evaluated quizzes with the highest ranking of 5 more than their peers.

Unlike quizzes, the usage of storing video materials had more stratified results. As can be seen in Table 3, it has received a maximum score in all categories. However, a rating of 4 or 5 was more frequent in the PLE and PBE groups (86,51% and 85,88 %, respectively) than in the PAE one (64.38%).

Discussion

The overall satisfaction of medical students regarding e-learning varies between 33% - 62% depending on the type of classes, communication methods, teaching skills and self-organization of the students. (Elshami W, 2021) (Bhattarai B, 2021) (Abbasi S, 2020) (Aziz Ansari K, 2021).

Our study shows that medical students considered that the basic functionalities of an online platform for e-learning were not offering enough ground for professional development. Despite that, 99.81% of them appreciated at least one feature that would not have been available in the conventional education process, which shows that blended learning should not be abandoned. More productive e-learning was found to depend on to motivation of the teacher and his ability to maintain interaction, but also on the ability of the students to self-discipline autonomous practice (Reinhart A, 2021). Indeed, the students who believed their progress through the e-learning period was better than expected had a higher appreciation of the overall teaching communication and of the e-learning tools and lower needs for further development of the platform, except for the interactive tools. The year of medical training also involved different perspectives on the online training. Genders' differences in opinion could only be correlated with the standardization process, which was more popular among men. The most important advantage was time management, and this proved particularly true for the clinical years, when there is a lot of time wasted commuting between different hospitals. Curiously, when asked what they disliked most about e-learning, the clinical year students answered: *"missing the habit of going to the hospital"* (results previously communicated). For the final year students, better time management had offered them more time to study for the residency exam. It was also of greater advantage to the PBE group, and this might be one of the main reasons why they progressed above expectations. These findings are not surprising, as a previous systematic review showed that students who are also engaged in e-learning training have better outcomes (Chan, 2019), better control over teaching (Grainger, 2020), and increased autonomy, as required for an SCL.

The overall communication was considered better than before only by a quarter of the participants. The more task-oriented, independent learners (the PBE) had a higher acceptance percentage and got more easily accustomed to distance learning and online communication with teachers. On the other hand, those who had more difficulties adapting failed to reach their expected progress. These results suggest that the level of interaction with academics plays an undisputed role in the perception of the whole e-learning experience. Also, better communication is compulsory in order to upgrade the standard of education and progress and seems to be one of the decisive factors for the students' evolution.

There were major differences between online communication and direct interaction related to the year of study, most probably sustained by the particularities of every generation and by their main priorities. Interestingly, this finding is supported by another study, in which the majority of the students were from the first and second year of medical training (Bhattarai B, 2021) and was different in those in which the participants were better spread between the years of study (Abbasi S, 2020). The students from the first two years, referred to as the preclinical group, share similarities in the scope of training (basic science) and experience. The students from year 3 and 4 form the early clinical group, attend hospital rotations, and acquire basic clinical experience. The students in the last 2 years of training (advanced clinical group) are those fully accustomed to the hospital practice, and their main objective is admission to a residency program. Taking this into consideration, we might explain the major disapproval encountered in the year 3, 4, and 5 regarding the current form of communication with the teachers as a form of missing the real-time participation, explanations, and interaction, since they are the most involved in the gain of clinical skills. Students in the clinical years see a small benefit from e-learning, as switching from an in-person clinical activity to an online clinical activity might have affected their interaction with the teaching staff.

Moreover, this could be related to the impossibility of maintaining a mentor-apprentice relationship (Burgess, 2018), which is so important in the clinical years. The lowest percentage, found in the fourth year, might be related to the way in which our university organizes its medical programs. The fourth-year is the first full clinical year, where students have the greatest expectations and the biggest difficulties in adapting to the new teaching format (subsequent clinical modules). Thus, e-learning makes it even difficult for them to form reliable connections with their teachers, important to their professional development.

