Medical students' perception of e-learning approach (MeSPeLA) — a mixed method research

Mirosława Püsküllüoğlu[1], Michał Nowakowski[2], Sebastian Ochenduszko[3], David Hope[4], Helen Cameron[5]

[1]Department of Clinical Oncology, Maria Sklodowska-Curie National Research Institute of Oncology, Cracow Branch, Kraków, Poland
[2]2nd Department of General Surgery, Jagiellonian University Medical College, Kraków, Poland
[3]Department of Medical Oncology, Hospital Universitario Dr Peset, Valencia, Spain
[4]Centre for Medical Education, The Chancellor's Building, College of Medicine and Veterinary Medicine, The University of Edinburgh, Edinburgh, Scotland
[5]Aston Medical School, Aston University, Birmingham, UK

Corresponding author: Mirosława Püsküllüoğlu, M.D., Ph.D.
Department of Clinical Oncology, Maria Sklodowska-Curie National Research Institute of Oncology, Cracow Branch
ul. Garncarska 11, 31-115 Kraków, Poland
Phone: +48 12 634 82 28; E-mail: mira.puskulluoglu@gmail.com

Abstract: There is a discrepancy between the research exploring e-learning at medical universities in Central/Eastern and Western European countries. The aim of the MeSPeLA study was to explore the understanding, experience and expectations of Polish medical students in terms of e-learning. Questionnaire containing open-ended and closed questions supplemented by focus group discussion was validated and performed among 204 medical students in Poland before COVID-19 pandemia. Several domains: understanding of e-learning definitions; students' experience, preferences, expectations and perceptions of e-learning usefulness, advantages and disadvantages were addressed. The qualitative data were analyzed using an inductive approach. 46.0% of students chose a communication-oriented definition as the most appropriate. 7.4% claimed not to have any experience with e-learning. 76.8% of respondents indicated they had contact with e-learning. The main reported e-learning advantages were time saving and easier time management. The most common drawback was limited social interactions. The acceptance of the usage of e-learning was high. Medical undergraduates in Poland regardless of the year of studies, gender or choice of future specialization showed positive attitudes towards e-learning. Students with advanced IT skills showed a better understanding of the e-learning definition and perceived e-learning to be a more useful approach. The expectations and perceptions about e-learning in Polish medical schools seems similar to some extent to that in Western European and the United States so we can be more confident about applying some lessons from these research to Poland or other post-communist countries. Such application has been accelerated due to COVID-19 pandemia.

Keywords: e-learning, online-learning, medical education, virtual learning environment.

Introduction

In the field of medical education, there is a strong focus on studies performed in Western Europe and the United States of America (USA). Little has been published about the Polish medical education system [1, 2]. Before COVID-19 only few literature positions addressing the opinions and perceptions of medical students in post-communist countries about e-learning were found. It can be expected that local legislation, infrastructure or culture may influence the preferences.

The interpretation of e-learning differs among students and faculty workers [3, 4]. The reason for this lack of agreement may be the existence of competing definitions. Sangrà *et al.* (2012) grouped e-learning definitions into: technology-driven; delivery-system oriented; communication-oriented and education-paradigm-oriented. E-learning is usually seen positively and accepted widely by medical students all over the world [5, 6]. There may be some predictive factors for e-learning acceptance, such as gender or previous educational background [7, 8].

The aim of this study was to explore the beliefs, attitudes, perceptions, understanding, experience and expectations of medical students about e-learning. The results supported to plan e-learning activities and the introduction of online teaching methods into Polish medical curriculum. This process was unexpectedly accelerated by COVID-19 pandemia. Data gathered in this research showed to what extent we could transfer conclusions from studies performed in Western Europe/USA.

Methods

A mixed method study using both qualitative and quantitative approaches was planned. For qualitative part of the project a constructivist approach was used with elements of the grounded theory view [9, 10].

Research design

A. Building a questionnaire
   — A literature search to get a general opinion about the topic, to justify the choice of the topic and to create a list of themes.
   — Exploratory short pilot interviews to choose the most relevant topics. Chosen questions were discussed to ensure they were appropriate, detailed and adjusted to the Polish sociocultural context.
B. Performing a questionnaire consisting of closed and open-ended questions.
C. Performing a supplementary focus group discussion to investigate or clarify topics that were not explored enough in the survey.

Ethical issues

Questionnaire

A. Questionnaire development

The questionnaire was built, piloted and administered according to guidelines [11]. The primary list of themes consisted of 25 questions that were discussed with 4 students and 4 tutors from Jagiellonian University Medical College (JUMC) and 2 from University of Edinburgh. Finally, a survey in Polish consisting of 16 questions and a personal information section was built (Appendix 1).

B. Pilot linguistic sampling and questionnaire distribution

The final version was distributed among 6th and 3rd year Students of JUMC. First 14 participants were asked to provide additional comments on language style, acceptability and understandability of the questions. There were no significant comments and no further changes. The questionnaire was given to 204 students who signed a consent form.

C. Questionnaire analysis

Analysis of the open-ended questions was performed for each question separately. After reading the text carefully a list of open codes was built by using colour coding method [9, 10]. Then axial coding was performed. In Q8 whenever the author could assign the response to one of the options in Q10 no new code was created. The same rule was used for Q9 and Q11.

To conduct quantitative data analysis elements of descriptive statistics (mean, standard deviation, percentage distribution) were used. When appropriate, a chi-squared test was performed to check existing correlations between answers for pairs of questions in the survey. In the case of pairs of questions collecting quantitative data a Spearman's rank correlation coefficient was calculated (R range from –1 to +1). $P < 0.05$ was considered significant. Statistical analysis was performed using computer software Statistica 9.0 PL (StatSoft Poland).

