

Article

Teaching Methods in Medical Education: An Analysis of the Assessments and Preferences of Students

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Abstract: Knowing which teaching methods students value the most is important, as it directly affects the quality of learning. This paper analyzes which teaching methods are most commonly used in the Medicine Degree at a Spanish university, as perceived by both professors and students. It further explores the students' assessments of these methods and the relationship between these assessments and the methods' frequencies of use. The participants were 36 professors and 150 students. Professors completed the Teaching and Assessment Methodology of University Faculty Questionnaire (TAMUFQ), while students were administered a specially designed questionnaire. The questionnaire defined twelve teaching methods, and students were asked to provide their personal assessment and the frequency of use for each method based on their experiences. Professors reported adhering to a traditional style of teaching and assessment. According to the students, the most commonly used method was the lecture, although their assessments of lectures were significantly lower than the frequency with which that method was being used. Regarding the eleven remaining methods, the prospective doctors' assessments were significantly higher than the methods' degree of use. The main conclusion is that, while students did not negatively assess lectures, they considered them to be overused. This may mean that the potential of other teaching methods is being missed.

Keywords: instructional preferences; lecture; medical education; teaching method



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1. Introduction

According to the United Nations, there is no single path toward sustainable development, but it is an interdisciplinary task that must be tackled from different perspectives. For this reason, seventeen different sustainable-development goals (SDGs) have been defined in the 2030 Agenda [1]. More specifically, the third objective is to guarantee a healthy life and promote the well-being of all. Heading towards this ambitious goal, a large number of variables of very different natures come into play (economic, social, political, cultural, environmental, etc.). The present study focuses on a very specific area that we hope could contribute to improving the indicators of Goal 3 of the SDGs: the initial training of doctors who, in the future, will play an important role in the functioning of health systems. In particular, we concentrate on one specific aspect of this training: the analysis of the teaching methods used in medical education.

When a teacher is faced with the challenge of training a group of students in a certain field, there is a wide range of teaching methods available. The choice of a specific method can be influenced by different variables. Among these are the type of content to be taught and how it can be tailored to each methodology, the student's level of prior knowledge, time constraints imposed by study plans (which often require working on a large amount of content in a limited amount of time), the number of students per class, the physical layout of the classroom, the availability of material resources, etc. All these elements must

be considered in order to consistently select a specific teaching method from among the wide range of possibilities.

Once we have reduced the universal catalog of available teaching methods to the specific list of methods that can be used to work on specific content within a specific classroom, one of the variables that comes into play is the instructional preferences of the students and their assessments of the different methods [2,3]. In fact, these preferences have a significant influence on their motivation and predisposition toward learning, which may affect the quality of the learning itself and the grades [4].

In medical education, lectures have traditionally been the fundamental pillar upon which most of the theoretical training of students is based [5–7]. It is probably for this reason that previous research on the instructional preferences of medical students has focused on analyzing students' assessments of lectures. Some research shows that this method is highly valued by students just beginning their training in medicine, but their assessments get significantly worse in later phases of the training process [5].

In addition, combining lectures with practical case-solving has been found to significantly improve students' grades [6]. Moreover, when it comes to learning new content (not reviewing or delving into already-known content), the lecture is one of the most valued teaching methods among students [7].

However, it seems that there have been clear indications, for a few years now [8], that many students prefer to view the lessons in prerecorded formats. This trend will most likely be intensified in the coming years due to the increasing interest in the flipped-classroom approach [9]. As a matter of fact, some review studies state that this method can improve learning in medical students [10,11].

The forced shift to fully online education as a result of the COVID-19 crisis [12] seemed to imply an acceleration of the transition towards educational models closer to flipped-classroom proposals, in which students study the theory with the support of videos and other resources outside of class, and they dedicate face-to-face sessions to solving tasks that require prior study. Nevertheless, after the reversal of the forced changes towards online education, pre-pandemic teaching methods seem to have resumed at many faculties [13], i.e., a return to on-campus lectures, although hardly any studies have systematically analyzed this. It is interesting to note that medical students believe that live lectures should continue as a teaching method in the preclinical curriculum, considering that active-learning strategies are less important [14].