The first year's uniform distribution of answers regarding the comparison of online and face-to-face training might be due to the lack of experience and the brief time spent having a direct interaction with the teachers before the pandemics. The sixth-year is just the opposite - reducing enthusiasm, and focusing on the residency preparation exam leads to fewer worries about hospital training. On the other hand, juniors in the second year might improve communication with the teachers, as they already have a basic experience regarding efficient methods of studying and might benefit from online explanations alongside theoretical classes. Another explanation of these differences is the evolution in the learning style towards a multimodal learning style and more strategic learning (Samarakoon, 2013) in the final year of study.

It is also notable that almost 10% of the students did not formulate any opinion about the communication platform. This might not necessarily be related to the students' lack of interest, but rather, it should be discussed in the context of the multiple limitations imposed and the changes in the students' routine and actions.

Standardization of teaching was perceived as a benefit by only one-fifth of the students. A previous systematic review of the e-learning solutions in medical education suggested standardization of these methods and a gradual introduction in the curricula (Childs, 2005), in a blended learning training but, since then, the expectations for flexibility of the generation Z (Eckleberry-Hunt, 2018) apparently prevailed. For example, a more recent survey in an Australian university found that peers' recommendations were more frequently followed than those from the teaching staff. In this survey (Judd, 2017), learning notes or articles provided by teachers or found on the institutional platform were used for learning far less than other internet resources.

The online teaching milieu aligns to current advancements in medicine, heavily directed towards telemedicine which, nowadays, seems closer than ever. Digital learning is expected to change future

communication with patients. Nevertheless, few students acknowledged this fact (Kyaw, 2019) in other surveys. We also had very few students considering this an opportunity for the development of their communication skills, particularly in the PLE group, the ones having probably a more negative vision regarding online communication.

The desire to continue the communication through the existing platform was maximal in the first and last year of study, with a nuance for the last year that wanted a more interactive one. These results could stem from the differences in terms of experience and major priorities. Thus, the first year, which is the least oriented and accustomed to the university demands, might take advantage of attending online classes since this is much more time-sparing. Also, the seniors in the sixth year might benefit from such a flexible schedule if the prospect of the residency exam is taken into consideration. This highlights the utmost importance of active participation in classes. Similar to prior results, early clinical years are again the most vulnerable to the lack of direct communication or extensive explanations; without this direct interaction, they will have more uncertainties when choosing their specialization.

The overall most useful features of the Google class platform were the courses and video storage and the Q&A feature. The videos with case presentations were better valorized by the PBE group. The difference between classic teaching format and videos presentations of clinical cases goes beyond the assimilation of theoretical knowledge and practical skills. A qualitative study that compared these two formats of training delivery showed a substantial improvement of students' patient-centeredness when video-based patient cases were provided (Pedersen, 2018). The fact that they were more valorized in our study by those who also claimed for more interaction despite better acceptance of online communication during the training process complete the picture of a more goal-oriented student in the PBE group and assign them as more suitable for an SCT approach.

The quizzes generated the least enthusiasm of all. The biggest utility of the tools was scored by the students in the PBE group, next in line being PAE. Those who performed less than expected were only slightly interested in implementing additional methods to their learning techniques compared to their peers. We don't have direct arguments from the existing data to say whether these results come from a better adaptation (in the case of PBE) or from a more compliant attitude to what is offered by the university; however, the better acceptance of the e-learning tool is an indirect argument consistent with the answers to many questions recorded from them. The PLE were apparently more accustomed to already existing techniques and to a stable learning style.

Those who performed better find it more useful to ask questions, while those who performed as expected weren't as reliant on this function. The teachers' feedback and answers were highly ranked by the PBE, followed by the PAE group. This indicates that receiving answers in real-time or after classes is needed for a better performance. In case-studies lectures which were introduced during the pandemic, the quizz interaction during the class was one of the main positive tools in keeping students' learning motivation (Rahm AK, 2021)

Having the necessary learning and video materials in one place and readily available seems to be important regardless of the perceived progress. In fact, this aligned with the better time management perception. Indeed, this was one of the main advantages also noticed in a sample of student nurses; in this group, accessibility of learning materials and saving time were the answers which gave the best scores of the survey (Thapa P, 2021). Going into more detail about what generates this perception, we found that both of those who performed less or better than expected would rely more on the possibility of storing video material, while those who performed as expected didn't find it as useful as their colleagues. This adds up to the general picture that PAE is more fond of the traditional teaching techniques (student-teacher encounter) and wouldn't rely on it as their peers.