Focus group

A list of topics for discussion was generated after careful analysis of data obtained from the questionnaire. Whenever the results of the survey were inconclusive, contradictory or simply interesting these topics complemented the list.

One focus group interview was performed with 7 students on the 27th of May 2016 and lasted 47 minutes. All participants signed a consent form, provided their personal data and could ask additional questions. The aims of the study and the purpose of the interview were explained. The interview was recorded using two audio tools.

To analyse the transcripts colour coding method was used. Themes were found and axial coding was performed.

Results

Population of the study

203 students returned the completed survey during school year 2016. Survey population characteristics are presented in Table 1.

Table 1. Survey population characteristics.

		Population		
		Total	**3rd year**	**6th year**
Population no		203 (100%)	101 (49.8%)	102 (50.2%)
Gender	**Male**	78 (38.4%)	33 (32.7%)	45 (44.1%)
	Female	122 (60.1%)	66 (65.3%)	56 (54.9%)
	Unknown	3 (1.5%)	2 (2.0%)	1 (1.0%)
Plans for future specialization	**Not decided**	51 (25.1%)	28 (27.7%)	23 (22.6%)
	Internal med.	67 (33.0%)	40 (39.6%)	27 (26.5%)
	Surgical	60 (29.6%)	24 (23.8%)	36 (35.3%)
	Other*	19 (9.6%)	7 (6.9%)	12 (11.8%)
	Unknown	6 (3.0%)	2 (2.0%)	4 (3.9%)
IT skills rating	**Mean (SD)****	3.81 (±1.00)	3.86 (± 0.99)	3.65 (± 1.07)

SD — standard deviation
* Including: paediatrics, dermatology, pathology, forensic medicine, radiology.
** Range: 1–5

The focus group interview was performed with one third year (F3), one fourth year (F4), three fifth year (M5, F5[1] and F5[2]) and two sixth year students (M6 and F6).

Questionnaire

Advantages and disadvantages of e-learning

According to the Polish medical students the most useful aspects of e-learning were: time-saving (81%); better time management (75%); being less stressful (48%); providing good quality materials (40%). Less popular options included: allowing better preparation for exams (20%); being more stressful (19%); not requiring much interaction with tutor (14%) or colleagues (13%).

Among negative aspects the most important were: lack of contact with patients (73%); worse interaction with tutors (56%) and colleagues (55%); being less useful for people with poorer IT skills (36%) and not requiring regularity in studying (32%). Less common responses included: being less stressful than traditional approach (13%) and offering worse preparation for exams (9%).

148 students answered Q8 and 139 undergraduates Q9. New themes were described and grouped into axial codes (Tables 2 and 3).

Table 2. Potential advantages of e-learning mentioned by students.

No*	Topic/theme	Code
36	Staying at home/at chosen place while learning	Comfort
17	Choosing time for learning (not to be mixed with time-management) by yourself	
13	Availability of materials (when required)	
12	More comfortable than traditional methods (unspecified)	
6	Deciding about the pace of studying a particular topic	
2	Possibility of eating and drinking while attending classes	
3	Doing it (courses) slower than expected	
1	Doing it (courses) faster than expected	
1	Not being distracted by others while studying	
1	Possibility of being dressed comfortably while learning (without consequences)	
16	Possibility of re-taking the course/taking it when absent	Technical aspects
11	Availability of materials (fast/easy access)	
6	Better visualization	
4	Unlimited access to materials	
1	Many people can use it at once	
11	Helping with consolidation/systematization of knowledge gained during traditional seminars	Educational aspect
8	Teaching how to work on your own	

Table 2. cont.

No*	Topic/theme	Code
4	It is more interactive (unspecified)	
4	Improving IT skills	Educational aspect
3	Possibility of taking more extra (optional) courses	
2	It is more progressive/up-to-date	
2	Making the course/materials standardized for everybody	
2	Providing contact with tutors from all over the World	
1	Increasing the learning speed (accelerates learning)	
3	No need to spend money on books	Economic aspects
2	Cheaper for University	
1	Saving teachers' time	
3	Possibility of receiving materials from a legal source	Legal aspects
2	Possibility of downloading computer programmes from a legal source	
2	No positive aspects	No positive aspects

* Number of responses

Table 3. Potential disadvantages of e-learning mentioned by students.

No*	Topic/theme	Code
2	Risk of 'depersonalization'	Comfort
2	Difficulty with focusing on studying while being distracted by the access to the Internet	
1	Low popularity of e-learning in Poland	
8	Common problems with equipment/programmes/platforms used for e-learning	Technical aspects
3	Difficulty with studying 'from the screen'/using technology	
1	Risk of infecting a computer with a virus	
1	Risk of losing data from the computer	
7	Cheating during exams	Legal aspects
5	Cheating (unspecified or with absences)	
3	Risk of stealing/loosing data from the computer	
2	Copyright infringement	
2	Deterioration of vision	Health aspect

Table 3. cont.

No*	Topic/theme	Code
2	Internet addiction	
1	Deterioration of health in many aspects	
9	Lack of students' motivation/engagement	Educational aspect
8	Difficult to teach practical skills/lack of practical skills teaching/too theoretical	
8	Higher risk of misunderstanding studied material	
8	It offers lower standards (in general)/is less sufficient than traditional approach	
6	Losing ability to work as a team	
6	It is impossible to receive immediate answers for questions/doubts	
4	Lack of supervision/insufficient supervision of students	
3	Lack of tutors' commitment	
3	Low level of tutors' professionalism	
3	Low reliability of e-learning materials	
2	Problems with receiving feedback from teachers	Educational aspects
2	E-learning can displace traditional well-proven and efficient methods (or reliable sources of information)	
1	Low requirements of e-learning courses	
1	Loss of prestige by the University	
1	High price of equipment and computer programmes	Economic aspects
10	No negative aspects	No negative aspects

* Number of responses

Expectations about e-learning application into medical curriculum

121 undergraduates answered Q14. Most popular themes were: high quality e-learning materials (47 respondents); good quality e-learning platform/system with materials (32); easy access to e-learning materials (15); good quality servers/Internet connection/equipment (9); e-learning introduction into elective courses (9).

