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Quantification of training in educational methodology among teachers on the degree course in medicine: a pilot study

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Abstract

Background Medical education has undergone significant changes over the last decades. Scientific and technological progress alongside contemporary society's changing requirements have driven demand for highly trained, competent doctors. In response to this need, university faculties of medicine have sought innovative forms of teaching and evaluating the students on their degree courses. The aim of this study was to quantify the characteristics and extent of academic training in teaching methods, of participation in innovative teaching initiatives, and training in simulation and debriefing among the teaching personnel on the degree course in medicine at the University of Granada (Spain).

Methods This transversal descriptive study was conducted among a population of 121 educators teaching on the medical degree course at the University of Granada, Spain. All responded to a specially designed CoRe-Content Representation questionnaire. This consisted of various parts: (a) demographic data; (b) teaching experience and qualifications; (c) specific information about training in teaching skills received. The Fisher test was applied whenever the dependent variable had two values (dichotomous) and the Chi-square test when it had more than two values (polytomic). Statistical significance was established with an alpha error of 5%.

Results The results showed that 87.60% of the educators had received no training in debriefing. There was a notable gender gap, whereby women held fewer management posts, fewer were engaged in clinical activity, and fewer had undergone training in clinical simulation. Teachers with degrees in medicine had undergone less regulated training than educators with other degree qualifications.

Conclusion The main areas of medical training that require improvement (and so present challenges to be met in the years to come) are as follows: a definitive solution to the existing gender gap, general implementation of new educational models and methods (especially learning based on clinical problem-solving and simulation), closing generation gaps, and improved training processes for educators with clinical attachment.

Keywords Medical education, Debriefing, Clinical simulation, Problem-based learning (PBL)

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Background

Medical education has undergone significant changes during the last decades. Scientific and technological advances alongside changing societal requirements have generated a growing demand for highly trained and competent doctors. In response to this need, University Faculties of Medicine have sought innovative teaching methods and new ways of evaluating students' progress on their medical degree courses. Training the doctors of the future is the key purpose of medical education. This must prepare healthcare professionals to face the challenges and demands of clinical ambits that are in a state of constant change [1]. To this end, university faculties of medicine are increasingly concerned with applying innovative approaches to teaching and learning and the implementation of new educational technologies. At the same time, the current demands imposed on healthcare professionals by contemporary society have bought about profound changes in all aspects of professional development within the medical sector. We believe that perhaps the most significant shift has taken place in the educational models applied in medical training. These include the introduction and development of new educational techniques (problem-based learning: PBL), the use of new clinical teaching scenarios [1], the introduction of information and communication technologies (ICT), the implementation of clinical simulation and academic debriefing, and even artificial intelligence (AI) models and their application. All these have conditioned emerging models of transformational change that affect all aspects of the teaching/learning process.

Simulation has been shown to be a valuable tool in medical training [1]. It has been observed that medical science students who have participated in simulation programs have higher levels of confidence and competence in the management of complex clinical situations [2] in comparison with those who have not. Simulation also allows students to acquire technical skills and take clinical decisions in a controlled and safe environment, which minimizes the risks associated with learning in real clinical situations with real patients, making simulation a key tool not only for medical training but also for optimizing patient safety [3–7].

Following clinical simulation, debriefing is the subsequent process of reflection and analysis that allows students and educators to discuss and reconsider their actions during the simulation, identify strengths and weaknesses, and so learn from the experience. Constructive feedback helps students to understand the implications of their real-time decision-making and actions and offers an opportunity to correct errors and improve execution in future clinical scenarios. Various research initiatives have shown that effective debriefing helps in the transference of clinical skills and improves learning [1, 8, 9].