Regarding the quizzes, all groups of study have a similar opinion – it's appreciated but not essential for their perceived progress. As for the other tools were more appreciated by the PBE and PLE, which could entail that they are more ready to find gaps and mistakes in their learning process.

The major differences between the PBE and PLE groups represent an argument for the usage of the SCT methods in blended learning medical training: goal setting rather than content acquisition, emphasis on in-depth understanding rather than broader but more superficial knowledge. Increased autonomy of the learner seems to be the spontaneous orientation of some students in a crisis. Through

the perspective of blended learning in medical schools, these rapid adapters (the PBE students) could serve as models for the others, facilitating the adaptation of the online tools to a proactive SRL (Berkhout, 2017).

The STC methods are very well supported by e-learning, and this time of inevitable extending usage of these methods might smooth the transition also for teachers. Several studies have shown that STC was adopted by a minority of teachers, particularly in the clinical years (Kim, Hwang, 2017), (Patil, 2016), (Zhang, 2013), but this attitude might change after more frequently used online teaching.

As many of our respondents underlined, e-learning and face-to-face learning should go together, as mentioned by undergraduate medical students participating in other studies (Puljak L 2020), (Elshami, 2021), (Forster C, 2021). In fact, this approach is supported by many studies that showed comparable results with both methods (Chan, 2016) but a better use of the faculty (Shaffer, 2004). A meta-analysis (Liu, 2016) showed that blended learning might be more effective than non-blended learning. Online learning is an effective method to increase knowledge but less effective than face-to-face learning for increasing skills and social competences (Bączek M, 2021). Therefore, these two methods are best used to complement each other. The e-learning might add a particular value to the training delivered to the Z generation (nowadays even called Zoomers) medical students, but the attractiveness of the medical platform should be carefully considered (Förster C, 2020). Their goal-oriented natural attitude, their pragmatic, self-informed and multitasking features (Schwieger, 2018) designate them as best candidates for SRL and should promote among the faculty members the selection of STC approaches. As they are digitally native, the introduction of online methods is inevitable and, for better results, should be carefully planned and properly implemented.

Conclusion

In conclusion, using the basic functions of an online platform and being offered the possibility of better time management were not enough to satisfy the needs required to progress for the majority of the students. Blended learning might solve a great part of the issue, but the expectations of generation Z suggest that a significant effort to improve digital delivery of some aspects of the medical training should be considered high on the agenda of the medical universities.