The return to the predominant use of lectures as a teaching method in medical education implies that other possible teaching methods that can be of great interest and complement the learning carried out in the lectures are not being explored enough, as evidenced by numerous studies.

For example, a recent systematic review [15] shows that problem-based learning is highly valued by undergraduate medical students, positively contributing to both knowledge and professional skills. Similarly, a recent meta-analysis [16] shows that peer-assisted learning can be a very useful method as a complement to lecture-based teaching. Another meta-analysis [17] also found that case-based learning was associated with increased interest and motivation among medical students compared to other teaching methods (especially when compared to lectures and tutorials-based teaching). In addition, in this same meta-analysis, case-based learning was found to be associated with better student academic performance compared to other teaching methods, which increases the interest in this method. Other teaching methods that are identified as promising in a revision of the literature carried out by Challa et al. [18] are case-based learning, simulation-based learning, e-learning, observational learning, and team-based learning. Finally, the review by Curran et al. [19] concludes that teaching methods that are supported by extended-reality techniques also present promising results in specific areas of medical education, such as surgical and anatomical education.

It is also important to note that some literature reviews have concluded that lectures are amongst the preferred teaching methods for teachers and students when it comes to

teaching specific content, such as evidence-based medicine [20]. Nonetheless, it may be argued that if lectures continue to play the leading role in medical education, the proven benefits of other teaching methods will remain unused.

The aim of the study, as reported in this article, is to categorize the different teaching methods used in the specific case of medical training at the Faculty of Medicine of the University of Valencia (Spain). More specifically, four research questions were prioritized:

1. Which teaching methods are most commonly used according to the professors?
2. Which teaching methods are most commonly used according to the students?
3. How do students assess these methods?
4. Is there a relationship between the degree of use and the assessment of these methods by the students?

Therefore, to answer these questions, three objectives were established:

1. To analyze which teaching methods are the most commonly used according to professors.
2. To analyze which teaching methods are the most commonly used according to students.
3. To analyze how students value these methods.
4. To analyze whether there is a relationship between the degree of use and the students' assessment of these teaching methods.

We consider that these objectives may be of interest, since they will allow us to know which methods are the most frequently used in medical education and how they are assessed by students. This analysis will shed light on whether lectures remain the main method in medical education, which would confirm that the potential benefits of more innovative methodologies are being missed. It will also contribute to achieving a better interplay between teacher-centered and student-centered teaching, which should lead to better learning motivation and, as a consequence, better learning effectiveness.

2. Materials and Methods

2.1. Participants

The participants in this study were 36 university professors teaching the Medicine Degree. Twenty-four of them (66.7%) were men and 12 (33.3%) were women. The mean age of the professors was 55.1 years (SD 10.4) and their years of teaching experience in medicine had a mean of 20.69 (SD 13.00).

At the time of the study, there were 180 third-year students of the Medicine Degree at one university in the city of Valencia (Spain). Of this total, 150 students (83.33%) completed the questionnaire. The mean age of the participants was 21.5 years (SD 0.3); 48 students were men (36.9%) and 82 were women (63.1%).

2.2. Instruments

Professors filled out the Teaching and Assessment Methodology of University Faculty Questionnaire (TAMUFQ, or CEMEDEPU in its Spanish acronym) [21]. The TAMUFQ consists of 51 Likert-type items with five response options, distributed in three scales: teaching-centered, learning-centered, and teaching skills. In this study, we use partial data from the second scale, specifically from its third factor: the use of traditional teaching and assessment methods (composed of six items). This factor has adequate internal consistency (Cronbach's alpha = 0.744). Additionally, the test has been evaluated with a large sample of university professors, so the direct scores can provide percentiles for each of the scales.