But the most important development has been the growing influence of concepts of pedagogical content knowledge (PCK), essential for the positive curricular development of any educator and especially teachers working in medical training. Shulman first introduced the concept of PCK in 1986 as the comprehension and representation of how best to help students understand specific items of course content by employing diverse strategies within a particular social and cultural context [10]. This involves a combination of knowledge and understanding of the discipline itself, pedagogical skills and strategies, as well as understanding of the context within which the teaching/learning process unfolds. This means that the educators must have full mastery of the medical concepts to be imparted and of the latest advances in their field, as well as the capacity to transmit their knowledge in ways that their students can understand. They should also be familiar with the most effective teaching strategies and be able to adapt and apply them in response to the particular needs and characteristics of the student group [10]. Problem-based learning (PBL) is a very effective method for medical training. It is thought that with PLB, medical students not only acquire knowledge but also the other abilities necessary for professional practice [11, 12].

The objective of this research was to quantify the characteristics that currently define academic training in teaching methods/methodologies, including participation in innovative teaching initiatives and training in simulation and debriefing, among the teaching personnel on the degree course in medicine at the University of Granada (Spain).

Methods

Study design

This descriptive transversal study was conducted among a population of teachers on the degree course in medicine at the University of Granada (Spain), who filled out a specially designed questionnaire, based on *CoRe-Content Representation* (a series of questions about ideas, issues, and specific topics). A minimal sample size of 120 was required to reach a 95% confidence interval in relation to the total number of teachers working in the Faculty of Medicine (established using the Qualtrics^{XM} sample size calculator).

Data collection

The study was conducted at the Faculty of Medicine, University of Granada (Granada, Spain). The recruitment period took place between December 2022 and December 2023. When authorization had been obtained from the University of Granada Research Ethics Committee,

individual invitations to participate were sent by email to all members of the faculty teaching staff (Professors). The invitation included a description of the study's purpose, objectives, guarantees of confidentiality, data protection, and anonymity, and a link to the self-designed and self-administered online questionnaire, via the "Google Forms" survey platform (at Google Drive ggomez@go.ugr.es). This consisted of a range of items relevant to training in teaching methods and teaching practices. Absolute confidentiality and anonymity were guaranteed to the subjects, whose participation was entirely voluntary. Participants were allowed a period of one month to complete the questionnaire and reminders were sent by email to encourage participation.

The questionnaire consisted of various sections as follows (Table 1): (a) demographic data: age, sex, education, and qualifications; (b) teaching experience: the participants teaching experience was investigated including the time served at the Faculty of Medicine and extent of participation in teaching activities; (c) innovation projects: participation in projects of educational innovation was explored, requesting information about proposals presented, implementation and the evaluation of these initiatives; (d) training in simulation, PBL and debriefing (face-to-face combined with online learning of at least 150 h); information was also collected about training and experience of the use of simulation and debriefing in the teaching context.

Data analysis

The data collected were downloaded from the "Google Forms" platform and subjected to statistical analysis using GraphPad Prism 7 software (San Diego, CA, USA). To express the results, contingency tables were produced for each variable in relation to sex, age, and training, respectively. Hypothesis contrast techniques were used to analyze differences between the proportions obtained. The Fisher test was applied when the dependent variable had two values (dichotomous) and the Chi-squared test when the variable had more than two values (polytomy). Statistical significance was established with an alpha error of 5%.

Ethical considerations

The study was approved in advance by the University of Granada Research Ethics Committee on 27th July 2022 (registration number: 2944/CEIH/2022).

Results

The study population consisted of 121 members of university teaching staff, who completed the questionnaire.

Sex

Of the 121 members of teaching staff who took part, 80 were men (66.12%) and 41 were women (33.88%). Regarding the sex variable, no statistically significant differences were found between men and women regarding the number qualified as doctors, accreditation by evaluation agencies, number of six-year terms in research, or number of five-year terms served in teaching activities. Regarding management posts and clinical activity, significant differences were found ($p=0.032$), whereby the posts of dean and vice-dean had only ever been held by men and 65.85% of women had never held any management post (Fig. 1). No statistical dependency was detected between the age and sex of the participants ($p=0.938$), so age is discarded as a confounding variable when interpreting these results.