References

- Abbasi, S., Ayoob, T., Malik, A., Memon, S.I. (2020) Perceptions of students regarding E-learning during Covid-19 at a private medical college. *Pak J Med Sci.* 36(COVID19-S4):S57-S61. doi: 10.12669/pjms.36.COVID19-S4.2766.
- Azevedo, R., Behnagh, R., Duffy, M., Harley, J., & Trevors, G. (2012). Metacognition and self-regulated learning in student-centered learning environments. In S. Land, D. Jonassen (Eds.) *Theoretical foundations of student-centered learning environments.* (p.171-197). New York and London: Routledge, Tylor and Francis Group.
- Aziz Ansari, K., Farooqi, F., Qadir Khan, S., Alhareky, M.C., Trinidad, M.A., Abidi T, Muzahheed, M. (2021) Perception on Online Teaching and Learning Among Health Sciences Students in Higher Education Institutions during the COVID-19 Lockdown - Ways to Improve Teaching and Learning in Saudi Colleges and Universities. *F1000Res.* 10:177. doi: 10.12688/f1000research.28178.1.
- Bączek, M., Zagańczyk-Bączek, M., Szpringer, M., Jaroszyński, A., Woźakowska-Kapłon, B. (2021) Students' perception of online learning during the COVID-19 pandemic: A survey study of Polish medical students. *Medicine (Baltimore).* 100(7):e24821.
- Berkhout, J.J., Helmich, E., Teunissen, P.W, van der Vleuten, C.P., Jaarsma, A.D. (2017). How clinical medical students perceive others to influence their self-regulated learning. *Med Educ,* 51(3):269-279
- Bhattarai, B., Gupta, S., Dahal, S., Thapa, A., Bhandari, P. (2021) Perception of Online Lectures among Students of a Medical College in Kathmandu: A Descriptive Cross-sectional Study. *JNMA J Nepal Med Assoc.* 59(235):234-238.
- Burgess, A., van Diggele, C., Mellis, C. (2018). Mentorship in the health professions: a review. *Clin Teach,* 15(3):197-202
- Chan, A.K., Botelho, M.G., Lam, O.L. (2019). Use of Learning Analytics Data in Health Care-Related Educational Disciplines: Systematic Review. *J Med Internet Res,* 13;21(2):e11241
- Chan, A.W., Chair, S.Y., Sit, J.W., Wong, E.M., Lee, D.T., Fung, O.W. (2016). Case-Based Web Learning Versus Face-to-Face Learning: A Mixed-Method Study on University Nursing Students. *J Nurs Res,* 24(1):31-40
- Childs, S., Blenkinsopp, E., Hall, A., Walton, G. (2005). Effective e-learning for health professionals and students--barriers and their solutions. A systematic review of the literature--findings from the HeXL project. *Health Info Libr J,* 22 Suppl 2:20-32.
- Eckleberry-Hunt, J., Lick, D., Hunt, R. (2018). Is Medical Education Ready for Generation Z? *J Grad Med Educ,* 10 (4): 378–381