Students completed an ad hoc designed questionnaire in which twelve different teaching methods were defined. The teaching methods that the participants were asked about were lecture, case study, problem solving through exercises, project-based learning, problem-based learning, cooperative learning, learning contract, peer assessment, role playing, inquiry-based learning, serious games, and flipped classroom. These methods were chosen because they have been recommended in two guides for university professors. The first of these was developed during the university reform at the beginning of this century, which put skills-based work at the heart of university teaching methods [22]. The second

guide is a more current publication, which incorporates some recently created teaching methods that have been added to the previous competency-based methodologies [23].

The definition of each method was extracted from these two guides, as shown in Table 1.

Table 1. Definitions of the teaching methods included in the instrument.

Teaching Method	Definition
Lecture	Presentation of a logically-structured topic in order to provide students with information that has been organized by the teacher.
Case study	Intensive and complete analysis of a real problem in order to learn about it, interpret it, solve it, generate hypotheses, contrast data, reflect, complete knowledge, demonstrate it, and train in possible alternative solving procedures.
Problem solving through exercises	Situations in which students are asked to develop appropriate solutions through the exercise of routines, the application of formulas or algorithms, the application of transformation procedures of the given information, and the interpretation of results.
Project-based learning	Students carry out a project (usually throughout the course) in order to tackle a task by planning, designing, and carrying out a series of activities.
Problem-based learning	A similar method to project-based learning, although it is less complex. The starting point is a problem, which is usually designed by the teacher. The student has to solve it in order to develop certain competencies and skills that have been previously defined.
Cooperative learning	Interactive approach of work organization in the classroom in which students are accountable for their learning and their classmates' learning in a co-responsibility strategy to achieve group goals and incentives.
Learning contract	An agreement established by the teacher and the student to achieve learning through a proposal for autonomous work, with supervision by the teacher and for a certain period.
Peer assessment	After the completion of a written work or oral presentation by a student, other students have to assess the work and give feedback according to criteria previously established by the teacher, or by the teacher together with the students.
Role playing	Representation of roles to exemplify a situation and the different points of view on this situation. Students must play as different characters and put themselves in their shoes to defend a position. The situation is conflictive and requires different points of view.
Inquiry-based learning	It is research work. A topic is raised, and research must be done to reach a conclusion. It can include problems, cases, field investigations, experiential learning, and other types of research papers.
Serious games	Games or video games specifically designed for learning are used. To be successful in these games, it is necessary to have previously acquired certain knowledge or skills.
Flipped classroom	The study of theoretical concepts is carried out outside the classroom through the autonomous study of written or audiovisual materials. The lesson time is dedicated to answering questions regarding the material studied and carrying out complex tasks, such as solving cases or preparing applied works based on the studied contents.

Following each definition, the participants were asked two questions: "How often is this method used in the lessons that you attend in the Medicine Degree?" and "How positive do you think these methods are in your training as a medical professional?". In both cases, a response scale from 1 to 10 was used, in which 1 meant "never used" or

“not positive at all”, and 10 indicated “used in all lessons” and “absolutely positive”, respectively.

The joint approach of these two questions allowed achieving the three objectives of the study: to know the degree of use of each method according to the students, to analyze how students assess these methods, and to compare the degree of use and the assessment that students make of each method.

2.3. Procedure

Participants completed the questionnaire online on a Google Form. The first author of the article provided the students with the link at the beginning of a lesson. Participants filled out the questionnaire on their mobile devices. Before responding, they had to provide their informed consent to take part in the study under conditions of anonymous and disinterested participation. This study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Committee of Ethics and Human Research of the University of Valencia (registration number 2262904).

2.4. Data Analysis

The analyses were performed with the statistical package SPSS (version 26) for Windows. For the first three objectives, descriptive measures were calculated, in particular, the mean and the standard deviation. Additionally, for the first objective, the scale of the TAMUFQ instrument itself was used to obtain the percentile score corresponding to the average of the direct scores of the participating teachers. Finally, in order to find out if there were differences between the degree of use of each method and the students' assessments of it, a within-subjects ANOVA was carried out with two levels: assessment of the use and positive assessment of the type of teaching.