Regarding healthcare activities and attachment to clinics, significant differences were found ($p=0.003$) between men and women. More men were involved in healthcare activities (63.75%) and attached to clinics (50%) than women (34.14% and 26.83%, respectively). As for training in teaching methods, no significant differences were found between the sexes but 63.75% of men and 77.77% of women had received no regulated training in teaching methods. Twenty-two men and nine women did not take part in teaching innovation projects. As for the production of teaching materials, 63 men and 28 women had developed teaching materials. Twelve men and four women had received awards for teaching innovation. No significant differences between men and women were found in training received in: ICT (48 men, 25 women); E-learning (39 men, 20 women); virtual environments (27 men, 16 women); PBL (30 men, 13 women); and debriefing (10 men, 5 women). However, 87.60% of the participants had received no training in debriefing (Fig. 2). As for training in clinical simulation, significant differences were found between the sexes ($p=0.019$); 33.75% of men had received some training but only 14.63% of women.

Age

Eighty-three teachers (68.59%) were aged over 45 years and 38 (31.41%) under 45. Of those aged over 45, 80 were qualified doctors, as were 30 of those under 45 ($p=0.004$). In the older group, 67.47% had completed six-year terms in research, while among those under 45, 36.83% had done so ($p=0.002$); none had completed five or more six-year terms. Regarding management posts held, staff aged over 45 had held more of these positions, as well as the posts of dean and vice-dean, while 76.31% of younger staff members had never held management posts, with statistically significant difference ($p=0.002$). No significant differences were found between age groups in engagement in healthcare activity and clinical attachment.

Table 1 Data collection table

SOCIODEMOGRAPHIC VARIABLES											
AGE	SEX	COUNTRY OF BIRTH			DEGREE COURSE YEARS TAUGHT		1st	2nd	3rd	4th	5th	6th
GENERIC ACADEMIC VARIABLES											
DEGREE(S)											
DOCTOR		UNIVERSITY OF									
SPECIALITY/IES (CLINICAL TEACHING)											
SUBJECTS TAUGHT											
SUBJECTS		COMPULSORY			OPTIONAL						
NUMBER OF YEARS IN MEDICAL EDUCATION											
ACADEMIC POSITION		SL	UD	CD	AD	PAL			APHS		
WORKING HOURS		FULL-TIME			PART-TIME						
ACADEMIC ACCREDITATION		DEVA			ANECA						
CLINICAL ATTACHMENT		YES			NO						
NUMBER OF SIX-YEAR TERMS (RESEARCH)											
NUMBER OF FIVE-YEAR TERMS (TEACHING)											
MANAGEMENT POST		DD	SD		D		VD				
HEALTHCARE ACTIVITY		YES			NO						
TYPE OF HEALTHCARE ACTIVITY		FULL TIME			PART TIME						
HEALTHCARE CENTRE											
SPECIFIC ACADEMIC VARIABLES											
REGULATED TRAINING IN TEACHING METHODOLOGY		YES			NO						
TYPE OF TRAINING RECEIVED		ORGANIZATION	EXPERT		MASTER'S DEGREE		DIPLOMA				
YEAR COMPLETED											
DOCTORATE IN EDUCATION SCIENCES		YES			NO						
RETRAINING IN TEACHING METHODS		YES			NO						
PARTICIPATION IN TEACHING INNOVATION PROJECTS		PARTICIPANT			DIRECTOR						
DEVELOPMENT/PRODUCTION OF TEACHING MATERIAL		YES			NO						
AWARDS RECEIVED FOR INNOVATION IN TEACHING		YES			NO						
TRAINING RECEIVED IN NEW INFORMATION AND COMMUNICATION TECHNOLOGIES		YES			NO						
TRAINING RECEIVED IN E-LEARNING		YES			NO						
TRAINING RECEIVED IN DEVELOPMENT OF VIRTUAL ENVIRONMENTS		YES			NO						
TRAINING RECEIVED IN CLINICAL SIMULATION		YES			NO						

Table 1 (continued)

