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Blended Learning Techniques and their Usefulness in Medical Education

ABSTRACT OF THE DOCTORAL THESIS

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Content

Introduction

Today, digital technology has become increasingly used in everyday activities, and its intensive use in most areas of activity has led to changes in the structure of society, and even in the psychology of individuals, who are gradually changing their views on life, work and education, on the ideal way to spend leisure time and on the attributes of an optimal working climate. In this general context, it is clear that concepts of the educational process are also changing, and it is natural that they should keep pace with technological progress and incorporate new tools in an attempt to make it simpler and more efficient. The protagonists of this process, pupils, students and even teachers, are people with fundamentally different lifestyles from those of 20 years ago, for example, with different expectations and concepts.

The most obvious changes are seen in the current generation of students. This is the so-called 'Generation Z' (children born after 1997), also known as iGen, post-millennials or digital natives. These are children who have been exposed to technology early in life, so that using computers and gadgets has become second nature to them, as has online and social networking. The learning style of Generation Z students has features that differentiate it from the learning styles preferred by other generations of students: the most common preferred method is active learning (through discussion and involvement in practical projects), based on sensory stimuli (visual - images, graphics, auditory and kinesthetic). Learning 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 discussion with classmates and sharing projects and learning materials) or Google (for documentation and searching for scientific references). Students prefer self-paced, individual study with a flexible timetable and multimedia-intensive teaching materials: explanatory or demonstration videos, PowerPoint presentations with audio support, simulations, collaborative projects, discussion forums, online quizzes and case studies in the classroom environment (seminar or practical work room).

To resonate with these demands, the portrait of the ideal teacher has also changed significantly: first and foremost, he or she must be a good communicator, approachable and friendly, transparent, enthusiastic, passionate and competent in his or her field, able to propose realistic goals and provide immediate and constructive feedback on their

achievement, willing to provide professional and emotional support to his or her students, both academically and individually, to prepare them for their future careers.

In this context, the concept of blended education, which refers to the intensive integration of digital resources into the teaching process and its mixed online and on-site delivery, combining as far as possible the advantages of both methods in an optimal way, is becoming increasingly popular among teaching tools.

The study of this concept and its potential is a topical concern in international research, which has been stimulated all the more in recent years, when the COVID-19 pandemic has forced major changes in teaching to be addressed in order to keep university life at a more or less normal pace. In this unique and hopefully unrepeatable context, digital methods and distance learning have emerged as the only viable solutions, which have shown their full usefulness and potential to function as equal partners in the teaching process in the future.

Most approaches in international research on the effectiveness of using blended learning techniques are based on the comparative study of students' opinions according to the demographic factors that individualize them and possibly by analyzing their learning outcomes before and after attending blended programs. However, the research we have carried out goes deeper into this approach, investigating students' views in relation to how they relate to the virtual environment and online communities - students' general behavior as consumers of Internet services should be correlated with their preferences for different learning styles. The aim of the study was to establish which working methods are most popular with students in general, and, for different types of teaching tools, which categories of students they resonate best with - so that teachers can adapt their working style to the characteristics of the students they are teaching.

As a research method, we used the opinion survey, carried out on a consistent sample of students (551), selected from 4 medical universities in Romania. In addition to the standard statistical analysis, in order to investigate the internal connections between the items included in the questionnaire we used multivariate analysis, through the Two-Step Clustering procedure; the number of clusters was calculated automatically, using the Bayesian Schwarz criterion (BIC) and a maximum limit of 15 clusters. In this way we were not only able to cluster students according to common opinions, but also to identify the predictors responsible for this clustering - a novel approach that allows us to better understand the intimate reasons why students prefer or do not prefer a learning tool and, consequently, to make an informed selection of the optimal methods to make it more effective.

The results we obtained show clear correlations between students' favorable or unfavorable opinions about blended learning and their general preferences towards modern technologies and in particular towards Internet services, broadly divided into four categories: information, communication, entertainment and home facilities. This gives a different, and in our view more complex, picture of both the digital teaching tools that can work in higher medical education and the typology of students who will enjoy using such tools and be able to make the most of their benefits.

The main beneficiaries of this study are teachers, who work directly with students, but on the next level we find universities as a whole, which, by creating academic curricula attractive to students improve their promotion rates and their position on the educational market, being more attractive to future applicants - so that the pertinent investigation of the optimal methods of modernizing academic curricula by using blended learning techniques can be included, without any doubt, among university marketing strategies. At the last level we find the whole national education system, which in turn can become more efficient, providing competent and well-prepared graduates for the labor market.

Another noteworthy attribute of the present study is its deeply interdisciplinary character: initiated as marketing research, it focused in its approach on the potential application of digital technologies in the field of medical education, and its results were obtained through statistical studies, using both standard and advanced methods. We have thus set up a rewarding project, which has provided a wealth of useful data, both for my own future research that I wish to undertake in this area, and for any other research group that may be interested.

I. CURRENT STATE OF KNOWLEDGE

Chap. 1. Marketing – Basic Concepts

Health is defined as the state of balance between a person and their living environment; this concept has a profoundly multidimensional character (absence of disease + complex psychological, social and economic aspects), being practically a resource that supports an individual's functions in society (Purcărea, 2023). The health care service is one of the most complex social services, aimed at identifying a concrete health problem and eliminating it, together with the holistic treatment of a patient, physically and mentally (Ștefan, 2019); coordination from a multidisciplinary perspective is required for its efficiency (Popa, 2007).

Marketing science is a science that has the potential to create bridges between various fields through an integrated approach to them; in particular, healthcare marketing aims to meet the needs and desires of healthcare consumers and build long-term, win-win sustainable relationships (Kotler, 2016). Marketing activities are indispensable for the success of an organization, its economic and social development and the avoidance of financial risk (Purcărea, 2017); another definition of the concept characterizes it as "the means by which individuals or institutions are provided with the level of living" (Kotler, 1998).

In conclusion, marketing science can be defined as a complex and interdisciplinary concept, specific to the market economy and indispensable for achieving performance in an organization, being at the same time theory, practical activity and the art of applying principles and methods, an intrinsic component of the managerial sciences.

The basic functions in marketing are (Purcărea, 2017): permanent prospecting of the market and consumers, essential for the adaptation of the organization to the external environment and its dynamics; satisfying the needs and desires of consumers - the meaning of the existence of the organization; increasing economic efficiency, necessary for the survival of any organization and the permanent adaptation of the organization to the dynamics of its environment. These functions are exercised through the use of specific operational concepts (Purcărea, 2023): segmentation; targeting; positioning. Marketing strategy is defined as assessing the potential of the organization, formulating the objectives to be achieved and facilitating their attainment, using qualitative and quantitative multidisciplinary tools (socio-psychological, economic, mathematical, statistical, etc.).

The health care marketing mix is based on the concept of integrated care, embodied in the combination of the 10Ps (Lim, 2020):

- Product: The medical service offered by the organization as a treatment solution;

- Price: In relation to the financial possibilities of the beneficiaries, estimated by the minimum wage;
- Distribution: Various options, through the contribution of digital technology; telemedicine systems;
- Promotion: Informs and makes patients aware of the need to use the health services they need;
- People: Human resources in healthcare organizations - influence the quality of healthcare provided;
- Process: Effective staff monitoring procedures - maintain quality of services with minimum cost and maximum profit, both financial and non-financial;
- Physical records: Hard evidence of services provided: staff qualifications, technical characteristics of equipment used, best practice documents: patient statements, presentation booklets, etc.;
- Bundling: Grouping health services into service packages, which may also contain additional facilities useful for the patient;
- Partnership: Cooperation agreements between organizations and/or independent professionals, binding to create integrated service offerings;
- Policy: Procedures and protocols governing the formation of institutional partnerships and the organization of other elements of the marketing mix to create coherent integrated service offerings.

Its use in practice is in its infancy, although it has the potential to become the quality standard in the future.

Modern marketing approaches in health care organizations:

1. Online marketing: It is a pioneering field; it eliminates the main difficulties faced by traditional methods (high costs, high consumption of human resources, time-limited accessibility, use of inefficient techniques and transmission of perishable messages) and offers additional benefits, among which can be mentioned: more informational value of products and services, more interactivity for the consumer and more options to select desired products and services (Orzan, 2007). Its specific activities can be grouped into 4 categories (Hofacker, 2001): communication, selling, information provision and networking functions. The primary consumer is the patient/friends or relatives/any other citizens in general, who seek medical information out of simple curiosity or for objective reasons (Powell, 2011). Among the tools used in health services, the most commonly used are: websites; email

marketing; newsletters; medical forums; medical blogs; social networks; online advertising; search engine marketing.

2. Social Marketing: It aims to improve the health status of individuals in particular and the population in general and to address public health problems by motivating people to adopt a healthy lifestyle and to participate in healthcare programs (Purcărea, 2017; Purcărea, 2023). Its general objectives are: changing harmful behaviors and preventing disease; preventing accidents caused by harmful behaviors; protecting the environment affected by harmful behaviors; and promoting health by mobilizing the community (Purcărea, 2023; Cheng, 2009). Its product is not a physical good, but a beneficial idea that people need to solve certain problems; its price is not monetary, but refers to the psychological consumption, of time or effort, that the individual has to undergo to achieve change. The basic tool is communication (Răducu, 2021), which aims to inform and motivate individuals to make decisions in favor of their health and provides feedback - through the contribution of information technology.

3. Experiential Marketing: It is a particular strategy, through which organizations address different categories of consumers, with different cultural values, whose desires and needs are met by offering emotionally triggering experiences that stimulate their senses and facilitate the formation of personalized bonds (Țucmeanu, 2022); it can include 5 types of experiences (Schmitt, 1999): sensory; affective; through thinking; through action; relational; the ultimate strategy is to interconnect all these experiences in a holistic, intensive approach, designed to greatly improve the life of the health care consumer.