In Q14 undergraduates indicated they expected e-learning to be introduced for basic (51.7%) rather than clinical courses (24.6%); for optional (70.9%) than obligatory (48.3%) courses and as b-learning (57.1%) rather than as a standalone approach (27.6%). 18.7% claimed they would use e-learning for clinical decision making train-

ing and 8.4% for manual skills teaching. The only notable difference between year 3 and 6 was observed for clinical courses: only 15% of 3rd year in contrast to 35% of 6th year undergraduates saw a place for e-learning in this situation.

Level of understanding of e-learning

Third year students assessed their level of understanding of e-learning significantly higher than sixth year students ($p = 0.0009$; 4.18 [$\pm$ 0.78] vs. 3.76 [$\pm$ 0.76] on a 1–5 Likert scale). These differences were not seen when considering plans for the future or gender.

E-learning definition

The year of studies, gender or plans for future did not affect the students' choice of communication-oriented definition (option 4), which was the most frequently selected (46.0%) with technology-driven definition (2) as the next most common option (24.7%). Educational-paradigm-oriented definitions (5, 6) were the least common choices (6.1% and 5.1% respectively). For students claiming they were very confident with e-learning definition options 2 and 4 were equally frequent preferences.

The level and the type of experience with e-learning

7.4% of participants claimed not to have any experience with e-learning (similar for 3rd and 6th year students); 61.1% experienced e-learning during obligatory and 32.0% during elective (optional) courses; 76.8% indicated they had used an e-learning platform (VLE, virtual learning environment), 44.8% quizzes, 29.6% YouTube, 26.1% video lectures/materials, 21.7% files uploaded from the Internet, 11.3% Facebook, 10.3% audio lectures/materials, 9.9% forum without teachers' moderation, 7.4% online lectures/sessions, <3% used other options.

The influence of various sociodemographic factors

Regardless of the year of studies, gender or plans for future, the results did not differ in terms of the estimated level of experience (2.19 [$\pm$ 0.80] on a 1–5 Likert scale), level of e-learning usefulness (3.58 [$\pm$ 1.11]) or usefulness in comparison to traditional approach (3.00 [$\pm$ 1.10]), intention to introduce e-learning to medical curriculum (3.39 ($\pm$ 1.19]) and agreement with e-learning replacing traditional approach (2.20 [$\pm$ 1.05]).

The most useful attributes and the weakest points of e-learning were indicated with similar frequency regardless of group. Male students more frequently assessed their IT skills higher than female students ($p = 0.015$, $R = 0.23$). More than half of the male students intended to choose surgical specialization (52.6%), whereas female students preferred internal medicine (41.8%).

Association between quantitative data

Students who were more confident with e-learning definition indicated they had more experience in the past ($p = 0.007$; $R = 0.19$), found e-learning a more useful approach ($p = 0.00008$; $R = 0.28$); also in comparison to traditional methods of teaching ($p = 0.0012$; $R = 0.23$); saw more place for e-learning in medical curriculum ($p = 0.0013$; $R = 0.23$); were more willing to agree with the statement about e-learning replacing traditional approach ($p = 0.04$; $R = 0.15$) and claimed to have better IT skills ($p = 0.003$; $R = 0.25$). The greater the experience with e-learning, the more e-learning was seen as a useful approach ($p = 0.00008$; $R = 0.28$), although not in comparison to traditional methods of teaching ($p = 0.09$; $R = 0.12$); more e-learning in medical sciences curriculum was welcome ($p = 0.0016$; $R = 0.17$); without greater tendency to agree with the statement about e-learning replacing traditional approach and without correlation with IT skills. Respondents who assessed e-learning as a more useful approach were more prone to indicate this strategy as more useful than traditional methods ($p < 0.0001$; $R = 0.68$), would welcome e-learning in medical curriculum ($p < 0.0001$; $R = 0.64$); were more willing to agree with the statement about e-learning replacing traditional approach ($p < 0.0001$; $R = 0.37$) and claimed to have better IT skills ($p = 0.001$; $R = 0.23$). Also undergraduates indicating e-learning being a more useful approach than traditional methods saw e-learning more willingly in medical curriculum ($p < 0.0001$; $R = 0.62$); agreed to a greater extent with the statement from Q15 ($p < 0.0001$; $R = 0.55$) and assessed their IT skills as better ($p = 0.012$; $R = 0.18$). Those, who wanted more e-learning to be used in medical curriculum and who showed greater tendency to agree with the statement about e-learning replacing traditional approaches, estimated their computer skills to be more advanced ($p = 0.0015$; $R = 0.11$ and $p = 0.018$; $R = 0.17$).

Whenever R is around -0.2–0.2 the trend may be described as existing; in case of R around 0.3–0.4 ($-0.4 - -0.3$) the correlation is seen.

Focus group

The focus group interview lasted for 47 minutes. The themes were organized around three areas: a) students' perception of e-learning definition; b) students' perception of e-learning methods; c) students' expectations regarding e-learning.

As questions in the focus group meeting appeared there in order to explain doubts that arose after the survey analysis then some planned coding for the analysis of these questions was pre-defined and one could not say the pure grounded theory approach was applied.

The results are presented in Table 4.

Table 4. Results of focus group interview.

