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ORIGINAL ARTICLE

Associations Between Medical Students' Opinions on Usage of Internet Services and Digital Teaching Tools

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Abstract: *Currently, the educational process must integrate new tools, to keep pace with technological progress. Our paper aims to investigate the extent to which the preferences of medical students for the autonomous use of multimedia resources in the learning process are correlated with their opinions towards the Internet and the intensity of using it in their daily activities. Methods: We investigated 395 medical students from 4 medical universities in Romania, 75.9% females, and 88.8% in the 1st and 2nd years of study. Students were asked to express on Likert-scales their agreement with a list of statements about Internet services, as well as whether they like learning using multimedia tools and how intensively they use Internet services. Results: The students agree to a medium to large extent with the favorable statements about Internet services but are also aware of the negative influences that indiscriminate use of such technology can have. The intensity of Internet usage is high, although not exaggerated. With small exceptions, the students who enjoy using multimedia resources during the learning process have also favorable opinions about Internet services, and use them constantly, mainly for information and instant messaging on social networks*.

Keywords: *multimedia-based learning; blended learning; Internet services; social networks; medical students*

INTRODUCTION

Currently, digital technology has become increasingly used in everyday activities, and its intensive use in most fields of activity has attracted changes in the structure of society, and even in the psychology of individuals, who gradually change their conceptions about life, work, and education, about the ideal way of spending leisure time and about the features of an optimal work climate. In this general context, it is obvious that the educational process must integrate new tools, in an attempt to keep pace with technological progress. The protagonists of this process, students as well as teachers, are people with a fundamentally different lifestyle than 20 years ago, with different expectations and conceptions.

The most obvious changes are noticed in the case of the current generation of students. This is the so-called "Generation Z" (children born after 1997), also known as iGen, post-millennial, or digitally native. These are children who have been exposed to technology from the beginning of their lives, so using computers and gadgets has become second nature to them, as have the activities online and on social networks. Consequently, these children prefer to study independently, at their own pace, using visual or kinaesthetic didactic tools, which give them immediate feedback. It is important for them to respect the right to privacy and personal space; they are pragmatic, entrepreneurial, and generally reluctant to take risks (because they faced periods of economic recession in childhood); although they generally enjoy interaction with the teacher, Generation Z children have fewer social skills associated with face-to-face communication and the art of conversation, compensated instead by intense online activity [1].

There are currently relatively few studies in the literature concerning Generation Z issues, which usually focus on describing its characteristics [2,3], effective strategies for recruitment in the public sector [4], and individuals' attitudes towards work [5], but without focusing on the specific problems of medical students of this generation, with their own needs, preferences and learning styles.

Obviously, the learning style of Generation Z students has features that differentiate it from the learning styles preferred by other generations of students. The most preferred method is active learning (through discussion and involvement in practical projects), based on sensory stimuli (visual - images, graphics, auditory and kinetic). Knowledge is achieved through observation, practice, and quick and targeted access to the necessary information through the use of technology and online resources: e.g. YouTube for video tutorials, Facebook (for chatting with classmates and sharing projects and teaching materials), or Google (for documenting and searching for scientific references). Students prefer self-study, at their own pace, with a flexible schedule and teaching materials that intensively use multimedia resources: explanatory or demonstrative video sequences, PowerPoint presentations with audio support, simulations, collaborative projects, discussion forums, online questionnaires, and case studies in the classical environment (seminar room or practical works). In this context, the portrait of the ideal teacher has also changed significantly: firstly, he must be a good communicator, close and friendly, transparent, enthusiastic, passionate and competent in his field, able to propose realistic goals and to provide immediate and constructive feedback on their achievement, willing to provide professional and emotional support to his students, both academically and individually, to prepare them for their future careers.

In this context, the concept of blended education, based on the intensive integration of digital resources into the teaching process, is becoming increasingly popular among teaching tools.

Such education programs are usually developed in mixed regimes, online and onsite, combining as much as possible in an optimal manner the advantages of both methods. Blended courses are a current trend that provides a new and effective instructional experience to the students they address, and have several major advantages:

- Flexibility in the teaching schedule, which simplifies students' access to the course, regardless of their physical location and allows them to organize their time and pace of learning according to their own needs and availability;

- More effective teaching: Most scientific studies show that blended teaching is more effective than traditional courses, but also than full online courses. A 2009 report from the United States examined 51 studies comparing online and traditional methods and concluded that students enrolled in blended learning programs score on average better on exams than those enrolled in full-onsite programs [6]; on the other hand, blended teaching programs also perform better than fully online ones as well [7], as they still give to the students the opportunity to interact effectively with the teacher when needed.