4. Interpersonal WOM Communication (Word-of-mouth): It is informal and impersonal word-of-mouth advertising, whereby a service is recommended by a person, usually the consumer who has used it, based on their personal experience and impressions; it has a strong persuasive role in influencing consumer opinions and decisions (Purcărea, 2020; Purcărea, 2023); it is an expression of their real satisfaction and transparency in the communication process. A related concept is "health information seeking behavior" (HISB), defined as a coping strategy adopted by an individual when they know they are in a potentially dangerous situation, and seek as much information about it as possible to familiarize themselves with it (Rees, 2000). The search actions in this approach are: questioning, asking for clarification, exchanging information, reading, listening or using third party information collections (Purcărea, 2023); the online environment is the best framework for WOM or HISB activities - which have thus become e-WOM / e-HISB.

5. Neuromarketing. It is a marketing approach that is based on identifying the

processes that take place in the consumer's brain to find out what their desires are and what causes them (Purcărea, 2023); it assesses "the impact of cognitive, affective and sensorimotor marketing stimuli on consumer reactions during purchase decisions" - by recording consumer brain activity (imaging techniques). Marketing techniques focus on stimulating the reptilian brain, which makes most rapid purchasing decisions, and on creating positive emotions, physiologically expressed through the release of dopamine, which stimulates the emotional brain to purchase products or services repeatedly.

Neuromarketing research quickly provides detailed and accurate information about subjects' true preferences, helps understand the subconscious decision-making process, and enables the identification of customer types (Horska, 2017) - certainly a cutting-edge, yet currently disputed field.

Chap. 2. University Marketing– Implementation Principles and Functions

University marketing is an indispensable component for the effective management of academic institutions, with complex objectives and consequences; it focuses on the student, who is the customer and beneficiary of the university, who must know and satisfy his/her needs, desires and interests, starting from the idea that the main functions of an academic institution are those of learning, scientific research and public service. The marketing macro-environment of universities (contextual environment) includes (Grigorut, 2011): the natural and economic framework of the region; the demographic framework; the technological and cultural level and the legislative framework. The marketing microenvironment of universities (work environment) refers to the groups with which the institution is in direct contact and from which it needs support, material or non-material, to fulfil its educational role: students, master's students, doctoral students; influential people - stakeholders; institutions responsible for future education (continuing education) and the business community; control organizations (ARACIS, CNCSIS and public).

University marketing operates with ideas and services (non-material goods), whose mental representation is essential and materialized by the concept of image, on its four coordinates - desired image; transmitted; received and effective; in this context, the components of the image to be pursued are: notoriety (spontaneous, assisted, "top of mind"); content; intensity, clarity and history.

Marketing strategy is defined as the way and directions in which an organization acts in response to the influence of environmental factors (Purcărea, 2017), following their analysis; its main components are:

- Action strategy - services offered by the organization;
- Outcome strategy - the degree of usefulness of the services offered and how they meet customer requirements;
- Engagement strategy - who will carry out strategic activities, where and when.

Effective practical ideas in designing current university marketing strategies include: using social platforms and user-generated posts; ensuring priority in online search engines; defining brand image; focusing on students; video-marketing techniques; use of paid advertising; statistics and graphs; participation of high school students in university courses; popularizing successful careers; promoting diversity; organizing interactive webinars; presentation brochures and guides or e-marketing.

Marketing research is the process of analyzing the internal and external environment of the organization by collecting, recording, processing, analyzing and interpreting data provided by the market, for an efficient allocation of material, financial and human resources; it allows the understanding of the market and promotes decision-making appropriate to the context and analysis of the results obtained by the organization following the implementation of a marketing strategy (Purcărea, 2017). Two major categories of research are used in the field: qualitative (usually used to understand a specific phenomenon or problem; conducted in small groups of people) and quantitative (used to investigate quantifiable phenomena; conducted on large, representative samples and allowing extrapolation of results).

The main university marketing policies are:

1. Product policy: It focuses on the design and delivery of products, services and ideas that meet the needs of target groups and the mission and objectives of the institution. Ideas are one of the most important products offered by universities; they are grouped into three categories: opinions; attitudes; principles. The main product offered by universities, in turn, focuses on two key concepts:

- qualification: is the official recognition on the labor market of the results obtained by a person in the process of learning, through an act of study which confers the legal right to practice a profession;
- learning outcomes: are the sum of knowledge, skills and competences that a person has acquired and can demonstrate after completing the learning process.

The general objective of the university education system is to develop competences by acquiring new, up-to-date knowledge and skills, maintaining existing ones and developing an adaptive-flexible and anticipatory-participatory attitude to the work process; in this context, the core of the higher education system is the specialization/study program, which has the task of training a distinct, self-contained category of professionals (characterized by the curriculum, subject descriptions, the organization of students and teaching staff during the study program and the academic quality assurance system).

2. Price Policy: Price is the expression of the value of products or services, indicating for the seller the value of the goods embodied in the product, and for the buyer the intensity of need, the nature and degree of expected satisfaction and overall utility (Heyne, 2014). Price is a fundamental element in the development of marketing strategies; it is determined by analyzing internal factors in the organization (costs) and external factors (demand and competition). Price is expressed either in actual value (tuition) or in the form of opportunity cost - individuals always have more needs than resources, so any choice they make involves some cost, not always expressed in money. The cost of university education is primarily related to the cost to the student, but there are also other costs associated with it.

Pricing is done taking into account several criteria: cost; demand; competition; income; perceived value; the main effective pricing strategies are: Leader Pricing strategy; Follower Pricing strategy; Predatory Pricing strategy; Skimming Pricing strategy; Penetration Pricing strategy.

3. Distribution Policy: It refers to the totality of decisions and activities involved in the process of exchanges between the institution and the target groups concerned; it is an area of dynamic interventions, since it must be reformulated and adjusted periodically. Exchanges involve ideas, goods and services that must be qualitatively and quantitatively appropriate and reach the target group at the desired time and place. The distribution channels used by universities are usually short, with the institution coming into direct contact with the target group, i.e., potential students, without having to use intermediaries; sometimes, however, intermediaries are necessary in order to achieve more efficient distribution and maximize revenue (e.g., County school inspectorates; embassies and specialized recruitment services). An important element in the distribution policy of universities is their physical location, which must be sufficiently visible and easily accessible to all. Modern education systems - online, distance or correspondence - partly eliminate the requirements for optimal location, but it is still important, at least for image and promotion.

4. Promotion Policy: It is the scientific approach to maintain control over the

messages conveyed about the institution in the external environment and to use them to achieve its objectives, using specific tools for this purpose: advertising and free publicity; public relations; sales promotion; sales force; embedding promotional information in the product, through design, packaging, labelling or branding; participation in exhibitions (trade fairs, shows, etc.) with its own stands; sponsorship and patronage or the personalized approach to the consumer.

Universities promote non-material products such as ideas or services; the product must therefore be presented with a specific message, which is more difficult to establish than in the case of economic organizations; the most common problem is lack of funds; the preferred solution is the Internet, which is the main promotional medium not only because of its low cost but also because of its suitability for the specific target group. Academic sobriety does not suit the use of overly commercial means of promotion, not so much because of the high costs as because of the perception of the target group. An important role in promotion is played by free publicity due to active presence in the community, media interest in education issues and public relations actions addressed to the media.

Chap. 3. Curriculum Modernization Strategies: The Concept of Blended Learning and its Role in Modern Higher Education

Blended education is defined as online or on-site learning, combining as far as possible in an optimal way the advantages of both methods; it is a current trend, particularly favored by the pandemic context, which offers the following advantages: flexibility in the teaching schedule, which simplifies students' access to the course regardless of their physical location and allows them to organize their learning time and pace according to their own needs and availability; more efficient teaching (Yates, 2009; Zhang, 2018); clearer organization of content; stimulation of active learning, which emphasizes student autonomy and the creation of learning communities; lower costs. A special category of students for whom blended learning forms are well suited are those who have opted to continue their studies after a period of interruption.

The design of a blended course is intrinsically based on technology, which is selected according to the nature of the course and the expected outcomes; a successful principle is to use the simplest tools, which do not place additional demands on the students, focusing on the teaching-learning process rather than on the complexity of the mechanism assisting this

process. The transfer of a course from a classical format to a mixed format entails significant changes; both the learning time required from the student changes and the time allocated to teaching, which, even if not increased, certainly changes in frequency and duration. Instead of a fixed number of daily or weekly meetings with students, usually lasting two hours, the teacher will have to carry out a series of daily or weekly activities, shorter in duration and randomly distributed throughout the day.

The blended format should be used in such a way as to stimulate students' participation and motivate them as convincingly as possible; elements to be taken into account when designing blended courses are: the modality (onsite or online) that best matches the expected learning outcomes of the course; the set proportion of learning time spent onsite versus online; the teaching methodology agreed by the teacher; the teaching materials available; the online technology that best matches the expected learning outcomes without distracting either students or teachers; the degree to which both teacher and students are familiar with the online technology and how student involvement changes the dynamics of the course.

Students' emotional motivation triggers their desire to learn and leads them to accept the intellectual effort required; this is most easily achieved through interaction - between student and teacher; between students; or between students and the proposed teaching material. Blended courses combine these three forms of interaction, with the opportunity to use the advantages of each. Online lectures can be conducted synchronously (in real time) or asynchronously (e.g., e-mail communication) (McDowell, 2011); asynchronous interaction has the advantage that it is not constrained by time and space. One difficulty raised, however, is that the online environment tends to amplify a person's behavioral characteristics, for better as well as for worse; teachers who are enthusiastic and empathetic with students will be more effective, but those who are bland will accentuate their distancing from students - an aspect that thus needs to be carefully controlled.

II. PERSONAL CONTRIBUTIONS

Chap. 4. Designing a Course Topic in Mixed Format ("Blended Learning")

The best solution is to redesign the whole course, using as a reference its objectives and the desired results, so as to take full advantage of the benefits offered by both the on-site tools that are retained and the online tools that are created. The desired outcomes of a course are defined by the knowledge, skills and abilities that a student should ideally have mastered by the end of the course; to achieve these outcomes, the teacher provides content, activities, interaction and feedback that guide and assist students in the learning process. The courses will be built one by one, to achieve a clearly defined objective, and only after that will they be grouped in the analytical syllabus - iterative development.