	Code	Theme	Exemplary quotation
Students' understanding of e-learning definition	Technology	Technology-driven definition	'This is using computer and the Internet to study.' (F6)
	Education	Study materials	'One of the criteria for e-learning should be that materials, once created for it, ought to be available numerous times for students.' (M5) 'E-learning materials should be created only for e-learning purposes. They must be adopted for this educational approach, its capabilities and limitations in order to optimize this method.' (M6)
		Time	'E-learning is the time you communicate with others through the Internet for the purpose of education (...), or you send or receive e-materials.' (F4)
	Communica-tion	Time and/or space	'In e-learning student and tutor must be in different places, different time or both at once.' (F6)
		Direct contact with tutor	'There are two conditions you can call some [education] e-learning: there is no direct contact with a teacher and you use the Internet to communicate.' (F3)
		Individual approach	'Thus when he [teacher] sends me materials I call it e-learning, but at some point I must have the possibility to ask my questions or discuss materials that were sent to dispel my doubts.' (F5[2]) 'In e-learning I need somebody to follow if I make any progress and test my knowledge, without it you can't call sending materials through the Internet 'learning'.' (F4)
	Student-centered learning	Choice	'If I have online meeting with teacher through Skype this is not e-learning for me. To call it e-learning I need to have a choice when to study. In need to choose place and time to have proper level of motivation. He [teacher] obviously must be available somehow, but being forced to meet him for example on Tuesdays and Thursdays at 2pm online is not different to traditional teaching at all.' (F3)
Students perception of e-learning methods	Students' engagement	Passing exams	'I don't think that using one approach or other will really influence if you pass or not, but it [studying] can be done faster and in a more interesting way.' (M6)
		Students' motivation	'I am a medical student and I need this knowledge and skills. If I have additional tool to make it [studying] easier that motivates me enough.' (F5[2])
	Teachers' engagement	Study materials	'If they [teachers] prepared good quality e-learning materials it would not take more time than talking the same presentation to 14 different groups per year.' (M5)
		Teachers' time	

Table 4. cont.

	Code	Theme	Exemplary quotation
		Teachers' motivation	'I don't think they [teachers] could change their behavior just like that and [start to] be better prepared for classes or be more interested in passing knowledge. If they were forced to teach by using e-learning some of them would be motivated to be more interactive.' (F4) 'Teachers are more careful about what they talk when it is recorded.' (F5[1])
	Cooperation	Working as a team/on your own	'(…) and it is also about working with others.' (F5[1]) 'I can decide on my own about what to do with this problem, nobody will help me unless I decide to check the answer in my computer and I have as much time as I need.' (F3)
	Learning pace	Doing something at your own pace	
		Acceleration of learning speed/ time saving	'If they [teachers] prepared good quality e-learning materials you would have everything in one presentation and would not waste time for searching for reliable sources.' (M5)
	Social aspect	Contact with patients	'It [platform with cases] will not replace a direct contact.' (M6) 'It can replace collecting patients' history, but will not teach us how to examine a patient.' (F5[2]) 'If it's in addition to bedside teaching it's ok, but not instead.' (F3)
		Contact with students/ teachers	'Sometimes classes are so boring that you just don't want to study because you are so bored. E-learning would improve it' (F3) 'Contact with other students during classes motivates you.' (F5[1]) 'If you have this time saved [by using e-learning instead of traditional classes] you can use it for meeting your friends outside of University.' (F6)
	Ethical issues	Copyrights	'It happens now that lecturers don't want to share their presentations, because they used some photos or maybe some slides they do not own. If they were obliged to share these materials they would be much more careful with using this stuff.' (F4) 'They [teachers] talk to us using very technical language. How would patient feel if he saw his gentle and sympathetic physician explaining this procedure in such a cruel way, without any emotions?' (M6)
		Internet addiction	'We are all already addicted to the Internet.' (F6) 'If it was the only disadvantage of e-learning I do not see a problem.' (M6) 'I think that e-learning works as prevention from Internet addiction.' (M5)

Table 4. cont.

	Code	Theme	Exemplary quotation
			'It is much easier to be addicted to Facebook than to Pegaz [VLE].' (F3)
		Risk of cheating	'The cheating is common and students don't feel uncomfortable with it unless caught. (...) It is the same with e-learning.' (F4) 'Currently, teachers don't remember or don't want to check the presence list, thus you may sign a list for somebody else. It is also cheating and it will be the same for e-learning.' (M5) 'I have to know things as future physician. Nothing motivates me for studying as much as the need to pass exam and I don't think I would cheat even taking online MCQs as a final exam.' (F3)
		Need for ethical regulations	'We should predict such risk in advance and have some regulations.' (F6) 'It is important to make sure students don't cheat during the exams. I wander if online exams are possible at all. Maybe there should be oral exams online? So the teacher sees if you cheat.' (F6)
	E-learning methods	VLE	'Some platforms like USOS are popular in Poland. But in USOS you can only check your grades from the exam.' (F5[1]) 'You can't call USOS an e-learning platform.' (F3) 'I previously thought that if I have an access through the Internet to this platform and we talk about e-learning we should discuss USOS, but now I agree — it has nothing to do with e-learning.' (M5) 'We have PEGAZ. It works as a platform but is useless and awful. We only use it for less important subjects like foreign languages. When you were absent during the classes you can do some quizzes or do some exercises and you don't have to worry about your absence.' (F3)
		Facebook	'I wonder if our [study] group e-mail box or Facebook or a forum are also e-learning? (...) We use it pretty common to exchange opinions regarding our studies, but I have never thought of it as of e-learning tools.' (F5[1])
		E-mail box/ forums	
		Resources sent by tutors through the Internet	'In e-learning I need somebody to follow if I make any progress and test my knowledge, without it you can't call sending materials through the Internet 'learning'.' (F4)
		Materials downloaded through the Internet	'Foreign students commonly download materials for their exams [USMLE, United States Medical Licensing Examination]. It never happened to me (...). They [materials] are not in Polish and they are not corresponding with requirements for our exams and that may be the reason I do not feel they might be useful for me.' (M5)

Table 4. cont.