TRAINING RECEIVED IN PROBLEM BASED LEARNING	YES	NO
TRAINING RECEIVED IN DEBRIEFING	YES	NO

ABREVIATIONS
FP: FULL PROFESSOR
UD: UNIVERSITY DEGREE
CP: CONTRACTED PROFESSOR
AP: ASSISTANT PROFESSOR
CAP: CONTRACTED ASSOCIATE PROFESSOR
APHS: ASSOCIATE PROFESSOR OF HEALTH SCIENCES
DEVA: DIRECTORATE FOR EVALUATION AND ACCREDITATION
ANECA: NATIONAL AGENCY FOR EVALUATION AND ACCREDITATION
DD: DEPARTMENT DIRECTOR
DS: DEPARTMENT SECRETARY
D: DEAN
VD: VICE-DEAN

No significant differences were found between the age groups in regulated training in teaching methods received, although 63.15% of those under 45 had received no training of this type. No significant differences were found in participation in teaching innovation projects (71 older and 29 younger than 45), or in the elaboration of teaching materials (64 older and 27 younger than 45). As for prizes/awards received for teaching innovation, significant differences were found ($p=0.002$), whereby 16 older teachers had received awards, but no younger staff member had received one.

Regarding training in specific teaching methods, no significant differences were found between the age groups for: ICT (52 older and 21 younger than 45), E-learning (20 older and 20 younger than 45); virtual environments (30 older and 13 younger than 45). Significant differences were found for training in clinical simulation ($p<0.001$): 30 of those over 45 had received training but only three aged under 45. Training in PBL and debriefing did not show differences between the groups, but both age groups exhibited low percentages (Fig. 3).

Academic qualifications

Of all the teaching staff surveyed, 87 had degrees in medicine (71.90%), while 34 (28.10%) had other degree qualifications. There was observed a detectable association in the academic qualifications, both in relation to age ("Medicine group" tend to be older than "Other qualifications group", $p<0.001$) and in relation to sex (the proportion of men and women tends to be more unbalanced in "Medicine group" when compared to "Other qualifications group", $p<0.001$). There were no differences between holding the title of "Doctor," in other words those with degrees in medicine, and staff members with other qualifications. So, most teaching staff members were Doctors. Over half (56.32%) of those with the degree in medicine were accredited by National Agency for Evaluation and Accreditation (ANECA), as were 88.23% of those with other degrees (with statistically significant difference: $p<0.001$) (Fig. 4). The number of six-year terms in research and five-year terms in teaching were similar between staff members holding the degree in medicine and those with other degrees. Management posts were held by both teachers with degrees in medicine and those with other qualifications. More Doctors were involved in healthcare activities or were attached to clinics (51), while none of the staff members with other degrees were attached to clinics ($p<0.001$).

More teachers with other degree qualifications had undergone regulated training in teaching methods than those with the degree in medicine, with statistically significant difference ($p=0.039$) (Fig. 5). In the same way, there was more participation in teaching innovation

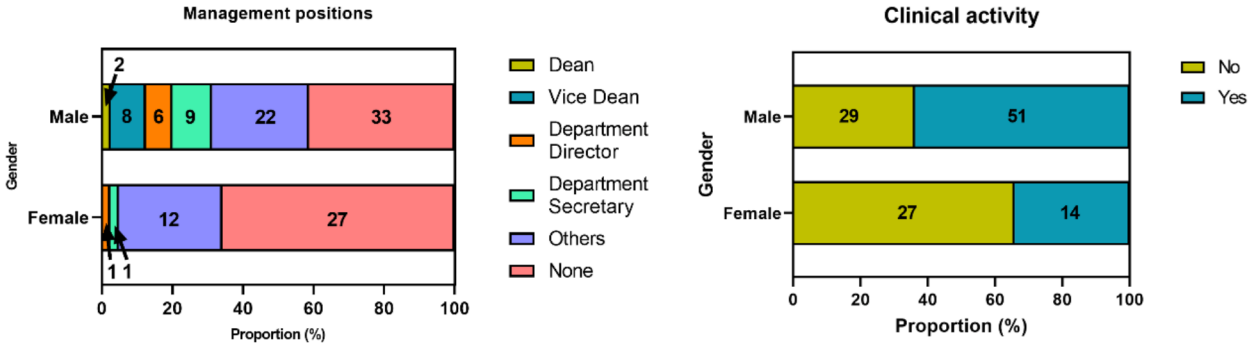

Fig. 1 Management posts held by teaching staff and clinical activity in relation to sex ($p = 0.032$ and $p = 0.003$, respectively)