3. Results

3.1. Professors' Scores on the TAMUFQ

The average score of the professors who answered the TAMUFQ question about their “Use of traditional teaching and evaluation methods” was 3.05 (on a scale ranging from 1 to 5). The standard deviation was 1.04. This score places the average score of participating teachers in the 70th to 75th percentiles. These findings suggest that teachers identified with a traditional style of teaching and assessment (at levels between the 70th and 75th percentiles).

3.2. Students' Scores on the Questionnaire on the Use and Assessment of Teaching Methods

Table 2 shows the results of the mean and standard deviation of the students' perceptions of the use of each method and of their assessments (in terms of positive or negative). In both cases, the scores ranged from 1 to 10. Likewise, Table 2 shows the F and *p* values of the ANOVAs performed and the direction of the statistically significant differences. No differences were observed between men and women in any of the assessments of teaching methods.

The most-used of the methods was the lecture, while the least-used were peer assessment and the flipped classroom. The best-valued method was the case study, while the least-valued method was peer assessment.

Statistically significant differences were found between perceptions of the use of each method and the students' assessments of them, for all the methods about which they were asked. In the case of the lecture, the students indicated that their degree of use (8.53 out of 10) was significantly higher than their assessment of it (6.91 out of 10). For the remaining eleven teaching methods, in all cases, the participants expressed an assessment that was significantly higher than the actual use of the methods.

Table 2. Results of the ANOVA in which the perception of the use and the students' assessment of the twelve teaching methods were compared.

Teaching Method	Use M (SD)	Valuation M (SD)	F _(1,117)	p	Differences
Lecture	8.53 (1.35)	6.91 (2.14)	22.173	<0.0001	USE > ASS
Case study	5.58 (1.98)	8.74 (1.31)	66.053	<0.0001	ASS > USE
Project-based learning	4.57 (2.90)	6.03 (2.54)	5.380	0.022	ASS > USE
Problem solving through exercises	4.12 (2.10)	7.76 (1.94)	78.294	<0.0001	ASS > USE
Inquiry-based learning	4.07 (2.65)	6.48 (2.18)	21.771	<0.0001	ASS > USE
Cooperative learning	3.74 (2.49)	6.48 (2.39)	26.082	<0.0001	ASS > USE
Problem-based learning	3.45 (2.30)	7.22 (2.00)	72.570	<0.0001	ASS > USE
Serious games	3.32 (2.51)	7.15 (2.55)	80.985	<0.0001	ASS > USE
Learning contract	3.02 (2.47)	6.63 (2.67)	32.234	<0.0001	ASS > USE
Role playing	2.83 (2.13)	6.82 (2.39)	50.118	<0.0001	ASS > USE
Flipped classroom	2.77 (1.81)	6.73 (2.53)	63.055	<0.0001	ASS > USE
Peer assessment	2.77 (2.19)	5.30 (2.70)	32.492	<0.0001	ASS > USE

M = mean; SD = standard deviation; ASS = students' assessment of the method (1–10 scale); USE = students' perception of the use of the method (1–10 scale).

4. Discussion

The aim of this study was to explore which teaching methods are most commonly used in the Degree in Medicine in the Faculty of Medicine at the University of Valencia (Spain), to analyze the students' assessments of these methods, and to find out whether there is a relationship between the degree of use and the students' assessments of these methods.

The findings show that lectures are the predominant method in medical education in the context analyzed. This statement is supported both by the professors' responses in a questionnaire on teaching methods and by the students' answers in a questionnaire on the same subject. The remaining methods play a much smaller, and sometimes residual, role. This result aligns with the finding of numerous national and international studies that confirm that lectures have been (and continue to be) the main method in medical education lessons [5–7].