- Clearer organization of content: It is the natural result of a well-designed blended course, which must provide students with clear and detailed indications of using the proposed resources, activities, and tests, helping them to concentrate better and proposing an optimal pace of learning, in the same way that the teacher guides students onsite in going through the exposed materials;

- Stimulation of active learning, which emphasizes the student's autonomy in effective learning communities;

- Lower costs: Reducing the number of onsite meetings frees up the teaching spaces of the institution and reduces some utility expenses. The teachers and the students will gain lower transport costs and time savings, although logistics expenses can be slightly increased (it is necessary to purchase adequate personal computers and involves additional costs for electricity consumption and telephone subscription).

Our paper aims to investigate the extent to which the preferences of students at medical faculties for the autonomous use of multimedia resources in the learning process are correlated with their opinions towards the online environment and the Internet and the intensity with which they use such resources in their daily activities, not necessarily related to the learning process.

MATERIALS AND METHODS

We conducted a case study that enrolled 395 medical students from 4 medical universities in Romania. The general features of the sample are shown in Table 1. Students are 3 quarters females (75.9%); most students are in the 1st and 2nd years of study (88.8%), aged between 18-20 years (74.4%), with an average age of 21.78 ± 3,736 years and a range of variation between 18-48 years.

Also, most students come from faculties of Dental Medicine (34.4%) or General Medicine (47.6%), mainly from the "Grigore T. Popa" University of Medicine and Pharmacy in Iasi, Romania (50.9%); 27.1% of the participating students are from University of Medicine and Pharmacy in Craiova, and 20.3% from University of Medicine and Pharmacy "Victor Babeș" in Timisoara.

Students were invited to fill in an online questionnaire in order to express their agreement degree with a list of statements about Internet services (favorable – 7 items and unfavorable – 3 items). In addition, they were asked whether they like learning using multimedia tools and resources and how intensively they use different Internet services (7 items).

The agreement degree with the proposed statements was quantified using a 5-step Likert scale, ranging from 1 – very small agreement to 5 – very large agreement.

Table 1: General features of the study sample

		n	%
Gender	masculine	95	24.1
	feminine	300	75.9
Age group	18-20 years	294	74.4
	21-24 years	78	19.7
	over 25 years	23	5.8
Year of study	1	228	57.7
	2	123	31.1
	3	44	11.1
Specialization	Dentistry	136	34.4
	General medicine	188	47.6
	Dental technique	70	17.7
	Prophylaxis assistance	1	0.3
University	UMPh Iasi	201	50.9
	UMPh Craiova	107	27.1
	UMPh Timișoara	80	20.3
	UMPh Cluj Napoca	7	1.8
Total		395	100.0

The questionnaire was presented and explained individually to each study participant.

Participation in the study was voluntary. Participants were informed about the study and the overall objectives of the research and, at the beginning of the questionnaire, were invited to give their informed consent. The questionnaires were completed anonymously.

The study was approved by the Research Ethics Commission of the "Grigore T. Popa" University of Medicine and Pharmacy, Iasi (decision no. 21/16.11.2020).

Statistical analysis

Data collected from students were recorded and processed in SPSS 29.0 (SPSS Inc., Chicago, IL) for Windows.

The responses to each item were characterized by frequency distributions and contingency tables. The numerical variables were characterized by descriptive statistics (mean, standard deviation, standard error, range of variation, and median). Comparisons between samples were made using the Kruskal-Wallis test for quantitative data, after having previously verified that they comply with the normal distribution law, using the Shapiro-Wilks normality tests. We considered the p-value ≤ 0.05 to be statistically significant (*) and the p-value ≤ 0.01 to be statistically highly significant (**).

RESULTS

The 7 favorable statements about the Internet were as follows:
- Item 1: The main advantage of the Internet is that it provides information fast;
- Item 2: The main advantage of the Internet is that it provides correct information;
- Item 3: Freedom of expression should not be restricted on the Internet;
- Item 4: Most people would not be able to cope if they no longer had access to the Internet;
- Item 5: I can't imagine my life without Internet access;
- Item 6: People who socialize on the Internet are happier than others;
- Item 7: If I didn't socialize on the Internet I would be sadder.

88.6% of students evaluate the Internet as a fast source of information (item 1) but are more reserved about its correctness (only 30.6% of them think that information on the Internet is much or very much correct – item 2).

68.9% of students believe that most people would not be able to cope if they no longer had access to the Internet (item 4) and 60.7% believe that they themselves would not be able to cope if there is no Internet (item 5). 53.9% of students believe that freedom of expression should not be limited to the Internet (item 3).