- Elshami, W., Taha, M.H., Abuzaid, M., Saravanan, C., Al Kawas, S., Abdalla, M.E. (2021) Satisfaction with online learning in the new normal: perspective of students and faculty at medical and health sciences colleges. *Med Educ Online*. 26(1): 1920090.
- Förster, C., Eismann-Schweimler, J., Stengel, S., Bischoff, M., Fuchs, M., Graf von Luckner, A., Ledig, T., Barzel, A., Maun, A., Joos, S., Szecsenyi, J., Schwill, S. (2020) Opportunities and challenges of e-learning in vocational training in General Practice - a project report about implementing digital formats in the KWBW-Verbundweiterbildungsplus. *GMS J Med Educ*. 37(7):Doc97. doi: 10.3205/zma001390.
- Grainger, R., Liu, Q., Geertshuis, S. (2020). Learning technologies: A medium for the transformation of medical education? *Med Educ*, 00: 1- 7. <https://doi.org/10.1111/medu.14261>
- Judd, T., Elliott, K. (2017). Selection and Use of Online Learning Resources by First-Year Medical Students: Cross-Sectional Study. *JMIR Med Educ*, 3(2):e17
- Kandi, V, Basireddy, P.R. (2018) Creating a Student-centered Learning Environment: Implementation of Problem-based Learning to Teach Microbiology to Undergraduate Medical Students. *Cureus*. 10(1):e2029.
- Kim, K.J, Hwang, J.Y. (2017) Characteristics of medical teachers using student-centered teaching methods. *Korean J Med Educ*, 29(3):187-191
- Kyaw, B.M., Posadzki, P., Paddock, S., Car, J., Campbell, J., Tudor Car, L. (2019). Effectiveness of Digital Education on Communication Skills Among Medical Students: Systematic Review and Meta-Analysis by the Digital Health Education Collaboration. *J Med Internet Res*, 21(8):e12967
- Liu, Q., Peng, W., Zhang, F., Hu, R., Li, Y., Yan, W. (2016). The Effectiveness of Blended Learning in Health Professions: Systematic Review and Meta-Analysis. *J Med Internet Res*, 18(1):e2
- Matsuyama, Y., Nakaya, M., Okazaki, H., Lebowitz, A.J., Leppink, J., van der Vleuten, C. (2019) Does changing from a teacher-centered to a learner-centered context promote self-regulated learning: a qualitative study in a Japanese undergraduate setting. *BMC Med Educ* 19(1):152
- Patil, A.A., Chaudhari, V.L. (2016). Students' perception of the educational environment in medical college: a study based on DREEM questionnaire. *Korean J Med Educ*, 28(3):281-8
- O'Doherty, D., Dromey, M., Loughheed, J., Hannigan, A., Last, J., McGrath, D. (2018). Barriers and solutions to online learning in medical education - an integrative review. *BMC Med Educ*, 18(1): 130
- Pedersen, K., Moeller, M.H., Paltved, C., Mors, O., Ringsted, C., Morcke, A.M. (2018). Students' Learning Experiences from Didactic Teaching Sessions Including Patient Case Examples as Either Text or Video: A Qualitative Study. *Acad Psychiatry*, 42(5):622-629
- Puljak, L., Čivljak, M., Haramina, A., Mališa, S., Čavić, D., Klinec, D., Aranza, D., Mesarić, J., Skitarelić, N., Zoranić, S., Majstorović, D., Neuberger, M., Mikšić, Š., Ivanišević, K. (2020) Attitudes and concerns of undergraduate university health sciences students in Croatia regarding complete switch to e-learning during COVID-19 pandemic: a survey. *BMC Med Educ*. 20(1):416.
- Rahm, A.K., Töllner, M., Hubert, M.O, Klein, K., Wehling, C., Sauer, T., Hennemann, H.M., Hein, S., Kender, Z., Günther, J., Wagenlechner, P., Bugaj, T.J., Boldt, S., Nikendei, C., Schultze J.H. (2021) Effects of realistic e-learning cases on students' learning motivation during COVID-19. *PLoS One*. 2021;16(4):e0249425.
- Reinhart, A., Malzkorn, B., Döing, C., Beyer, I., Jünger, J., Bosse, H.M. (2021) Undergraduate medical education amid COVID-19: a qualitative analysis of enablers and barriers to acquiring competencies in distant learning using focus groups. *Med Educ Online*. 26(1):1940765.
- Saekow, A. (2011). E-learning Readiness of Thailand's Universities Comparing to the USA's Cases. *Int J e-Education, e-Business, e-Management e-Learning*, 1(2):126-131
- Samarakoon, L., Fernando, T., Rodrigo, C. (2013). Learning styles and approaches to learning among medical undergraduates and postgraduates. *BMC Med Educ*, 13:42
- Schiekirka-Schwake, S., Anders, S., von Steinbüchel, N., Becker, J.C., Raupach, T. (2017) Facilitators of high-quality teaching in medical school: findings from a nation-wide survey among clinical teachers. *BMC Med Educ*, 17(1):178
- Schwieger, D., Ladwig, C. (2018). Reaching and Retaining the Next Generation: Adapting to the Expectations of Gen Z in the Classroom. *Information Systems Education Journal*, 16(3): 46–54
- Shaffer, K., Small, J.E. (2004). Blended learning in medical education: use of an integrated approach with web-based small group modules and didactic instruction for teaching radiologic anatomy. *Acad Radiol*, 11(9):1059-1070
- Spencer, J.A., Jordan, R.K. (1999) Learner centred approaches in medical education. *BMJ*. 318(7193):1280-1283
- van Houten-Schat, M.A., Berkhout, J.J, van Dijk, N., Endeldijk, M.D., Jaarsma, A.D.C, Diemers, A.D. (2018). Self-regulated learning in the clinical context: a systematic review. *Med Educ*, 52(10):1008-1015
- Vilceanu, B.V., Balan, A.M., Juganaru, E., Merlusca, E., Rascu, A., Otelea, M.R. (2021) E-learning during the COVID-19 pandemic: the impact on medical students' perceived academic progress. *RJMO*, 72(1):31-39
- Thapa, P., Bhandari, S.L., Pathak, S. (2021) Nursing students' attitude on the practice of e-learning: A cross-sectional survey amid COVID-19 in Nepal. *PLoS One*. 2021;16(6):e0253651.
- Zhang, Z., Liu, W., Han, J., Guo, S., Wu, Y. (2013). A trial of patient-oriented problem-solving system for immunology teaching in China: a comparison with dialectic lectures. *BMC Med Educ*, 13:11