Each course will be built online, even if some scheduled activities take place onsite; each course is built completely according to a common structure that transfers from one course to the next. An online course consists of the following components:

- a module or folder which organizes all the component activities in their actual sequence;
- an introductory page, which explains the content, shows the expected results and provides the learner with the necessary teaching material/resources;
- online activities: discussion groups (forum type), assessment tests, problems to be solved.

a) Setting objectives and measurable outcomes of the course:

The ultimate goal of any course is change - the teacher believes that what they are teaching is useful because it can change the lives and evolution of their students for the better, and students are similarly motivated to learn when they believe that what they are learning will enable them to change, evolve, and change the world around them (Whitaker, 2013). The immediate goals and measurable outcomes of the course must be identified in this interpretation. Once the goals of the course have been established, it will be determined how they will be distributed over the time allotted to the course, i.e., their natural sequence and the time required to achieve each goal. The learning outcomes should then be specified on the course website, in their desired sequence, so as to clearly map the course for students, but also for teachers and network administrators.

b) Designing assessments to measure the proposed outcomes

The purpose of assessments is to find out the extent to which students have achieved

the desired learning outcomes by examining their performance, either directly through observation or indirectly through examination. Assessments are concerned with the actual activities or skills that students will be able to perform in the future when they have to apply in practice what they have learned in the course.

In the case of blended courses, the forms of student assessment are more diverse, using both onsite methods, whereby the teacher supervises the exam and directly observes the students' presentations, and online methods, whereby student's work is submitted and checked digitally (Anderson, 2008). *On-site assessments* are suitable for testing physical skills, human interaction or the mastery of laboratory procedures; the student performs the tasks required and the teacher watches him in all aspects and can intervene when necessary; they are also a good solution for oral examinations to assess students' verbal and non-verbal communication skills and how they interact with their interlocutors. *Online assessments* offer the advantage of flexibility, saving time and space, automation and the possibility of repeating them as often as necessary; the most common type of online assessment is the grid test, which is an important tool because it makes the student aware of his/her real level and motivates him/her in the active learning process. Another example is the assessment of assignments and projects on proposed topics, which are designed to demonstrate creativity, critical thinking, analysis and synthesis skills or knowledge of working methods and tools. Some online assessment activities can be designed so that feedback is obtained not only from the teacher but also from peers through peer assessments.

c) Designing learning activities that prepare students for the proposed assessments

Learning activities can also be designed to take place onsite or online; in the case of blended courses, learning is predominantly online, so learning activities should also be designed accordingly. The working principle in designing learning activities is to maximize the advantages of the onsite format, but also those of the online format, with an emphasis on active learning and linking the two modalities. The design of digital content is of paramount importance for its success; the basic rules are simplicity and clarity, concretized by the use of elements, taken from the standard rules of textbook writing (Adattil, 2018; Hojjati, 2014). To be effective, digital content must be able to attract and retain the attention of students; it is scientifically proven that the degree of attention with which the audience follows an exposition is maximum at the beginning and decreases considerably along the way, because the human brain cannot concentrate on a subject for more than 10 minutes (Medina, 2009). Practical examples from the teacher's personal experience may be interspersed between the

theory segments to keep the audience interested and emotionally engaged (Brown, 2014). Online courses are usually accompanied by onsite, hands-on sessions in which students will have to apply what they have learned (Kyndt, 2013). A good practice is to propose projects to be solved through teamwork - in this way students interact with and support each other, become more responsible and in addition can be monitored by the teacher, who individually advises the formed teams.

d) Establishing the workflows a student has to go through and creating the proposed activities

This is as important a stage as the others, as students need to be able to easily find their way around the site allocated to the course, to quickly understand what they have to do and when (both online and onsite); therefore, a well-built site should contain the following functions (Amaral, 2010):

- Organize all lessons in a unified and accessible format;
- A general description of the analytical program, the course outline and a guide to the course;
- A clear and personalized indication of the next steps to be taken by students;
- Clear indication of the assessment activities to be completed and links to them;
- Ongoing provision of technical assistance and guidance on the course rules;
- Provision of appropriate tools for communication between students and with the teacher;
- Provision of contact details of the teacher and other teachers and tutors involved in the course.

The teaching content is sequenced linearly, in units that can be identified as Modules, Lessons or Topics, and their overall presentation style must be clear, concise, logical and functional. The course home page should clearly state what is expected of students, i.e., how and when they are to consult the learning content, how they are to communicate with their peers and how they are to contribute to on-site activities or discussion groups - this will enable students to maintain the teacher's desired pace from week to week, adapting their learning style to the requirements.

There is no universal recipe for designing a successful blended course; iterative development is the strategy that works best, and involves designing step by step, in small steps. First design a single unit of a blended course, and if it works, design the other units in the same pattern; also, if difficulties are encountered during the course of a unit, update the whole structure, applying the changes to all units already designed.

Chap. 5. Making University Medical Education More Efficient by Applying Blended Learning Techniques

5.1. Working hypothesis, general objectives

The recent period has provided the opportunity to put into practice the blended learning concepts defined as such in the literature, with most of their variants; thus, the pandemic has facilitated a radical paradigm shift by switching the entire learning process from onsite to online format - a switch that would certainly not have been possible under normal operation. Online learning techniques have had to practically "stand the test of fire" and have proved their reliability and proved to be an invaluable experience, in my personal opinion, for both teachers and students. In a first stage the teaching program was exclusively online, allowing the testing of this style of work, and then it was switched to hybrid mode, which was the ideal framework for the use of the mixed approaches, which are the subject of this paper.

I have thus had the opportunity to design courses in mixed format and to apply them in practice (Chapter 4), but also, and even more importantly, to try to evaluate their effectiveness on a large scale, by investigating not only the opinions of the students with whom I work directly, and who represent a relatively small and particular sample (first-year students, specializing in dental medicine), but the opinions of all students in medical faculties - since they have all come into contact, to a greater or lesser extent, with the teaching tools concerned.

This is the basis for the study I have carried out, which aims to identify students' opinions on the effectiveness of blended learning and the tools it uses. The aim of the study was to establish which working methods are most popular with students in general, and, for different types of teaching tools, which categories of students they resonate best with - so that teachers can adapt their working style to the characteristics of the students they are addressing.

I have proposed a more comprehensive approach to this problem, based on the idea that it is not only basic demographic characteristics and prior educational background that determine students' preferences for a particular learning style but, equally important, how they relate to the virtual environment and online communities - students' general behavior as consumers of Internet services should be correlated with their preferences for different learning styles.

With the formulated objective, the research I conducted is in line with the general

trends present in the literature, which have highlighted that the use of digital techniques in the educational process stimulates students' participation, motivates them and eventually triggers faster "deep-learning" processes (Clark, 2005). Moreover, there is also evidence of a so-called "multimedia effect", according to which students learn better from text combined with images than from plain text (Mayer, 2009), which is not systematic and is in turn influenced by certain variables, such as the nature of the content conveyed, the student's previous level of knowledge, their learning and 3D projection skills (Fletcher, 2005), but has a proven contribution to the cognitive process, since:1) images facilitate the construction of mental models (Eitel, 2013) and speed up information processing; 2) images combined with text allow for distinct representations of the same information in long-term memory, generating multiple access points that facilitate search (Van Genuchten, 2012); 3) images stimulate inferential mechanisms (Jamet, 2006), building logical connections between representations.

The novelty elements brought by the present study derive from the application of known results from the literature to the particular field of Medicine - given that such results have been reported in different educational fields and at different levels (high school, university or post-graduate studies, in institutional or self-taught settings). Also, the whole literature reports international results, this type of studies being made for various countries, especially in the Anglo-Saxon sphere, and not at all for Romanian education - therefore such an initiative, directly oriented for medical students in Romania, may be all the more opportune. In addition to this, as mentioned above, a more exhaustive approach investigating several behavioral factors that play a determining role in students' acceptance or rejection of blended learning techniques, together with the statistical methods used for the analysis, from the Data Mining area, can be added to the above.

5.2. General Research Methodology

We conducted a case study in which 551 medical students from 4 universities in Romania were included. The general characteristics of the group are presented in Table 1. Three quarters of the students are female (76.2%); most of the students are in years 1 and 2 of study (63.7%) and are aged between 18-20 years (53.9%), with a mean age of 21.78 ± 3.736 years and a range between 18 - 48 years. Also, most of the students come from Faculties of Dental Medicine (47.5%) or General Medicine (34.5%), mainly from the University of Medicine and Pharmacy "Grigore T. Popa" in Iasi, Romania (64.6%).

Table 1. General Characteristics of the Study Sample		n	%
Sex	male	131	23.8
	female	420	76.2
Age group	18-20 years	297	53.9
	21-24 years	158	28.7
	over 25 years	96	17.4
Years of study	1	228	41.4
	2	123	22.3
	3	44	8.0
	4	2	.4
	5	44	8.0
	6	82	14.9
	resident	28	5.1
Specialization	Dental Medicine	262	47.5
	General Medicine	190	34.5
	Dental Technique	70	12.7
	Prophylaxis Assistance	1	.2
	Orthodontics and Dental Facial Orthopedics	28	5.1
University	UMF "Grigore T. Popa" Iași	356	64.6
	UMF Craiova	108	19.6
	UMF "Victor Babeș" Timișoara	80	14.5
	UMF "Iuliu Hațieganu" Cluj Napoca	7	1.3
Previously graduated university studies	yes	55	10.0
	no	496	90.0
Parents' level of study			
father	Secondary school	12	2.2
	High school	141	25.6
	Junior college	48	8.7
	Professional	168	30.5
	University	182	33.0
mother	Primary school	1	.2
	Secondary school	18	3.3
	High school	141	25.6
	Junior college	69	12.5
	Professional	120	21.8
	University	202	36.7
Total		551	100.0

Students were invited to complete an online questionnaire (Annex 1) consisting of 4 sections that addressed the following issues:

- Section I: Opinions about the effectiveness of online university education: favorable opinions (17 items) and unfavorable opinions (14 items), respectively the degree of participation and involvement in online teaching activities (4 items);
- Section II: Views on the effectiveness of multimedia resources in university education

(17 items);

- Section III: Agreed characteristics of educational videos (15 items);
- Section IV: Internet user profile (24 items).