	Code	Theme	Exemplary quotation
		Skype	*'If I have online meeting with teacher through Skype this is not e-learning for me.'* (F3)
		Web pages with interactive cases	*'There are some interactive cases [*on the Internet*]. You can decide about diagnostics and treatment and it shows you step by step if your decisions are correct or not. (...) I did them because I was curious, this was not a part of a programme.'* (F3)
		Scientific web pages	*'But sometimes we use this type of materials [*in response to the previous quotation*] e.g. I am sure you use UpToDate to read new guidelines. I do.'* (F4)
Students' expectations about e-learning	Sociocultural (local) aspect	Teachers' attitude	*'I don't think they [*teachers*] could change their behavior just like that and [*start to*] be better prepared for classes or be more interested in passing knowledge. If they were forced to teach by using e-learning some of them would be motivated to be more interactive, which is so uncommon for some old-fashioned courses.'* (F4)
		Organization of school year	*'When you have an exam three months after the course was finishes you don't remember much, if we had a platform with materials, interactive cases it would be much easier.'* (F4)
		Educational aspect	*'It never happened to me to download lectures from the Internet and to study for the purpose of our exams. They [*materials*] are not in Polish and they are not corresponding with requirements for our exams and that may be the reason I do not feel they might be useful for me.'* (M5)
	Introduction of e-learning to the curriculum	Planning	*'It [*e-learning' introduction*] must be well prepared and reasonably planned, it can't be done like: 'let's do it and let's check if it works'.'* (F5[1])
		Place and role (b-leaning)	*'I have my knowledge from the lecture or books and then I use it doing interactive cases or quizzes on the platform.'* (F3)
	Technology	Internet connection	*'University should ensure the [*Internet*] connection and some equipment.'* (M5)
		Equipment	
		Students' comfort	*'Imagine that all information you usually look for ages are in one place, all high quality, condensed to save your time.'* (F3) *'Using e-learning should not require advanced IT skills, it should be adjusted to everybody including those with poorer [*IT*] skills.'* (F5[2])
	Education	Study materials	*'One of the criteria for e-learning should be that materials, once created for it, ought to be available numerous times for students.'* (M5)

	Code	Theme	Exemplary quotation
			'E-learning materials should be created only for e-learning purposes. They must be adopted for this educational approach, its capabilities and limitations in order to optimize this method.' (M6)
		Students' motivation	'I do not expect [from e-learning] anything in terms of motivation. I am a medical student and I need this knowledge and skills. If I have additional tool to make it [studying] easier that motivates me enough.' (F5[2])
		Need for practical approach	'It would have to include a lot of practical aspects, put us closer to real life situations. I don't need another ton of lectures and diagrams.' (M6)
		Contact with teachers/feedback	'A tutor needs to have information if you actually go through the material and if you understand it, only then introducing e-learning would make any sense.' (F6)

VLE — virtual learning environment

Discussion

Understanding the e-learning definition

No previous study directly checking the understanding of the e-learning term among medical students was performed. The second unique aspect is the time-oriented definition that emerged during the focus group interview. The third thing worth noticing in our study is the correlation suggesting that the more confident the students were with the e-learning definition the more open they were to this approach and its introduction.

Sangrà's study (2012) showed that the choice of e-learning definition was dependent on numerous factors e.g. previous experience. In this research the previous experience with e-learning influenced the level of confidence in terms of e-learning understanding, but did not influence the choice of definition. Almost half of the surveyed Polish students chose communication-oriented definition as the most suitable. It could be hypothesized that undergraduates expect student-centered teaching and a cooperative environment from e-learning. Interestingly, the technology-driven definition was the second most common choice in our questionnaire, whereas other authors suggested it to be less popular approach [3].

Experience of Polish medical students with e-learning

Only around 7% of Polish students denied any contact with e-learning. Data are consistent with these from United Arab Emirates, but are not comparable with outcomes from India where only half of the undergraduates used it before intervention [12, 13]. The motivation of undergraduates from these countries is probably different. Polish students are not interested in materials that prepare for United States Medical Licensing Examination.

Data from an Austrian study published in 2006 show similar percentage of users of existing e-learning materials, but recently published paper indicates that this percentage is above 90 [8, 14]. However, there may be a significant difference in the quantity of e-learning resources employed by students from these two countries. Additionally, in our project students claimed to have had only 2.19 (± 0.80) of experience.

76.8% of our respondents indicated they had had contact with VLE. During the focus group interview it turned out that students meant local platform has never worked as VLE. Another popular method was YouTube. The percentage of users seems higher in terms of studies from Western European and Middle Eastern countries. However, recent paper regarding dental students from USA pointed YouTube among three electronic application with the greatest impact on their learning [6, 15]. Only 11.3% of Polish students admitted to have used Facebook as a learning source. This tool is widely used all over the world [16]. It can only be hypothesized that this low percentage is due to the fact that Polish students do not treat Facebook as an e-learning tool.

Perceptions and beliefs about e-learning usefulness

Polish medical undergraduates found e-learning a valuable approach and equally as useful as the traditional approach. The majority of respondents opted for b-learning and in Q14 students claimed that e-learning 'should only be used as b-learning'. These cautious opinions are echoed by medical students from other countries including Slovakia [17].