However, the results of the ANOVA reveal that lectures are the only method rated lower by students than its degree of use in the classroom. The students' assessment of the lecture is not particularly negative (it is the fifth method out of twelve). Nevertheless, the result seems to suggest that students perceive this method as being overused. The lecture is a tool that has been proven valid (and probably essential) in medical education over the years. The moderately positive assessment of the students in this study, as well as the results of other previous studies [6,7], corroborate this conclusion. Moreover, lectures are a method that is positively assessed by teachers and students, when used in combination

with other teaching methods and for the teaching of certain types of content, such as evidence-based medicine [20].

However, the findings of this study indicate that students seem to perceive an excessive use of this method, which continues to be almost the hegemonic method in the training of prospective doctors. This very perception of “overuse” of lectures has already been highlighted by numerous studies that represent an important criticism pointing to the “abuse” of this method [24,25]. Furthermore, where an analysis of student preferences has been performed comparing lectures with other teaching methods, the results show that students prefer case-based learning [17] or problem-based learning [15]. The main criticisms regarding the overuse of lectures in medical education rely on the fact that students acquire a passive role in which in-depth knowledge and understanding of the content is not necessarily rewarded, but rather, the memorization of content is “encouraged” in some cases. Of course, this memorization is necessary in university education, but it cannot become the main way of learning, since it can be detrimental for deep learning.

The results of the current study also lead us to think that the potential of many other different methods to complement the lecture is probably being missed. Participants especially expressed their confidence in the case study (the most valued method), but they also seemed to express their interest in other methods that are rarely used. Role playing, serious games, and the flipped classroom seem to be the most striking cases, since these are the methods with a greater degree of difference between their scarcity of use and the high assessments given them by students. In this regard, the scientific literature shows that these methods have promising results. This fact has been pointed out by recent systematic reviews on the effects of the flipped classroom [26] and serious games [27,28] in medical education, even though more research on these methods is still required (especially in the case of serious games).

Furthermore, compared to lectures, it is possible that these teaching methods allow the treatment of certain important subjects that are not part of the formal medical education curriculum but are relevant to future doctors, such as sustainability [29]. As an example, role playing could be used to work on issues related to unequal opportunities for access to health care, or future doctors could be presented with case studies in which they have to suggest alternative solutions that are more sustainable than the standard ones. However, the incorporation of both these new teaching methods and sustainability-oriented content would also imply a slight change in the type of student assessment [30]. In fact, the type of evaluation is one aspect that could be influencing the preferences of medical students for one method of teaching versus another, while the assessment of learning focuses on purely theoretical content and closed-end questions, leaving aside socio-effective content and reflection, so it makes sense for students to prefer lectures rather than other methods.

Another result of interest was that cooperative learning and peer assessment were two of the methods that were valued the least by the students. Only these two methods involved some form of collaboration between students, suggesting a strong preference by medical students for individual work over group work.

Group work poses additional demands compared to individual work, including spending time planning the actions to be carried out in coordination, assigning roles and distributing tasks among the members of the group, as well as committing to work in coordination and meeting deadlines set by the group. Probably, students perceive these requirements as incompatible with the demands of the different subjects. Likewise, it is also possible that this type of teamwork is perceived by students as tasks that are beyond their control, since the result does not depend only on themselves, but also on the involvement and performance of other people.

Our findings coincide with those of other studies, which have also found that medical students do not perceive peer assessment positively [31]. However, two reviews on the topic highlight some potentialities of peer assessment if the necessary precautions are taken into account in a sensitive subject, such as feedback and assessment among the students [32], as well as using different variants of cooperative learning [33]. In any case,

the results of this study point to a strong preference for individual work over methods that require group work.

We believe that this result has implications for medical education, since some of the skills that medical professionals must acquire are closely related to knowing how to coordinate with other professionals [34]. For this reason, we think that, regarding the students' preference for individual work, time being dedicated to training in inter-professional collaboration is needed, since it is an important competence in medical education.