Overall, students were asked to express their agreement with each item on a 5-step Likert scale, ranging from 1 - agree to a very low extent to 5 - agree to a very high extent; for section III students were only asked to tick YES to the features they found most appealing and useful in the educational videos, and for section IV, items 11-24, students were asked to choose from a list of possible answers the answer they found most appropriate, or to rank a list of options in order of preference.

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 general aims of the research and, at the start of the questionnaire, were asked to give their informed consent. Questionnaires were completed anonymously. The study was approved by the Research Ethics Committee of the University of Medicine and Pharmacy "Grigore T. Popa", Iași (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 sample size was calculated using the formula for a finite population, with 5% margin of error and 95% confidence level, taking into account that the original population is represented by 63216 Romanian students who were enrolled in the academic year 2020-2021, at faculties with a health and social work profile (according to official statistics). Based on the sample size calculation, the proposed study needed a minimum of 382 participants, so the sample size we achieved (of 551 students) is fully satisfactory.

Responses to each item were characterized by frequency distributions and contingency tables. Numerical variables were characterized by descriptive statistics (mean, standard deviation, standard error, range and median). Comparisons between samples were performed using the Chi-square test for qualitative data and the Mann-Whitney and Kruskal-Wallis tests for quantitative data, after first checking that they followed the law of normal distribution using the Shapiro-Wilks normality tests. We considered p-value ≤ 0.05 as statistically significant (*) and p-value ≤ 0.01 as highly significant (**). In order to investigate the internal connections between the items included in the questionnaire, we used multivariate analysis by means of the Two-Step Clustering procedure; the number of clusters was calculated

automatically using the Bayesian Schwarz criterion (BIC) and a maximum limit of 15 clusters.

In a first step, we reported the overall results obtained from the questionnaire at the whole group level, after which we refined the statistical analysis by means of 4 separate studies, oriented towards the sections of the questionnaire under investigation. The summary results of these studies will be detailed below.

Chap. 6. Students' Views on Online Learning vs. Other Elements Investigated

6.1. Working hypothesis and specific objectives

The concept of e-learning (also known as computer-assisted learning, online learning or web-based learning) refers to distance learning using electronic and digital technology (Basak, 2018; Sinclair, 2016). E-learning programs can run synchronously (online lectures, teleconferences, webinars or live streaming), but also asynchronously (recorded lectures, e-learning materials or learning apps installed on a computer, tablet or smartphone) (Basak, 2018; Prabhath, 2021). They can also function as such or in hybrid form, combining physical presence in the classroom with interaction in cyberspace (Basak, 2018). E-learning programs began to be implemented in the 1990s as a deployment alternative for distance learning, and in the last 10 years they have become increasingly present in university education and have entailed a shift from the classic teaching style and passive student to an active learning process based on collaboration between teacher and students (Banson, 2022; Wong, 2019; Muñoz Cristóbal, 2018). A veritable explosion of such programs being implemented on a large scale occurred in 2020 during the COVID-19 pandemic (Konstantinidis, 2022), which led to innovative curriculum transformation for many health-specific disciplines (Rose, 2020). The pandemic highlighted the value of e-learning programs as critical components that ensure continuity of the educational process in times of crisis (Fauzi, 2022). It is estimated that in the coming years e-learning will grow from the current 2% to a 30% share of all educational programs worldwide (Law, 2018). Furthermore, the World Federation for Medical Education promotes the use of technology as a best practice in medical education (Hays, 2012).

Currently, research is focused on quantifying the effectiveness of e-learning programs compared to traditional teaching methods on objective coordinates: degree of acquisition of

new knowledge, improvement of existing knowledge (theoretical concepts and practical skills), etc. A disadvantage already reported for programs of this type is that initially the number of students enrolled is high, but a significant number of students also fail to complete them (Wong, 2019), for various reasons such as lack of time, insufficient knowledge, inability to understand course content and lack of guidance from the lecturer (Hew, 2014). Online learning is challenging for students because they receive increased responsibilities in the learning process: they must independently appropriate the information they receive, set goals, and evaluate their progress (Kop, 2011), all of which can be overwhelming for untrained students, especially when the system is not specifically designed to encourage their active participation (Lee, 2013).

There are many successful strategies for getting and keeping students engaged that lead to academic success online (Broadbent, 2015). The teacher's task is to design online courses so that they are as consistent as possible with the actual needs of potential students. Campbell (2004) has shown that, to be effective, online learning in the undergraduate cycle must foster metacognition and reflective and collaborative learning (Campbell, 2008). Online learning platforms should facilitate interaction between teacher and students through visually appealing layout, flexibility, ease of navigation, and clear and well-structured content (Gudmundsdottir, 2018; Pham, 2019; Rani, 2014).

In the medical field online learning can be useful and is successfully applied. Numerous research collections have provided concrete scientific data on the effectiveness of collaborative web-based e-learning tools and their benefits for both students and physicians and other health professionals with different specializations: anatomy and physiology (Prabhath, 2021; Meinert, 2021; Mathiowetz, 2016), medical imaging and radiotherapy (Konstantinidis, 2022; Howlett, 2011), physiotherapy - management of knee osteoarthritis (Jones, 2021), pharmacy (Hamilton, 2020) or nursing (Chan, 2021).

Our study addresses this broad issue in order to assess the level of attractiveness of e-learning programs among Romanian medical and dental students and the factors influencing it: students' demographic characteristics (gender and age group), but also their personal background, materialized by their preferences as computer and Internet users (Dascălu, 2023a).

6.2. Summary Results

The results obtained in our study partially confirm the data in the literature, but also bring new elements, as follows:

- Romanian medical students are generally open to online teaching activities and liked online courses. Almost half of the students (43.9%) would prefer to participate in such courses in the future because they find them useful (28.9%), and almost a quarter of the students (23.6%) would prefer to participate in online internships in the future, although they are less useful in their opinion. Almost half of the students consider that there are medical disciplines that cannot be easily transferred online due to objective limitations. Our students find online learning more comfortable and flexible than traditional classes because teaching activities focus on the quality of the material delivered. They prefer to learn using digital tools and resources, to work autonomously and to personalize the tasks they have to solve according to their own learning pace. They also believe that the digital skills they acquire will be useful in their future professional life. Among the disadvantages of online learning, students pointed out the lack of communication and human interaction with teachers and the lack of relevant feedback from them; they do not always feel properly motivated to learn online and are aware of the objective limitations caused by certain peculiarities of some medical disciplines.
- No significant gender differences are found in terms of overall favorable or unfavorable opinions towards online learning (although such differences are reported, but particularized by specific characteristics investigated); instead, differences are found between age groups - more mature students are more agreeable to this learning style;
- Parents' level of education influences students' favorable opinions towards e-learning - which is least liked in families where parents have only secondary education;
- The study shows significant associations between students' general behavior as users of modern gadgets, digital technologies and Internet services and the extent to which they like online learning. Students who generally use multimedia resources in their learning process also agree significantly more with online learning - as do students who use Internet services mainly for information or home facilities (being advanced users with good computer skills).
- Students who use Internet services for entertainment do not have unfavorable opinions towards online learning, and those who use Internet services mainly for communication do not differ in their particular opinions, favorable or unfavorable, towards online learning - but this is explained by the fact that most students now use the Internet for communication on social networks, so that this criterion can no longer be used to differentiate them.

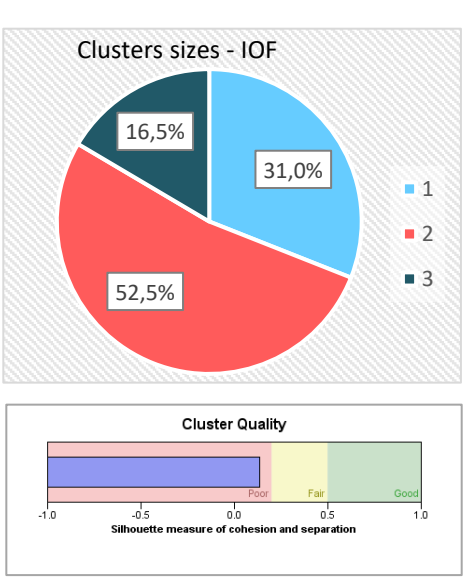

Figure 1. Size of identified clusters for favorable opinions on online learning

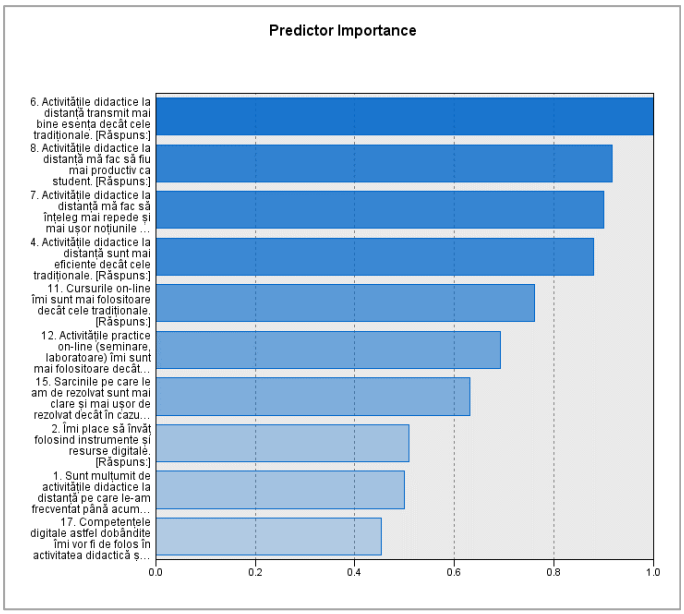

Figure 2. Hierarchy of the 17 items depending on the predictors' PI importance coefficients

The classification of the 17 items on students' favorable opinions towards online learning led to the identification of 3 clusters, the largest of which covered 52.5% of students and the smallest of which covered 16.5% of students (Fig. 1, 2).