Similarly to our study, students from numerous countries, also from Central Europe, indicated their positive attitude towards e-learning [14, 18–20]. A study performed with Turkish nurses show their positive perception of online learning regardless of age or work experience [21]. Research on United Kingdom (UK) Foundation Year 1 physicians showed that the majority did not want e-learning to be an obligatory part of their education, and only half described e-learning as useful. Although the newest data describe that majority of newly qualified physicians used e-learning packages [22, 23]. Recent paper about Australian medical undergraduates still indicates traditional resources as the preferred ones [14]. In work performed

among nurse students in the UK it was shown that e-learning may not be a preferable approach by all participants. The authors concluded that teaching approach must be customized to find the best method for each individual [24]. However, another data for UK undergraduate medical students' rated e-learning as comparable to traditional approaches in clinical skills education [25].

Perceptions and beliefs about e-learning advantages and disadvantages

Social interactions

Possible problems with communication appeared as the biggest challenges in our study. Interestingly, as shown by Danish study, when introducing new e-learning materials enabling social interaction in web forums increased students' satisfaction, but did not influence learning ability [26]. Other conclusions suggesting that learning is enhanced by building connections in a virtual environment were drawn from a study performed in USA [27]. Although, the quality of interpersonal contacts has been a concern for numerous scholars, there are also some votes that e-learning facilitates an interaction between a tutor and a student [28]. For almost 15% of our respondents 'not requiring much interaction with tutors/colleagues' acted as a benefit. It would be interesting to explore to what extent e-learning influences and changes the nature of social interactions.

Students' comfort

Students' comfort (e.g. time-saving) was seen as a major advantage. This data are consistent with numerous studies e.g. performed in the Czech Republic [29]. In one study from the UK it was shown that half of junior physicians find it most comfortable to perform e-learning activities exclusively at home [22]. Data from Serbia show that 72% of medical students agreed that a blended learning approach enables time independent learning [20]. This flexibility is connected with the next important topic: the need for regular work or self-discipline [30, 31]. Indeed, more than 30% of respondents in our project chose 'does not require regularity in studying' as a potential disadvantage of e-learning. It can be one of the reasons why the majority of scholars see e-learning as a part of b-learning. As shown in a study by Kassab *et al.* [32] the face-to-face component influenced students' motivation e.g. through intrinsic goal orientation.

Economic issues

Some Polish students claim that e-learning is 'cheaper for Universities'. Also among positive e-learning aspects 'saving teachers' time' and 'no need to spend money on books/extra materials' were named. Other students noticed that 'high price of equip-

ment and computer programmes' may act as a disadvantage. They also wish for 'proper equipment at University'. Data exploring the economics of this approach are limited [33, 34].

Students' preferences

One respondent claimed that '*e-learning is less attractive for kinaesthetic learners an often for auditory learners*'. There are no data exploring this area. Currently, learning modalities and students' preferences are not taken into consideration when building VLE [35]. There are some suggestions that e-learning can facilitate creating successful programmes for all groups of learners [36].

The risk of Internet addiction

Students mentioned the risk of the Internet addiction as a possible thread. Some interviewees claimed that medical students 'are already addicted to the Internet'. This comment has some confirmation in other publications regarding medical students all over the world [37–39]. In a study by Pawłowska *et al.* (2015) around 30% of all Polish students were in a high risk group of developing Internet addiction [39].

The risk of cheating

Numerous scholars raised awareness of ethical issues related to e-learning [40–42]. Some results suggest that e-assessment may be acceptable for medical students only if cheating is prevented by strict controls [43].

Tutors' engagement

Students commonly assume that e-learning can save tutors' time. Data show, that once prepared, the materials cannot be used for all groups of audience and require adaptations [44, 45]. Such procedures could lead to releasing resources not able to deliver planned learning outcomes. During the focus group some Polish undergraduates saw the possibility of improving tutors' engagement together with introducing e-learning. Indeed, recently published review also indicates time constrains and negative attitude of all involved as potential barriers in e-learning application [46].

Expectations of Polish medical students from e-learning

There are numerous papers describing the outcomes of introducing e-learning methods or a VLE into medical schools' curricula focusing on outcome measurements such as level of satisfaction, efficacy, but there are no data about students' expectations regarding this topic [17, 20, 47, 48].

Teaching soft skills

Only a few Polish medical students believe that e-learning can influence their professionalism, motivation or attitude. Also, not many wish it to be used for teaching non-technical skills like communication. This may result from cultural differences and general discrepancies between medical schools' curricula in Western Europe and Poland.

Student-centred strategy

The focus group revealed that some undergraduates see e-learning as offering a student-centred development. Moreover, acceptance of the usage of e-learning in medical sciences curriculum was high.

Influence of various factors on beliefs, attitudes and perceptions of e-learning

Third year students marked the assessed level of understanding of e-learning definitions significantly higher than sixth year students. The reason for this is unknown. There was no difference in terms of the level of experience or attitude towards e-learning.

Neither future specialization nor gender influenced the perception or acceptance of e-learning, and such association in case of gender was reported in other studies [7, 8].

Higher levels of IT skills declared by students correlated with numerous factors such as higher understanding of the e-learning definition, perceiving e-learning as a more useful approach, wishing e-learning to be used in medical curriculum more and replacing the traditional approach. This result is compatible with other studies suggesting that previous exposure to computers positively influence perceptions about e-learning [8, 19, 21, 49].

Limitations of the study

This single-centre study was performed among students from JUMC — the biggest and best rated medical faculty in Poland. Thus, it may not be a good example of an average quality medical training. The study was supplemented by only one focus group discussion. It permitted to explore doubts that appeared after analysing the questionnaire, but would not allow saturation of data. Additionally, there was a risk that students may not be completely open in focus groups for fear of peer criticism. The paper version of the survey was chosen purposively as there was a risk that only active users of the Internet would have volunteered to take an on-line survey. On the other hand, many students left open questions unanswered and 5% of the qualitative

data was illegible. Study was performed before COVID-19 pandemia. It may be hypothesized that fast introduction of online teaching in all areas of medical curriculum in 2020 significantly changed students' perception of online teaching.