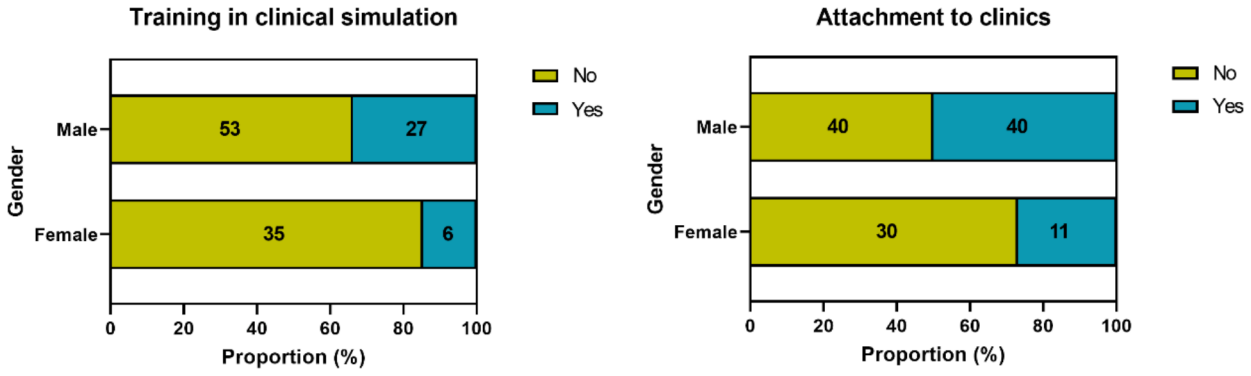

Fig. 2 Proportion of male vs. female teaching staff who had received training in clinical simulations ($p = 0.019$) and attachment to clinics ($p = 0.003$)