In terms of favorable opinions about online learning, the most important predictor is item **I_6a** - *Online teaching activities convey the essence better than traditional ones*, accompanied by equally pragmatic statements: online activities make students more productive, allow them to understand the concepts presented faster and easier, and are more efficient than traditional classes, thus being more useful than traditional ones. According to these predictors, there are three categories of students: those who do not like to learn online - they are young, aged between 18 and 20, they generally do not like to use multimedia resources for learning and use the Internet mainly for communication and entertainment; students in the second group partially dislike learning online or are neutral - they are also young (aged between 18 and 20), but use multimedia resources for learning and use the Internet mainly for communication and information. Students in the third group find online learning useful for them - they are older (over 21), they are willing to use multimedia resources for learning, and they use the Internet mainly for information, followed by communication.

The students clustering according to the other 14 items, detailing unfavorable opinions about online learning, revealed the presence of 2 clusters. The largest comprises 65.2% of cases and the other 34.8% (Fig. 3, 4).

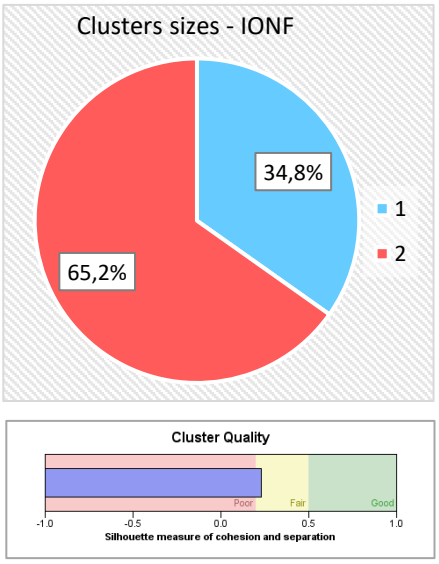

Figure 3. Size of identified clusters for unfavorable opinion on online learning

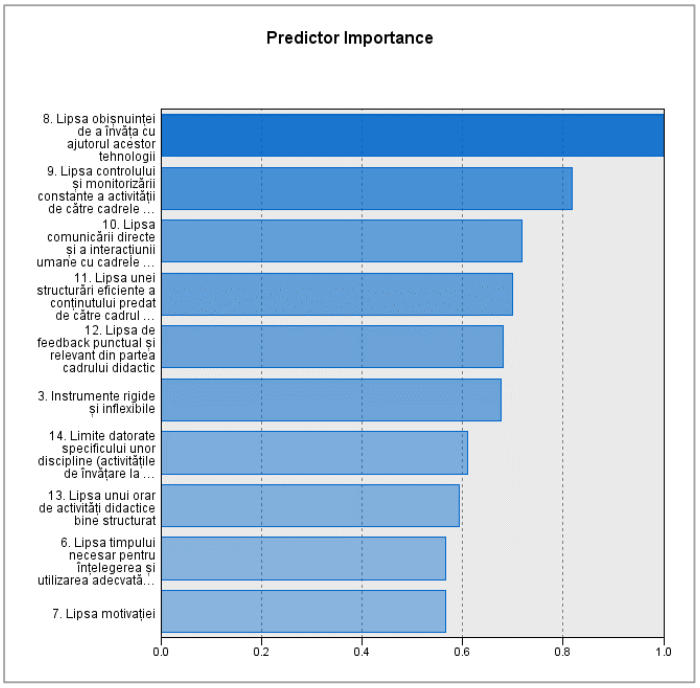

Figure 4. Hierarchy of the 14 items depending on the predictors' PI importance coefficients

In terms of unfavorable opinions about online learning, the most important predictor is item **I_8b** - *Students are not used to learning using these technologies*, accompanied by elements involving the human factor: students feel the lack of constant control and monitoring by teachers, direct communication and human interaction, and believe that teaching materials taught online are poorly structured. According to these predictors, there are two categories of students: one contains students who agree with the listed disadvantages of online learning - they are mostly young, aged between 18 and 20, neutral or partly disagree with the use of multimedia resources for learning and use the Internet mainly for communication and entertainment; the other category contains students who do not believe so much in the listed disadvantages - again, these students are older (aged over 21), use multimedia resources for learning and need Internet services mainly for communication and information.

Chap. 7. Students' Views on the Use of Blended Learning Techniques and Multimedia Resources in the Learning Process vs. Other Elements Investigated

7.1. Working Hypothesis and Specific Objectives

At present, the vast majority of subjects in medical education continue to rely predominantly on traditional teaching techniques. Such techniques certainly have their merits, proven by years of practice, but they now have to adapt to new challenges brought about by technological progress. The literature highlights numerous concerns about the challenges of modern teaching and the possibilities for its improvement, investigating the potential for the use of blended learning techniques. The aim of these research groups is to encourage universities and course coordinators to consider autonomous learning and to create the appropriate institutional framework in which blended learning techniques can be incorporated into the curricula of medical faculties (Varthis, 2018).

Blended learning is based on combining diverse learning styles and environments, combining traditional classroom with modern computer-assisted and multimedia methods (Graham, 2006; Ruiz, 2006). Blended learning techniques provide flexibility and mobility, generate interest and enhance collaboration among students (Kang, 2021; Ho, 2021). These techniques combine face-to-face and online, synchronous (real-time) and asynchronous (take place at different locations and times for each participant) teaching and learning activities (Bruggeman, 2021; Maggio, 2018).

Blended learning techniques were implemented accelerated during the Covid-19 pandemic. Lapitan et al (Lapitan, 2021) proposed a strategy to facilitate the transition from traditional face-to-face learning to online instruction - the DLCPA strategy, based on the integration of 5 components: Discover, Learn, Practice, Collaborate, Assess. This strategy, developed in a pandemic context, was designed in two phases: an asynchronous phase, consisting of pre-recorded videos on YouTube, used to allow students to study at their own pace, and a synchronous phase, conducted on videoconferencing platforms (Zoom, Google Meet). The effectiveness of the DLPCA strategy was analyzed based on three indicators: student learning experience; student academic performance; teacher opinions. The DLPCA strategy had an overall positive impact on students and teachers, the difficulties reported being primarily technical (stability of the Internet connection) or subjective (teachers' lack of experience in using videoconferencing systems). Most students were satisfied with the DLCPA strategy, as were teachers, who expressed their willingness to learn how to use such

tools and appreciated their ability to improve interaction with students.

In a systematic review, Coyne et al (Coyne, 2018) identified the core attributes that contribute to the development of an effective blended learning model applicable to any medical (and other) field: the connection between theory and practice and autonomy of learning. Blended learning techniques allow the use of different learning styles and repeated viewing of educational materials, improving the level of theoretical knowledge and practical skills, and are preferred by students compared to traditional methods due to their flexibility.

The present study aims to investigate in more depth how medical students perceive comparatively the usual didactic tools used in blended learning programs, in relation to the usual attributes that characterize them (gender, age group, parents' level of education), but also to a new attribute, not investigated so far in the literature: their general behavior as users of digital technologies and in particular of Internet services (Dascălu, 2023b). We chose this approach because, in our opinion, the success of a blended learning program based on digital tools should be significantly influenced by their general attitude towards the digital environment and the importance they attach to it in their daily activities, and not only in those related to learning. Thus, a learner who generally accepts digital resources and finds them useful not only for entertainment, but also for making different daily activities quicker or easier, should naturally also accept the blended learning style which, although at first glance may seem more impersonal, emphasizes autonomy, flexibility and empowerment.

7.2. Summary results

The results we obtained demonstrate the effectiveness of blended learning techniques in medicine, confirming the data already reported in the literature. There is no doubt that students prefer blended learning tools and multimedia resources for the flexibility they offer in the learning process and for the opportunity to organize their own study program according to the pace they agree. Our study represents a novel approach because it documents the idea that students' preferences for particular learning tools have well-founded motivations that correlate with the degree to which they generally like digital technologies and use them in their daily practice. Specifically, the following conclusions emerge from our study:

- There are no statistically significant differences neither between genders nor between age groups in students' preferences for using multimedia resources in the learning process; the highest proportion of students who do not agree with these tools (23.9%) come from families with high school education - while both students whose parents have

university education and those whose parents have only pre-secondary education agree to a great or very great extent to use multimedia tools in the learning process.

- Girls are more likely to favor traditional teaching methods, to which they attribute the most qualities; to a lesser extent they also value PowerPoint presentations; boys are more likely to value, although not statistically significant, the qualities of online documentation sources, and educational videos are highly valued by both sexes.
- Younger students, aged 18-20, are significantly more likely to like traditional teaching methods and significantly less likely to like educational videos and online documentary sources than the other two age groups.
- Students from university-educated backgrounds are significantly more likely than those from high school or pre-school backgrounds to agree with online resources - with the other blended learning tools being agreed with at similar levels by students, regardless of their family backgrounds.
- Students who use the Internet mainly for information, as well as those who use the Internet mainly for home facilities, largely agree with all four investigated blended learning tools; those who use the Internet mainly for communication or entertainment largely agree only with traditional teaching methods and educational videos, the other two proposed tools being only moderately agreed.