Conclusions

The results obtained for the Polish population overlap to some extent with these gained in other countries. However, as Poland prohibited MSc courses to be performed completely via e-learning and that these methods had not been widely introduced to medical curricula before COVID-19 pandemia it is impossible to directly transfer conclusions from Western Europe/USA. It would also be unjustified to transmit data from developing countries due to cultural, economic and organizational differences.

Due to COVIS-19 pandemia JUMC as well as other medical Universities all over the world introduced online courses into curricula during school year 2019/2020 [50]. Observations from our study are valuable in order to meet students expectations and define potential challenges. We plan to perform an update of the study in 2022 to assess the changes that are expected in students' beliefs, attitudes and perceptions about e-learning.

Conflict of interest

None declared.

Author contribution

M.P., D.H., H.C. and M.N. made significant contributions to the study design. M.P. and S.O. collected the data. M.P., D.H., H.C. and M.N. interpreted the research data. M.P. drafted the initial version of the manuscript. S.O. provided significant comments to initial version of the manuscript. D.H., H.C. and M.N. revised the manuscript. All authors read and approved the final version of the manuscript.

Funding

References

1. *Janczukowicz J.*: Medical education in Poland. Med Teach. 2013; 35: 537–543.
2. *Janczukowicz J., Rees C.E.*: Preclinical medical students' understandings of academic and medical professionalism: visual analysis of mind maps. BMJ Open. 2017; 7: e015897. 10.1136/bmjopen-2017-015897.
3. *Sangrà A., Vlachopoulos D., Cabrera N.*: Building an inclusive definition of e-learning: An approach to the conceptual framework. Int Rev Res Open Distance Learn. 2012; 13: 145–159.
4. Towards an inclusive definition of e-learning [Internet]. [cited 2021 Oct 1]. http://openaccess.uoc. edu/webapps/o2/bitstream/10609/10562/6/inf_ed_ang.pdf.
5. *Tang B., Coret A., Qureshi A., et al.*: Online Lectures in Undergraduate Medical Education: Scoping Review. JMIR Med Educ. 2018; 4: e11.
6. *Turkyilmaz I., Hariri N.H., Jahangiri L.*: Student's Perception of the Impact of E-learning on Dental Education. J Contemp Dent Pract. 2019; 20: 616–621.
7. *Golband F., Hosseini A.F., Mojtahedzadeh R., Mirhosseini F., Bigdeli S.*: The Correlation between Effective Factors of E-learning and Demographic Variables in a Post-Graduate Program of Virtual Medical Education in Tehran University of Medical Sciences. Acta Med Iran. 2014; 52: 860–864.
8. *Link T.M., Marz R.*: Computer literacy and attitudes towards e-learning among first year medical students. BMC Med Educ. 2006; 6: 34.
9. *Charmaz K.*: Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis. London: SAGE; 2006.
10. *Strauss A., Corbin J.*: Basics of qualitative research: Grounded theory procedures and techniques. London: SAGE; 1990.
11. *Cohen L., Manion L., Morrison K.*: Research Methods in Education. 6th ed. London: Routledge; 2011. 317–349.
12. *Eldeeb R.*: Students' Perceptions to e-Learning. Int J Res Method Educ. 2014; 4: 33–36.
13. *Rai S., Sirohi S., K K.A., Dixit S., Kujur A.*: Educational intervention study for awareness about various e-learning platforms to medical students of Indore city. Int J Med Sci Public Health. 2018; 7: 503–506.
14. *Wynter L., Burgess A., Kalman E., Heron J.E., Bleasel J.*: Medical students: what educational resources are they using? BMC Med Educ. 2019; 19: 36.
15. *Barry D.S., Marzouk F., Chulak-Oglu K., et al.*: Anatomy education for the YouTube generation. Anat Sci Educ. 2016; 9: 90–96.
16. *Jaffar A.A., Eladl M.A.*: Engagement Patterns of High and Low Academic Performers on Facebook Anatomy Pages. J Med Educ Curric Dev. 2016; 3: JMECD.S36646.
17. *Rusnakova V., Bacharova L., Simo J., et al.*: Integration of the e-Learning into the medical university curricula. Bratisl Lek Listy. 2012; 113: 324–330.
18. *Eldeeb R.*: Students' Perceptions to e-learning. Int J Res Method Educ. 2014; 4: 33–36.
19. *Brumini G., Špalj S., Mavrinac M., et al.*: Attitudes towards e-learning amongst dental students at the universities in Croatia. Eur J Dent Educ. 2014; 18: 15–23.
20. *Milic N.M., Ilic N., Stanisavljevic D.M., et al.*: Bridging the gap between informatics and medicine upon medical school entry: Implementing a course on the Applicative Use of ICT. Assefa Woreta S., editor. PLoS One. 2018; 13: e0194194.
21. *Karaman S.*: Nurses' perceptions of online continuing education. BMC Med Educ. 2011; 11: 86.
22. *Goh J., Clapham M.*: Attitude to e-learning among newly qualified doctors. Clin Teach. 2014; 11: 20–23.
23. *Kashora F.K, Charles D.-A.*: Online-learning: exploring practices among Foundation doctors. J Adv Med Educ Prof. 2019; 7: 14–19.
24. *Bloomfield J.G., Jones A.*: Using e-learning to support clinical skills acquisition: exploring the experiences and perceptions of graduate first-year pre-registration nursing students — a mixed method study. Nurse Educ Today. 2013; 33: 1605–1611.