On the other hand, only a small percentage of students believe that socializing in the virtual environment ensures a comfortable psychological status, making them happier (item 6 – 10.9%, respectively item 7 – 21.5%) – Table 2.

The 3 unfavorable statements about the Internet were as follows:
- Item 8: Internet is addictive;
- Item 9: Parents should limit their children's access to Internet to at most one hour;
- Item 10: People's privacy is at risk due to social media.

A large part of students believe that the Internet can be addictive (item 8 – 76.2%). Although they generally do not consider it necessary for parents to limit their children's access to the Internet (item 9 – only 41.0% agree to a large or very large extent), they still believe that people's privacy is at risk due to social networks (item 10 – 59.5%) – Table 3.

Table 2: Favourable opinions about Internet services – students' responses

Favorable opinions about Internet services	Agreement:									
	1 – to a very small extent		2 – to a small extent		3 – in average measure		4 – to a large extent		5 – to a very large extent	
	n	%	n	%	n	%	n	%	n	%
Item 1	1	0.3	4	1.0	40	10.1	125	31.6	225	57.0
Item 2	8	2.0	49	12.4	217	54.9	93	23.5	28	7.1
Item 3	9	2.3	16	4.1	157	39.7	107	27.1	106	26.8
Item 4	7	1.8	25	6.3	91	23.0	143	36.2	129	32.7
Item 5	21	5.3	35	8.9	99	25.1	115	29.1	125	31.6
Item 6	81	20.5	121	30.6	150	38.0	34	8.6	9	2.3
Item 7	75	19.0	118	29.9	117	29.6	46	11.6	39	9.9

Table 3: Unfavourable opinions about Internet services – students' responses

Unfavorable opinions about Internet services	Agreement:									
	1 – to a very small extent		2 – to a small extent		3 – in average measure		4 – to a large extent		5 – to a very large extent	
	n	%	n	%	n	%	n	%	n	%
Item 8	3	0.8	17	4.3	74	18.7	139	35.2	162	41.0
Item 9	43	10.9	56	14.2	134	33.9	94	23.8	68	17.2
Item 10	10	2.5	44	11.1	106	26.8	118	29.9	117	29.6

The consumer of Internet services profile was outlined through another 7 questions, regarding the way, intensity, and main purposes for which students use Internet services. The recorded responses are shown in Table 4.

Most students (97.5%) say they use the Internet daily, and 70.9% of them use the Internet at least 3 hours a day. Almost 1/3 of students (29.4%) believe that they could not give up the Internet without problems even for a day - which indirectly means acknowledging an addiction to this practice. On the other hand, half of students (47.6%) indicate the one-week period as the maximum limit for opting out of the Internet, which is also a limited time frame. Most students access the Internet using their mobile phones (84.6%).

Although they use online services quite intensively, the main objective of students is not written communication – thus, almost 3 quarters of them (71.6%) say they receive/send between 1 - 10 emails per day, and 9.4% say they do not use e-mail at all. Half of students (52.4%) are active on social networks, having over 100 friends; however, there is also a significant percentage of students (20.8%) who have fewer than 10 friends online. In contrast, 74.2% of students post on social media only a few times a year or a few times a month. Therefore, students use social networks in a relatively moderate regime, mainly for instant communication and less for permanent posts.

Finally, the students were asked whether they liked learning, even autonomously, using multimedia tools and resources (Item 18). The answers to this question are generally favorable: 41.5% of students say they like much or very much to learn using multimedia tools, 38.0% of students agree on average with this statement, and only 20.5% of students show a total or partial disagreement (Table 5).

In order to express more precisely the obtained results, we quantified them as numerical scores, calculated as arithmetic averages of the responses. We calculated 2 scores, one for favorable opinions about Internet services (INTF) and one for unfavorable opinions (INTNF), with a range of variation between 1 – 5, which we interpreted as follows:

- Values between 1.00 – 1.49 = agreement to a very small extent;
- Values between 1.50 – 2.49 = agreement to a small extent;
- Values between 2.50 – 3.49 = agreement in average measure;
- Values between 3.50 – 4.49 = agreement to a large extent;
- Values between 4.50 – 5.00 = agreement to a very large extent.

Using the same procedure, we calculated also a third score, to characterize the intensity in using Internet services (INTS) – with a range of variation between 1 – 4 and interpreted accordingly:

- Values between 1.00 – 1.49 = very low intensity;
- Values between 1.50 – 2.49 = low intensity;
- Values between 2.50 – 3.49 = high intensity;
- Values between 3.50 – 4.00 = very high intensity.