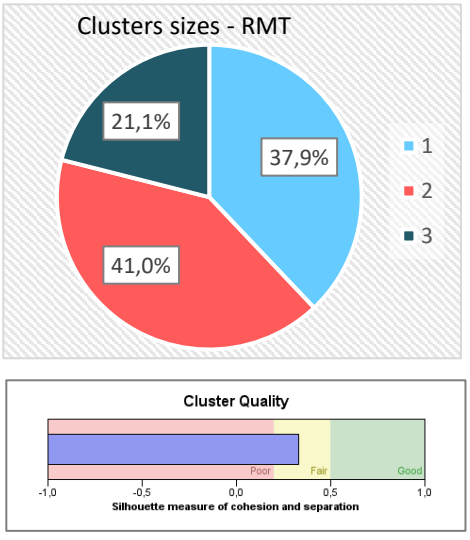

Figure 5. Size of identified clusters for the advantages of traditional didactic methods

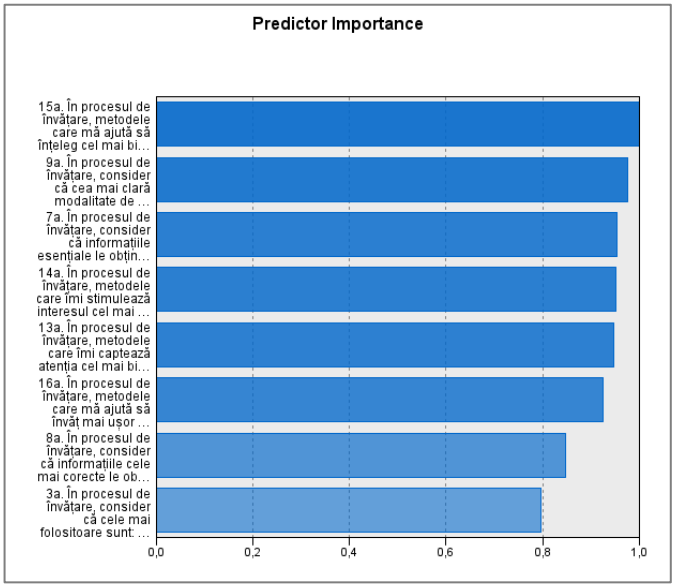

Figure 6. Hierarchy of the 16 items depending on the predictors' PI importance coefficients

We performed the classification of the questionnaire items (the 16 items evaluating the advantages of the 4 blended learning tools), using the Two-Step Clustering technique, in

order to identify the significant predictors among them and their internal connections.

The classification of the 16 items on traditional teaching methods led to the identification of 3 clusters, the largest of which covered 41.0% of students and the smallest 21.1% (Fig. 5.6).

The classification of the 16 items on PowerPoint presentations led to the identification of 4 clusters, the largest of which covered 37.4% of students and the smallest of which covered 14.5% of students (Fig. 7.8).

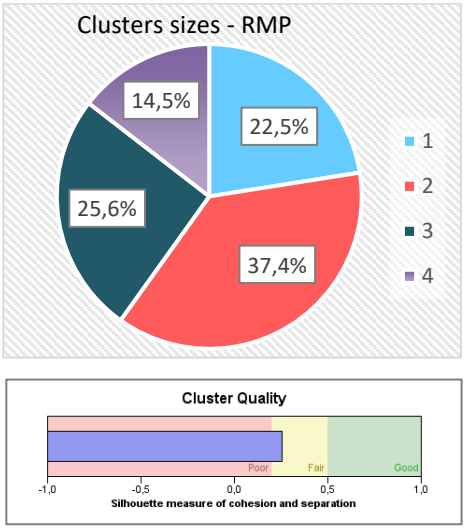

Figure 7. Size of identified clusters for the advantages of PowerPoint presentations

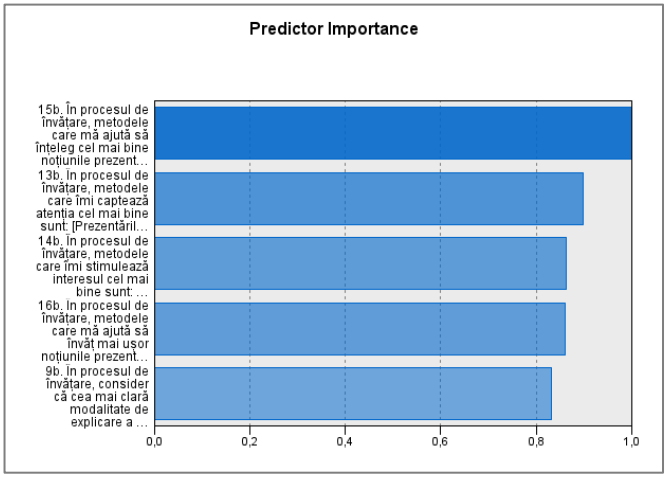

Figure 8. Hierarchy of the 16 items depending on the predictors' PI importance coefficients

The classification of the 16 items on educational videos led to the identification of 4 clusters, two larger ones, each encompassing about a third of the students, and two smaller ones (Fig. 9,10).

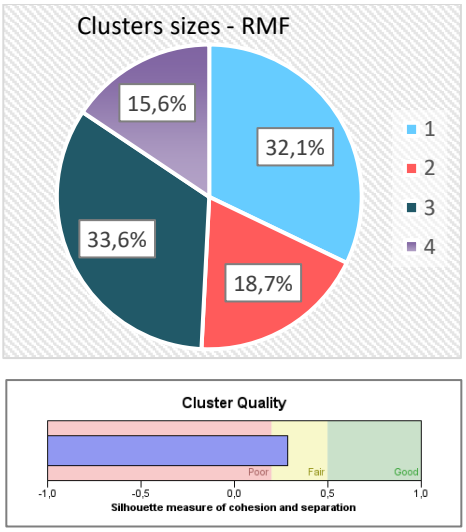

Figure 9. Size of identified clusters for the advantages of didactic films

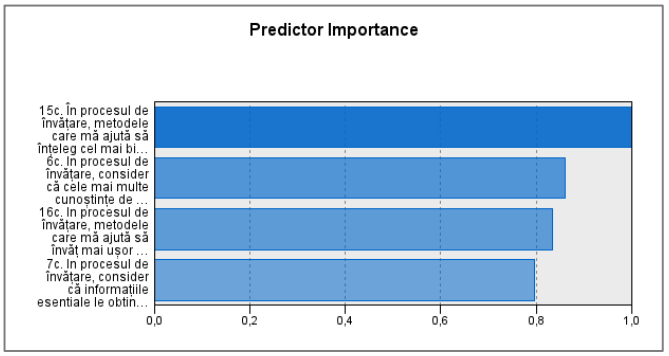

Figure 10. Hierarchy of the 16 items depending on the predictors' PI importance coefficients

The classification of the 16 items on online documentation sources led to the identification of 2 clusters of approximately equal size (Fig. 11,12).

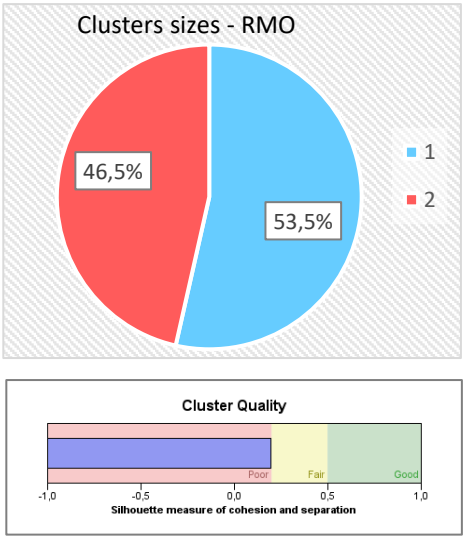

Figure 11. Size of identified clusters for the advantages of online documentation sources

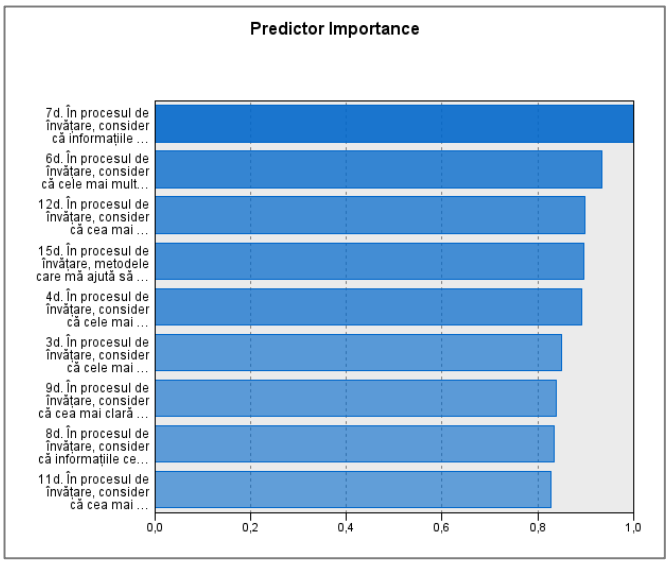

Figure 12. Hierarchy of the 16 items depending on the predictors' PI importance coefficients

The most important predictor in ranking students' opinions about traditional teaching methods, PowerPoint presentations and educational videos was item **II_15**: *Methods that best help to understand the concepts presented*; the most important predictor in ranking students' opinions about online documentation sources was item **II_7d**: *Methods that provide essential information*.

Students who strongly agree with traditional teaching methods are predominantly female, aged between 18 and 20, do not particularly agree with the use of multimedia resources in the learning process and use Internet services mainly for communication; students who strongly agree with PowerPoint presentations are also predominantly female, aged between 18 and 20 and use Internet services mainly for communication, but have a good level of acceptance of the use of multimedia resources in the learning process. The students who are very much in favor of educational videos are more than 3/4 female, evenly distributed by age group and with a good level of acceptance for the use of multimedia resources in the learning process; they use Internet services mainly for communication and information. Students who strongly or very strongly agree with the use of online documentation sources are slightly older and evenly distributed by gender; they generally enjoy using multimedia resources in the learning process and Internet services are also used for communication and information.

Classical oral presentations, as well as PowerPoint presentations and educational videos, are valued by students primarily for their usefulness, while online documentation

sources are valued for their ability to synthesize and scientific rigor. Other features valued by students are the clarity and synthesis ability of classic oral presentations, the interest-getting ability of PowerPoint presentations and the scientific rigor of educational videos. Our analysis therefore reveals that students accept certain teaching tools over others for very pragmatic reasons, which can then be used as benchmarks for their appropriate integration into blended learning programs.

In fact, two broad categories of students stand out: those who prefer the classical teaching style and PowerPoint presentations and those who prefer educational videos and online documentation sources. Students in the first category are usually female, in their first years of study (aged 18-20) and are mainly interested in Internet communication. Those who like traditional teaching methods tend to avoid the use of multimedia resources for study, being more inclined towards passive learning, while those who like PowerPoint presentations also like multimedia tools, being active learners. Students in the second category, in turn, also agree to use multimedia tools independently in their learning and active learning style and use all four categories of Internet services investigated (including home facilities). Students who agree to learn using online learning resources tend to be more mature (aged over 20), while educational videos are agreed by all students, regardless of age.