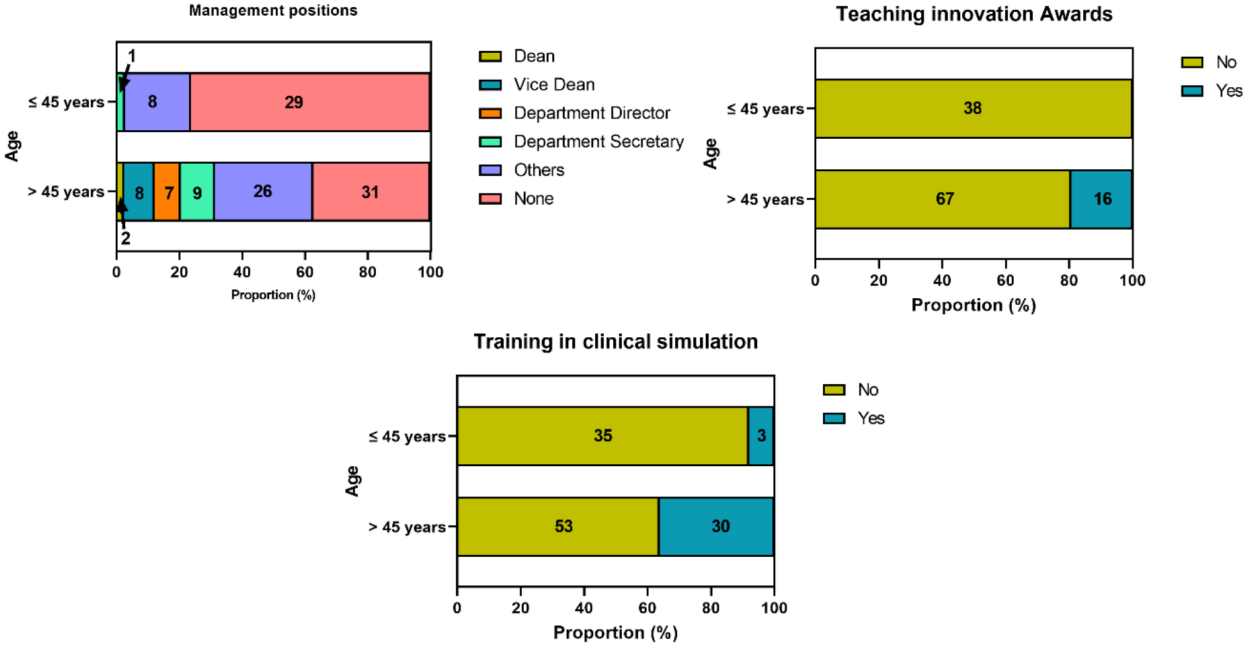

Fig. 3 Management posts held by teaching staff and clinical activity in relation to age ($p = 0.002$), teaching innovation awards ($p = 0.002$) and training in clinical simulation ($p < 0.001$)

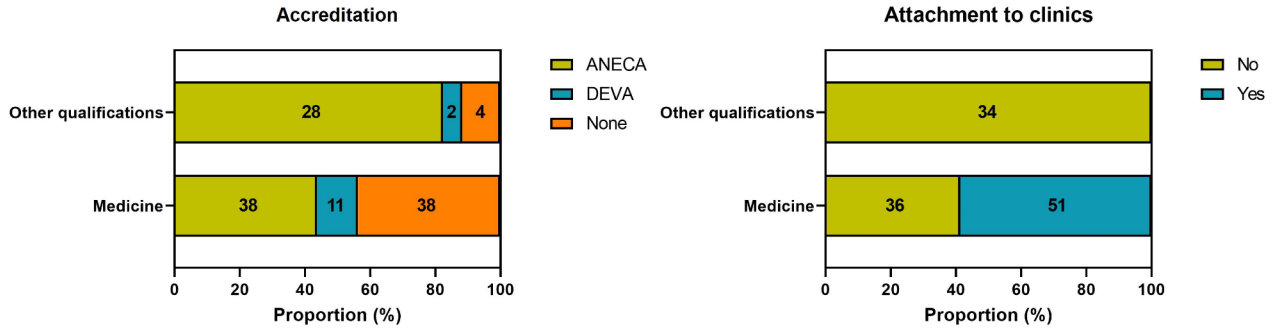

Fig. 4 Teaching access accreditation ($p < 0.001$) and attachment to clinics ($p < 0.001$) by staff members with the degree in medicine vs. those with other degree qualifications

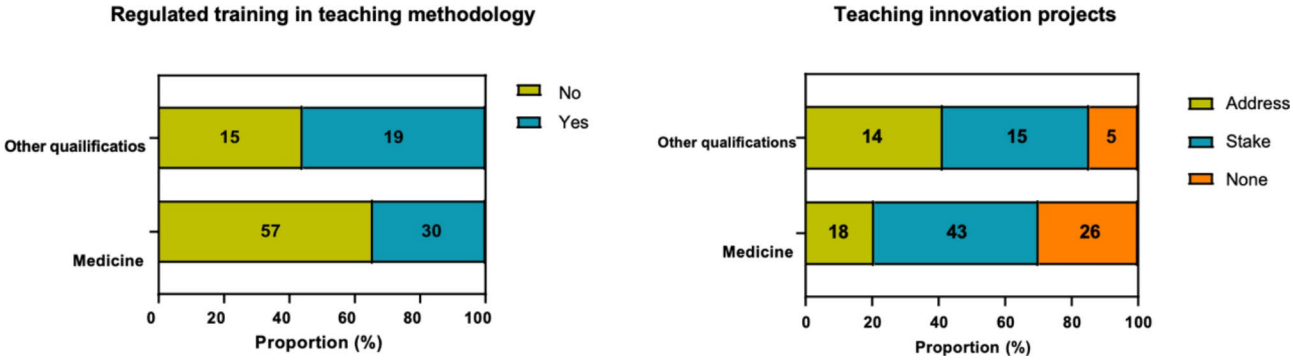

Fig. 5 Regulated training in teaching methods ($p = 0.039$) and participation in teaching innovation projects by staff members with the degree in medicine vs. those with other degree qualifications ($p = 0.0006$)