The results of this study should be interpreted while taking into account some limitations. First, the participants were third-year students working towards a university Degree in Medicine, a relatively early phase in the process of training prospective doctors. For this reason, it is possible that in the future, as they progress in their training, their perceptions of teaching methods may change, after encountering new subjects and, fundamentally, after practicing medicine under supervision in hospitals and other health centers. Likewise, we believe that their assessment of aspects related to teamwork would not necessarily be invariable over time, but rather, that their perceptions may change as they socialize with other colleagues and are subjected to situations in which collaboration with other professionals is essential.

Moreover, after the pandemic, many students and faculty agreed that scheduled live lectures should continue as a major mode of instruction during the preclinical phase of medical education [14]. Currently, it seems that many university students prefer video-recorded lectures to live lectures [8]. Therefore, one limitation of this study was not having considered the opinions of students about recorded lectures. Likewise, another limitation of this research was related to the type of data collection instrument used, which was only quantitative. More qualitative research techniques, such as interviews or focus groups, could complement the data obtained in this study and contribute to understanding the preferences of medical students regarding teaching methods. Furthermore, future studies should also include the most recent teaching strategies, such as gamification, which is a technique that usually overlays game goals with learning goals to motivate students' participation and constructive behavior [35]. However, the field of gamification in medical education is innovative and still in development. Another possible future line of research is analyzing the preferences of the professors in charge of the medical education of prospective doctors, and to examine the arguments that support those preferences. Finally, we believe that it would also be interesting to propose research designs with experimental and comparison groups, in order to assess the impact of teaching methods on the quality of learning. The results of this study were limited to analyzing the preferences of the students, while the impacts of the methods on academic performance or on the quality of learning were not examined. Because of this, we believe that this type of controlled design could be a major step forward in medical education research.

In short, to ensure that the results of this study contribute to improving the quality of medical education, and thereby contribute to sustainable development, our conclusions from this study are twofold and have implications for teaching practice and research.

First, students perceive an overuse of lectures in their lessons. It is a useful and necessary method, but it probably monopolizes too much time and this reduces the use of other methods that may be equally valid, such as the case study or the flipped classroom. Therefore, we believe that it would be useful for future research to explore the potential role of these other methods in medical education (in combination with lectures).

The second conclusion is that two of the methods least valued by students are related to collaboration between students. This finding suggests a preference for methods that involve individual work, which is probably perceived by the students as more controllable and as having results that are more predictable. We think that this is a result that should be taken into account, since it may be indicating a certain lack of teamwork skills, which are highly necessary for medical practice, especially when treatments involving professionals from different specialties are required.

5. Conclusions

We believe the findings from this study have significant implications in the area of sustainability. Of course, there is a need for future doctors to have solid theoretical training based on personal study and attendance at lectures. The results of this research seem to confirm that this theoretical aspect of medical education is reasonably guaranteed. Nevertheless, the professional competencies of doctors go well beyond these theoretical insights. In this sense, if we truly aspire to build sustainable health systems, we need to make significant changes in medical education.

The pillars of a sustainable health system need to be grounded in elements such as slow medicine [36] and other similar strategies to prevent burnout among healthcare professionals and to provide medical care under decent conditions. There is also a need to train future doctors in doctor–patient communication strategies [37], empathy, and compassion skills [38]. In fact, it is important to bear in mind that health refers to a broad concept that includes physical, mental, and social well-being, as well as the ability to function properly in the environment and the ability to take measures to protect and enhance one’s health [39]. Thus, considering this holistic view of the term, the initial training of doctors should go a little further than just ensuring the physical well-being of patients. In this regard, lectures seem to be a very unsuitable teaching method to achieve these types of essential professional skills in modern healthcare systems.

For this reason, we conclude that it is necessary to reconsider the teaching methods that are currently used in the education of future doctors. More specifically, we suggest that lectures be complemented by alternative methodologies for developing professional competencies related to comprehensive patient care, using holistic approaches that address not only patient-specific complaints but also interpret their background and history as a whole. This will allow for effective responses that will lead to the building of truly sustainable healthcare systems. Thus, we suggest that teaching methods such as gamification [40], or the flipped classroom [41], should gradually come to the foreground in medical education and become increasingly important complements to the lecture.

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