Chap. 8. Study Of Students' Preferred Features of Educational Videos vs. Other Elements Investigated

8.1. Working Hypothesis and Specific Objectives

Multimedia resources such as educational videos have recently revolutionized the teaching style in undergraduate medical education, opening up a wide horizon of new and exciting opportunities. By enabling students to participate in immersive and dynamic learning sessions, this type of material allows them to understand complex concepts, develop real practical skills and thus acquire the knowledge needed to become good professionals. Their integration into academic curricula with a medical focus offers a multitude of advantages, bringing an obvious added performance to the teaching process, with clear benefits for students, who receive a new and useful tool to prepare for real medical practice (Berrocal, 2021) - successful examples being reported in multiple fields (Kwan, 2011; Omar, 2013; Pereira, 2014; Shuldman, 2010; Haines, 2010). Current technological advances are enabling teachers around the world to create high-quality educational videos at low cost and

time investment (Krumm, 2022). Although relatively easy to produce from a technical point of view, teaching materials of this type are very complex in structure, including most forms of digital content - real footage, animations, simulations and interactive presentations; therefore, certain skills are required to produce them, which refer to the ability to organize and structure the material in a form that is as clear, coherent, correct and, at the same time, attractive to the target audience as possible. In the online environment at present there is a real influx of medical videos (a general Google search using the keywords "medical procedure" and video resources provided no less than 303,000,000 results), but their quality and content are very varied, so it is often difficult for teachers to identify the most competent materials, choose the best method to use them and the optimal teaching framework in which to implement them, and eventually decide whether it is better to use pre-existing videos or create original content (Dong, 2015).

Despite these dilemmas, educational videos are still today an indispensable practical tool for modern education, with an undisputed position among digital tools, promoting certain advantages and benefits, among which the following can be mentioned:

- Stimulating student interest and autonomous, flexible learning based on visual stimuli;
- Realistic graphical simulations;
- Access to advanced specialist information;
- Procedural demonstrations;
- Feedback and evaluation;
- Interdisciplinary learning.

It is therefore clear that educational videos are some of the most effective learning tools, with multiple possible uses and indisputable benefits for both teachers and students. Moreover, the results reported by our study also confirm the statement made, showing the clear preference of the students investigated for this type of resource. The major challenge, however, is to produce quality materials that are a real aid to the teaching process - not always a simple task, as it requires an investment of time and resources and, equally important, technical knowledge that university teachers do not have.

There is strong evidence in the literature that creating valuable educational videos requires not only specialist knowledge of the subject area, but also a wide range of knowledge from other areas: IT, set design, directing, filming techniques or audio recording and processing (Dong, 2015). The optimal solution, in fact, is for universities to employ professionals from these related fields to work with teachers and assist them in the production of video materials - but this obviously entails significant additional costs. In

addition, studies have also shown that, apart from the technical aspects, quality educational videos follow certain production rules that make them popular with students and enjoyable to watch, thus successfully achieving their intended purpose.

Our study aims, in turn, to investigate for medical and dental students the validity of these rules that give "popularity" to educational videos, in correlation with basic demographics, but also with their general behavior as users of digital technologies and in particular of Internet services - in order to substantiate the same hypothesis we formulated in previous research, namely that students who generally like digital resources position themselves differently towards any teaching tool compared to others. Therefore, also educational videos, for maximum effect, should be designed differently depending on the type of students they are aimed at (Dascălu, 2021; Dascălu, 2020; Dascălu, 2019; Dascălu, 2018).

8.2. Summary results

Our study confirms the data in the literature, according to which students highly agree with the educational videos. Regarding the recommended features for video design, we have in some cases registered different opinions. Thus, three quarters of students (74.6%) do not particularly prefer shorter videos, with no significant differences between genders or age groups, although students coming from families with pre-secondary education are more likely (38.1%) to like videos of 6 minutes or less. Three quarters of students (73.1%) also prefer videos with subtitles - mostly girls, regardless of age and parents' educational level. Almost all students (95.5%) want the videos to contain graphics to highlight important concepts, and opinions are almost evenly divided on the presence of the human instructor: 47.0% of students like videos designed as lectures, in which the teacher is filmed at the blackboard, while 53.0% like videos designed as PowerPoint presentations, with pictures and diagrams.

On the other hand, our study brings new data resulting from the correlation of students' preferred features of educational videos with their general views as users of Internet services. Thus: students who use Internet services primarily for information differ statistically significantly from the others in that more of them (48.9%) prefer educational films in which the teacher is filmed at the blackboard, where he/she explains and draws. Students who use the Internet mainly for communication are also those who prefer the narrator to speak in Romanian (86.2%), with no other statistically significant particularities. Students who use Internet services primarily for entertainment stand out statistically significantly from the

other categories in that they prefer the spoken text to be accompanied by captions at the bottom of the screen (78.1%) and animated graphics to explain it more clearly (90.2%), and the video to present the subject in a structured way, gradually moving from simple to complex (87.4%). Students who use Internet services for domestic facilities have no particular preferences in terms of how educational videos are made.

The classification of the 15 items on the characteristics of the educational videos preferred by the students led to the identification of 3 clusters, of approximately equal size, the most important predictor for defining these classes being item **FD7**: *Visually appealing - images used only for aesthetic purposes vs. their absence*, followed by item **FD10**: *Explanatory schemes and diagrams already drawn vs. drawn simultaneously with the explanations*; thus the classification is mainly determined by the students' perception of the visual aspect of the educational videos.

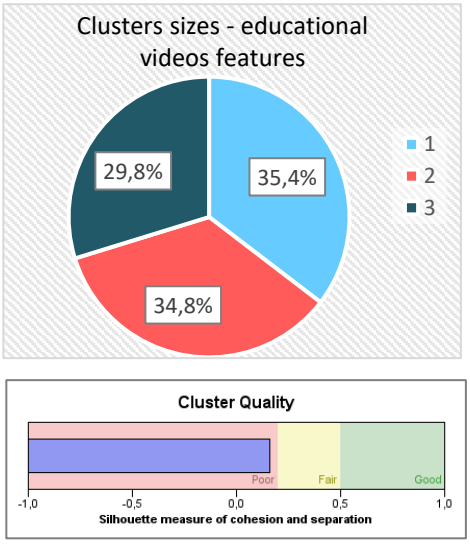

Figure 13. Size of identified clusters for preferred characteristics of educational videos

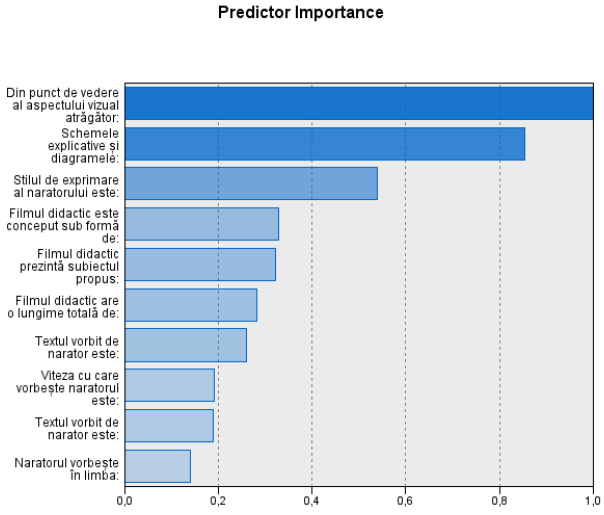

Figure 14. Hierarchy of the 16 items depending on the predictors' PI importance coefficients

The 3 clusters identified have relatively similar structures, without many statistically significant differences (Fig. 13,14).

The classification of students according to the agreed characteristics of educational videos is therefore determined by the perception of their visual appearance. The first identified cluster (35.4% of the cases) contains students who, in their vast majority, prefer educational videos to contain images used only for aesthetic purposes, to fill the breaks (90.3%). These students also agree that the narrator's voice should be female (59.5%), the narrator should speak in Romanian (94.4%), at a low speed (79.5%) and should express himself in a friendly conversational style (95.4%). All the students in this cluster want the

text spoken by the narrator to be accompanied by animated diagrams to explain it more clearly and by graphic elements to highlight the important notions, and for the subject to be presented in a structured way, explaining the simple notions first and then the complex ones (96.9%).

The second cluster also includes a third of students (34.8%), but the vast majority of them (88.0%) are not interested in educational videos containing images used only for aesthetic purposes, to fill the breaks, but want explanatory schemes and diagrams to be drawn simultaneously with the explanations (94.8%). Other specific preferences for students in this category are for the narrator's voice to be male (65.6%), spoken text to be accompanied by captioning at the bottom of the screen (86.5%), explanatory text for diagrams and drawings to be displayed directly on them, in the area to which they refer (89.6%), the film to be designed as a practical lesson, with the teacher filmed at the blackboard explaining and drawing (65.1%) and to be as long as necessary, not having to comply with the 6-minute rule (93.8%).

The last cluster groups 29.8% of students, who are also not interested in educational videos containing images used only for aesthetic purposes, to fill the breaks (65.9%), but agree that the explanatory schemes and diagrams are already drawn, in the film only explained (76.2%). Just over half of the students in this category (52.4%) agree that the narrator should speak at high speed, compared to only about 1/4 of the students in the other clusters, who usually prefer the narrator to speak at low speed. In addition, the vast majority of students in this cluster do not consider it necessary for educational videos to contain background music (80.5%). Almost 1/3 of them agree that the films should also be made as free-form presentations (30.5%) and the vast majority (81.7%) want them to be designed as PowerPoint presentations with animated pictures, diagrams and schemes.

It can be noted, however, that students who are not interested in educational videos containing images used only for aesthetic purposes and who agree that explanatory diagrams and charts should be already drawn, without being dynamically displayed, are slightly younger than the others and do not particularly agree to use multimedia resources in the learning process; they use Internet services mainly for information and communication. These are therefore students who are slightly disinterested in digital technologies in general.

Students who agree that educational videos contain images used for aesthetic purposes only and explanatory schemes or diagrams displayed dynamically are aged 18-24 and enjoy using multimedia resources in their learning, as do those who do not agree that educational videos contain images used for aesthetic purposes only, but prefer explanatory schemes and

diagrams to be displayed dynamically.