The analysis of these scores reveals that students agree to a medium to large extent with the favorable statements about Internet services (INTF = 3.44 ± 0.590), but also with the unfavorable statements about these services (INTNF = 3.69 ±

0.817), being therefore aware of the negative influences that indiscriminate use of such technology can have. The intensity of Internet usage is high, although not exaggerated (INTS = 2.85 ± 0.350) – Table 6.

Table 4: Intensity and main purposes in using Internet services – students' responses

		n	%
Item 11. On average, I access the Internet:	several times a month	3	0.8
	several times a week	7	1.8
	daily	385	97.5
Item 12. On average, the amount of time I spend on the Internet during a day is:	less than 1 hour	7	1.8
	1 - 3 hours	108	27.3
	3 - 6 hours	145	36.7
	over 6 hours	135	34.2
Item 13. I could quit the Internet without problems for a time frame of:	1 year	25	6.3
	1 month	66	16.7
	1 week	188	47.6
	not even a day	116	29.4
Item 14. Generally, I access the Internet using:	a desktop	13	3.3
	a laptop	47	11.9
	a tablet	1	0.3
	a mobile phone	334	84.6
Item 15. On average, the number of emails I receive/send daily is:	none	37	9.4
	1 to 10	283	71.6
	11 to 30	58	14.7
	31 to 50	12	3.0
	over 50	5	1.3
Item 16. The number of friends (contacts) I have on the most frequently used social network is:	under 10	82	20.8
	between 11 and 50	68	17.2
	between 51 and 100	38	9.6
	between 101 and 500	109	27.6
	over 500	98	24.8
Item 17. On average, the frequency with which I post new information on my social media profile is:	none	35	8.9
	several times a year	152	38.5
	several times a month	141	35.7
	several times a week	55	13.9
	several times a day	12	3.0

Table 5: General opinion about the use of multimedia resources during the learning process – students' responses

General opinion	Agreement:									
	1 – to a very small extent		2 – to a small extent		3 – in average measure		4 – to a large extent		5 – to a very large extent	
	n	%	n	%	n	%	n	%	n	%
Item 18: I like to learn using multimedia tools and resources	19	4.8	62	15.7	150	38.0	81	20.5	83	21.0

Table 6: Internet services usage scores - descriptive statistics parameters

	n	Mean (M)	Standard deviation (SD)	Standard error of the mean (SEM)	Min	Max	Median
Favourable opinions about Internet usage (INTF)	395	3.44	0.590	0.030	1.57	5.00	3.43
Unfavourable opinions about Internet usage (INTNF)	395	3.69	0.817	0.041	1.00	5.00	3.67
Internet usage intensity (INTS)	395	2.85	0.350	0.018	1.71	3.71	2.86

We compared these scores according to the students' degree of agreement with the usage of multimedia resources during the learning process, to identify the possible links between these two elements. We started with the hypothesis that the students who enjoy using digital technologies for entertainment in leisure time should also enjoy using them professionally, respectively during the learning process.

The obtained results are presented in Table 7 and actually validate this research hypothesis.

Table 7: Internet services usage scores – compared according to the degree of agreement with the use of multimedia resources during the learning process

	Agreement:					
	1 – to a very small extent	2 – to a small extent	3 – in average measure	4 – to a large extent	5 – to a very large extent	Kruskal-Wallis test
	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD	
Favorable opinions about Internet usage (INTF)	3.02 ± 0.705	3.43 ± 0.612	3.32 ± 0.545	3.53 ± 0.522	3.67 ± 0.593	H = 23.634 p < 0.001**
Unfavorable opinions about Internet usage (INTNF)	4.02 ± 0.842	3.68 ± 0.692	3.74 ± 0.807	3.58 ± 0.733	3.63 ± 0.973	H = 5.414 p = 0.247
Internet usage intensity (INTS)	2.75 ± 0.415	2.97 ± 0.325	2.81 ± 0.350	2.88 ± 0.324	2.80 ± 0.358	H = 12.310 p = 0.015*

There are statistically significant differences between the scores of favorable opinions about Internet usage, determined by the degree of agreement with the use of multimedia resources during the learning process. The lowest scores are found in students who agree to a very small extent with the use of multimedia resources (3.02 ± 0.705), and the highest in students who agree to a very large extent with the use of multimedia resources (3.67 ± 0.593), so these 2 elements are in clear correlation.

The situation is different for the scores of unfavorable opinions: the highest score of unfavorable opinions about Internet usage is found in students who strongly disagree with the use of multimedia resources in the learning process (4.02 ± 0.842). As the degree of agreement with the use of multimedia resources increases, the score of unfavorable opinions decreases, but with random fluctuations, so the observed differences are not statistically significant.