25. *Gormley G.J., Collins K., Boohan M., Bickle I.C., Stevenson M.*: Is there a place for e-learning in clinical skills? A survey of undergraduate medical students' experiences and attitudes. Med Teach. 2009; 31: e6-12.
26. *Worm B.S., Jensen K.*: Does peer learning or higher levels of e-learning improve learning abilities? A randomized controlled trial. Med Educ Online. 2013; 18: 21877.
27. *Paton C., Bamidis P., Eysenbach G., Hansen M., Cabrer M.*: Experience in the Use of Social Media in Medical and Health Education. Yearb Med Inf. 2011; 6: 21–29.
28. *Abaidoo N., Arkorful V.*: The role of e-learning, the advantages and disadvantages of its adoption in Higher Education. Int J Educ Res. 2014; 2: 397–410.
29. *Kratochvil J.*: Efficiency of e-learning in an information literacy course for medical students at the Masaryk University. Electron Libr. 2014; 32: 322–340.
30. *Omar N.D., Hassan H., Atan H.*: Student Engagement in Online Learning: Learners Attitude Toward E-Mentoring. Procedia — Soc Behav Sci. 2012; 67: 464–475.
31. *Półjanowicz W., Mrugacz G., Szumiński M., Latosiewicz R., Bakunowicz-Łazarczyk A., Bryl A., et al.*: Assessment of the Effectiveness of Medical Education on the Moodle e-Learning Platform. Stud Logic, Gramm Rhetor. 2013; 35: 203–214.
32. *Kassab S.E., Al-Shafei A.I., Salem A.H., Otoom S.*: Relationships between the quality of blended learning experience, self-regulated learning, and academic achievement of medical students: a path analysis. Adv Med Educ Pract. 2015; 6: 27–34.
33. *Ruggeri K., Farrington C., Brayne C.*: A global model for effective use and evaluation of e-learning in health. Telemed J E Health. 2013; 19: 312–321.
34. *Sissine M., Segan R., Taylor M., Jefferson B., Borrelli A., Koehler M., et al.*: Cost Comparison Model: Blended eLearning versus traditional training of community health workers. Online J Public Health Inform. 2014; 6: e196.
35. *Kanninen E.*: Learning styles and e-learning. Master Sci Thesis, Tampere Univ Technol. 2008; 12: 1–76.
36. Creating Successful eLearning Programs with Kinesthetic, Visual, and Audio Content [Internet]. [cited 2021 Oct 1]. http://soundcommunication.holdcom.com/bid/83260/Creating-Successful-eLearning-Programs-with-Kinesthetic-Visual-and-Audio-Content.
37. *Langarizadeh M., Naghipour M., Tabatabaei S.M., Mirzaei A., Eslami Vaghar M.*: Prediction of internet addiction based on information literacy among students of Iran University of Medical Sciences. Electron Physician. 2018; 10: 6333–6340.
38. *Masters K.*: Social Networking Addiction among Health Sciences Students in Oman. Sultan Qaboos Univ Med J. 2015; 15: e357–363.
39. *Pawłowska B., Zygo M., Potembska E., Kapka-Skrzypczak L., Dreher P., Kędzierski Z.*: Prevalence of Internet addiction and risk of developing addiction as exemplified by a group of Polish adolescents from urban and rural areas. Ann Agric Environ Med. 2015; 22: 129–136.
40. *Anitha C., Harsha T.S.*: Ethical Perspectives in Open and Distance Education System. Turkish Online J Distance Educ. 2012; 14: 193–201.
41. Are They Learning Or Cheating? Online Teaching's Dilemma — Forbes [Internet]. [cited 2021 Dec 1]. http://www.forbes.com/sites/georgeanders/2012/08/16/are-they-learning-or-cheating-online-teachings-dilemma/.
42. elearn Magazine: Academic Honesty in the Online Environment [Internet]. [cited 2021 Oct 11]. http://elearnmag.acm.org/featured.cfm?aid=1966302.
43. *Escudier M.P., Tricio J.A., Odell E.W.*: Student Acceptability of High-Stakes e-Assessment in Dental Education: Using Privacy Screen Filters to Control Cheating. J Dent Educ. 2014; 78: 558–566.
44. *Davids M.R., Chikte U.M.E., Halperin M.L.*: An efficient approach to improve the usability of e-learning resources: the role of heuristic evaluation. Adv Physiol Educ. 2013; 37: 242–248.
45. *Gould D., Papadopoulos I., Kelly D.*: Tutors' opinions of suitability of online learning programmes in continuing professional development for midwives. Nurse Educ Today. 2014; 34: 613–618.

46. *O'Doherty D., Dromey M., Lougheed J., Hannigan A, Last J, McGrath D.*: Barriers and solutions to online learning in medical education — an integrative review. BMC Med Educ. 2018; 18: 130.

47. *Felder E., Fauler M., Geiler S.*: Introducing e-learning/teaching in a physiology course for medical students: acceptance by students and subjective effect on learning. Adv Physiol Educ. 2013; 37: 337–342.

48. *Gazibara T., Marusic V., Maric G., Zaric M., Vujcic I., Kisic-Tepavcevic D., et al.*: Introducing E-learning in Epidemiology Course for Undergraduate Medical Students at the Faculty of Medicine, University of Belgrade: A Pilot Study. J Med Syst. 2015; 39: 121.

49. *Stamm T., Triller I., Hohoff A., Blanck-Lubarsch M.*: The tablet computer's impact on learning and National Dental Examination scores in orthodontics — a mixed-method research. Head Face Med. 2019; 15: 11.

50. *Skrzypek A., Perera I., Szeliga M., Cebula G.*: Modification of teaching during the COVID-19 pandemic at the Department of Medical Education of Jagiellonian University Medical College. Folia Med Cracov. 2020; 60: 113–121.