Chap. 9. Students' Views on Internet Services vs. Other Elements Investigated

9.1. Working Hypothesis and Specific Objectives

Finally, given that throughout the paper we have related students' opinions towards blended learning techniques to their general position towards digital technologies, defined by their behavior as users of Internet services, we propose to analyze their opinions towards these services in more depth, compared by demographic characteristics and in correlation with the other calculated scores. Such an approach is necessary for a more comprehensive understanding of medical students' psychology and the intimate causes that make them like or dislike digital technologies and use them constructively and effectively in the process of preparing them for a medical career.

9.2. Summary Results

Students generally have positive opinions about the Internet and its services, but do not consider themselves to be addicted to it. Almost all students use the Internet daily from their mobile phones, and most of them for at least 3 hours - which shows a clear degree of dependence on this technology, although it is not recognized as such; most students use these services for information, although they are also aware of the risk of not always getting correct information. It is interesting to note that socializing in cyberspace does not occupy a very important role among students' daily activities, and in no way replaces real socializing; moreover, almost 60% of students even consider that people's privacy is at risk because of social networks.

The average score of favorable opinions towards Internet services is in the medium to high range of agreement, with no significant differences between genders and age groups - although boys have a slightly higher score of favorable opinions than girls, as do the youngest students aged 18-20. The most favorable opinions towards Internet services are recorded among students from university-educated families, and the least favorable opinions are found among students from high school-educated families - the difference between them being statistically significant.

The average score of unfavorable opinions towards Internet services is also largely in

the area of agreement; its values are significantly higher for girls than for boys. Again, it is found that the score values vary in proportion to age: the lowest degree of disagreement was observed among young students, and the highest among students over 25. The most unfavorable opinions towards Internet services are found among students coming from families with secondary or pre-secondary education, but the differences observed are not statistically significant.

The score of favorable opinions towards Internet services is statistically significantly correlated with all opinion scores on the use of digital tools in the teaching process. Students who have favorable opinions towards Internet services in general also have favorable opinions towards online learning and agree with the use of PowerPoint presentations and online documentation sources as learning tools. On the other hand, they do not agree with traditional teaching methods and have a neutral attitude towards the use of educational videos.

The score of unfavorable opinions towards Internet services is directly correlated proportionally and statistically significant only with the score of disagreement towards online education and with the score of agreement towards classical teaching style - it is also correlated, also statistically significant, but inversely proportional, with the score of agreement towards online education. Students who do not generally agree with Internet services have a neutral attitude towards the use of digital tools in the teaching process, reflected in null correlation coefficients with agreement with them.

In general, students who agree to use multimedia resources in the learning process are also fairly consistent users of Internet services, which they use mainly for information, and of social networks, which they use primarily for instant messaging - a fact also confirmed by previous studies in the literature.

Chap. 10. Conclusions and Personal Contributions

The transition from traditional teaching to online teaching (fully or combined with traditional mixed-format teaching) is an inevitable step, linked to the digitalization of modern society. The COVID-19 pandemic has been the catalyst for this process, forcing medical schools to find urgent solutions to replace practice in hospitals and clinics with virtual training. Obviously, the pandemic was a very unsettling and traumatic experience for all of humanity, but one small benefit was to reveal that IT technology is poised to assist

people in most daily activities, to provide adequate communication and interaction even in isolation, and to facilitate work, learning and entertainment. E-learning has proved to be a good and practical solution, capable of bringing important advantages, strong enough to counterbalance the inherent disadvantages, so we can be sure that this technology will not be abandoned in the coming years, but will gain a permanent place among other educational tools.

Numerous studies have been and are being published in the scientific literature, from all regions of the world, on the effectiveness of blended learning and how it has been adopted by teachers and students, highlighting its advantages and disadvantages. Most of them are based on surveys that record the pros and cons of teachers and students, relate them to the level of performance achieved (possibly compared to the level achieved by traditional methods) and compare them according to standard demographic characteristics of the subjects, such as gender, age group, specialization, residence, income level, etc. The main aim is to identify the set of minimum requirements that digital teaching tools need to meet in order to be functional, effective, accepted without reservation by both teachers and students and to significantly improve the level of knowledge of students.

Such an approach is obviously correct, providing valuable information for understanding the phenomenon, but our study proposes a change of perspective, which we also find interesting and useful: it is not enough to evaluate students as a homogeneous group of individuals, in order to understand their reactions caused by standard demographic characteristics such as gender or age, it is much more productive to treat each student as a separate personality and to understand the intimate reasons that make them accept or not modern educational techniques and be able to adapt to their requirements.

The new approach we proposed in this paper was therefore to investigate more deeply the causes that make students hold favorable or unfavorable opinions about blended learning, which stem from their personal preferences and developmental background. We started from the idea that technically skilled students, who are attracted by gadgets, computers and the internet, will also be more open to all modern learning technologies and, in particular, to blended learning. To quantify this behavior, we asked students to indicate to what extent they use Internet services and for what main purposes, divided into four categories: information, communication, entertainment and home facilities. We correlated these responses with the scores for favorable and unfavorable opinions about blended learning and the teaching methods that emphasize it. We did indeed find significant results and definite associations between these elements, as already described.

Another aspect should not be ignored: the present study investigates a particular category of students - medical students. Medicine is a difficult specialization, and students are usually competitive and interested in achieving good academic results and quality training, both theoretical and practical, which is an essential requirement to become a good doctor. Therefore, a teacher has no right to fail during the teaching process. From this perspective, further analysis is needed of the characteristics of blended learning that can make the difference between its acceptance and non-acceptance, as well as the behavioral patterns of students that can influence their opinions towards this type of instrument. We designed the study around the idea that a student's view of IT tools in general, translated into how they choose to use such tools both for teaching training and in their everyday lives, will significantly influence how they position themselves in relation to blended learning and, consequently, the outcomes they are able to achieve in such a setting.

Another novel approach was to classify students according to their favorable and unfavorable views about blended education by automatic clustering using the Two-Step Clustering procedure. We chose this method of data analysis because in this way we were not only able to identify relevant clusters among students, but also the most important predictors responsible for their creation; the predictors found are interesting to analyze because they are not similar to the items initially reported as most popular.

This approach is original, as the literature consulted indicates that it has not been used before in studies of students' views on various features of the teaching process. Most studies of this type limit themselves to recording student responses and benchmarking them against different criteria, without investigating the structure of the items. The analysis of the items using classification techniques, such as the one we have chosen, is instead a more accurate method of study, which allows their prioritization and the grouping of students according to the identified hierarchies. In this way we can better understand the intimate reasons why students prefer or do not prefer a teaching tool and, consequently, we can make an informed selection of the optimal methods to make it more effective.

LIMITS AND FUTURE RESEARCH DIRECTIONS:

There are some limitations of the present study, which can be eliminated in the future by developing this line of research; among them I could mention:

- Relatively small number of students investigated, but coming from Medical Faculties - the majority of students included in the study coming from Dental Faculties;

- Relatively small number of students coming from university centers other than Iasi;
- Relatively limited investigation of elements related to the students' personal developmental background and psychological profile - in the study we limited ourselves to only two such elements, namely their preferences to use multimedia resources independently in the learning process and the extent to which they use digital technologies (i.e., Internet services) in their daily activities.

The results we obtained are encouraging enough to extend the study in the future by adding new elements on students' behavioral patterns that may be relevant, such as personal views on the general usefulness of IT and the Internet - all the more so as this line of research has not been much investigated (a meta-analysis study published in 2023 identified only 22 papers that indirectly address this issue, and none addressing the medical field (Schmid, 2023)).

Of high interest may be the incorporation of aspects of students' psychological typologies, which can be characterized using a wide range of tools. Among them, one instrument with great potential is the Motivational Persistence Scale - a measurement scale that quantifies an individual's inner level of motivation and tenacity in achieving personal goals. These characteristics are mandatory for a medical student and can correlate interestingly with their views towards blended learning.

Another issue debated in the literature, and which needs to be further explored, is the potential of different modalities of video feedback, compared to direct feedback from experts, in assessing and fixing long-term practical skills practiced by students - physically or with simulators, onsite or remotely. Our study was not originally designed to investigate these issues, but can be extended to include.

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The integration of modern technologies is changing the learning environment, both face-to-face and online, with definite effects, but which need to be quantified as precisely as possible, on the quality of learning, as measured by student achievement and satisfaction. The data provided by the present study and similar studies in the literature are primarily addressed to teachers, who need to rethink their teaching materials in line with the requirements of new generations of students. There are now clear indications that an effective academic curriculum is not only characterized by the quality of the scientific information conveyed, but also by the way in which this information is conveyed; moreover, when choosing one teaching tool or another, not only the technical aspects of the presentation

of materials and the conduct of online activities will be taken into account, but also the students' perceptions and reactions to the proposed learning environment, as reflected in their performance. Exploratory, evidence-based research is needed to understand how the online environment can improve the learning experience and thus the quality of teaching.

On the other hand, the informed and correct use of teaching tools with proven effectiveness has beneficial effects not only for students and teachers, but also for the whole health education system. It is clear that at the bottom of the pyramid are the teachers who work directly with students, and who will enjoy the satisfaction of a job well done when they see that students like and attend their courses, are motivated and achieve good learning outcomes. On the next level, however, are universities as a whole, which are improving their pass rates and their position in the education market, making them more attractive to future applicants. At the last level is the whole national education system, which in turn becomes more efficient and provides competent graduates who are well prepared for the labor market. And of course, the last beneficiaries, but by no means the last, are the patients, who will be treated by better trained, enthusiastic and passionate doctors, with extensive theoretical knowledge and advanced practical skills, both in the field of their specialties and in the use of modern technologies and digital media to improve the quality of medical care.

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1. Efficacy of Blended Learning Techniques in Medical and Dental Education: Students' Opinions in Relation to Their Habits as Internet Consumers

Authors: Dascalu Cristina Gena, Antohe Magda Ecaterina, Topoliceanu Claudiu, David Cristina, Purcarea Victor Lorin

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Authors: Cristina Gena Dascalu, Magda Ecaterina Antohe, Mihaela Moscalu, Victor Lorin Purcarea

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