The lowest score of Internet usage intensity is also found in students who strongly disagree with the use of multimedia resources in the learning process (2.75 ± 0.415) – therefore they are fundamentally against digital technologies. On the other hand, the highest score of Internet usage intensity (2.97 ± 0.325) is observed in students with little agreement for the use of multimedia resources in the learning process – so they are obviously not against digital technologies but probably prefer to use them exclusively for leisure. Students who agree to a medium or large extent with the use of multimedia resources in the learning process have scores of Internet usage intensity between the 2 categories mentioned above, so they enjoy using digital technologies both professionally and for leisure. The differences between the investigated categories of students are statistically significant.

DISCUSSION

The data from the literature prove that multimedia resources are an effective tool for learning because they are able to stimulate the students' interest [8] and improve their cognitive skills [9], also contributing to the development of supplementary skills – like empathy [10,11] or the academic writing [12]. Such tools are preferred by medical students because they tend to be kinaesthetic learners, who use multiple ways to present a topic for a better understanding [13,14,15] – observations also confirmed by our study.

Medical students are advanced users of smartphones and laptops and easily use such devices during their daily activities and learning [15,16] – a fact also confirmed by our results. The students investigated by us are generally interested in digital technologies and their applicability during the learning process [15].

It is thus natural that our students have generally positive opinions about Internet services, without thinking that they are addicted to them. Moreover, they are even aware of the presence of such a risk, which proves realistic and mature thinking. Most students use the Internet for information, although they are also aware of the risk of not obtaining accurate data – a fact confirmed by other literature data as well [17]. We must admit that the media and entertainment tools familiar to previous generations (TV, radio, written press) have now been joined by new, equally important, or even more important partners – the smart devices, which seem to have become the most convenient ways to access virtual environments.

Almost all students use the Internet daily, from their mobile phones, and most of them for at least 3 hours – which shows a certain degree of dependence on this technology, although it is not recognized as such. The most frequently used Internet services are, according to some authors, WhatsApp (as a fast communication solution) [18,19,20], YouTube, and Blackboard [21].

It is also interesting to note that socializing in cyberspace is not very important for our students and does not replace real socialization. Only half of the students have many friends on social media, but even they don't post very frequently (only a few times a year or a few times a month, which is a moderate pace). Moreover, almost 60% of students believe that people's privacy is at risk due to social networks – a result that is questionable, because not the social networks pose a danger, but the people using them inappropriately – an aspect that seems to have been omitted by students. Literature data also confirms that the students, particularly the medical students, are not very well informed about the ethical issues regarding the use of social media resources [21].

There is an obvious and positive association between the degree of agreement expressed by students towards the use of multimedia resources during the learning process and their favorable opinions towards the use of Internet services. This means that the general openness to modern technologies is reflected by integrating them into personal life, but also professionally. On the other hand, unfavorable opinions towards the use of Internet services are associated sometimes with the general avoidance of modern technologies. We also identified a separate category of students who, although they do not like to use multimedia resources in the learning process, are instead very active on the Internet; they are especially interested in activities on social networks, without being very concerned about the other advantages provided by digital technologies. Anyway, the students who enjoy using multimedia resources during the learning process are also constant users of Internet services, which they use mainly for information, but also for activities on social networks (mainly instant messaging) – a fact also confirmed by previous studies in the literature [21,22,23].

CONCLUSIONS

Technology is only a tool that can improve the teaching process, but not only by itself. Those who are responsible for change are the teachers, who can improve the students' outcomes by using technology to convey knowledge, streamlining their methods, and perfecting themselves [24]. The concept of blended education facilitates such approaches and can trigger positive changes, satisfying for students, who will benefit from flexibility and comfort, and, consequently, also for teachers, who will have the satisfaction that their work achieves its purpose and that the information they transmit is properly heard and acquired.

Conflicts of interest and sources of funding

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Authors' contribution

Conceptualization, C.G.D. and V.L.P.; methodology, C.G.D.; software, C.G.D. and R.S.C.; validation, R.S.C.; formal analysis, C.G.D.; investigation, M.E.A. and R.S.C.; resources, V.L.P.; data curation, C.G.D.; writing—original draft preparation, C.G.D. and M.E.A.; writing—review and editing, C.G.D. and V.L.P.; supervision, V.L.P.; project administration, C.G.D. and M.E.A. All authors have read and agreed to the published version of the manuscript.

Patient consent for publication

Informed consent was obtained from all subjects involved in the study.

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethical Committee of "Grigore T. Popa" University of Medicine and Pharmacy from Iasi, Romania (decision no. 21/16.11.2020).

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