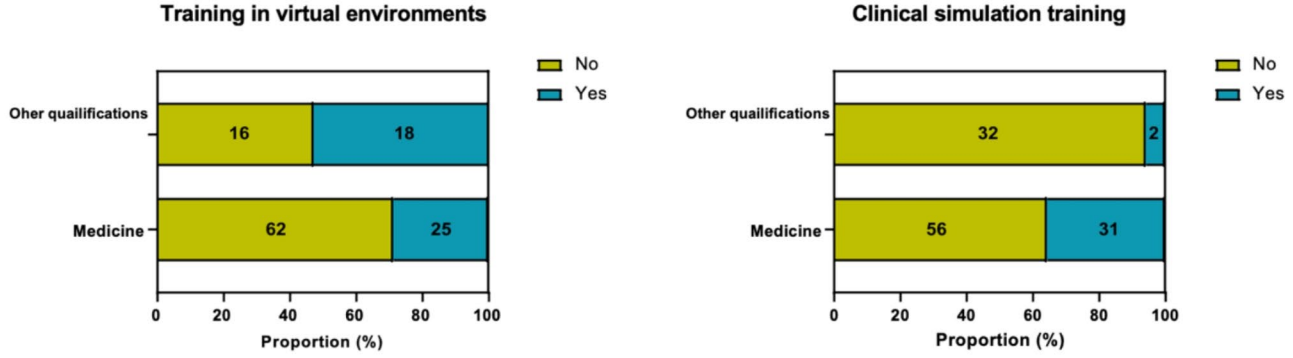

Fig. 6 Training in virtual environments ($p = 0.019$) and clinical simulation ($p < 0.001$) received by teachers with the degree in medicine vs. those with other degree qualifications

projects by those with degrees other than medicine, particularly in the role of project director ($p < 0.001$).

With regard to developing teaching materials, no significant differences were found between doctors and those with other degrees; this was the same for the numbers in receipt of awards/prizes for teaching innovation. As for training in specific teaching methods no significant differences were found between teachers with degrees in medicine and those with other degree qualifications for ICT (49 with the degree in medicine, 24 with other degrees), or E-learning (39 with the degree in medicine, 20 with other degrees). Significant differences were found between the two groups, whereby teachers with degrees other than medicine had received more training in virtual environments than those with the degree in medicine, while the reverse was true for training in clinical simulation received, so that more doctors had received training than staff members with other degrees ($p < 0.001$) (Fig. 6).

As for training in PBL and debriefing, no significant differences were found. Over a third (35.63%) of teachers

with the degree in medicine had received training in PBL compared with 35.29% of those with other degrees. Regarding debriefing, 12.64% of doctors and 11.76% of teachers with other degrees had undergone training.

Discussion

Medical education is a field that is in a state of constant evolution and the teaching methods employed to train future healthcare professionals are undergoing profound and significant changes. Teaching innovations such as the use of simulation and debriefing are promising developments that we believe could improve the quality and effectiveness of medical education, as well as ensuring patient safety. Taking into account the main objective of our study, we have focused our efforts on describing the training processes of the teaching staff of the Faculty of Medicine of the University of Granada (Spain). These results will allow us to analyze their impact through the specific development in the different subjects of the Degree of Medicine in the future, where the results of the evaluation will be the key to assess the benefits of these techniques. The present study has an additional social value in that the results highlight two of the major problems that face not only this university but society in general: the gender gap and the ongoing aging of teachers. These issues are discussed in greater detail as follows.

There is a pressing need to breach the gender gap in terms of the numbers of management posts held by women, women's clinical attachment, and training in clinical simulation. We hope that the present work will help cast light on the existing gender gap between men and women in terms of women's professional development within academic medicine, a gap that also occurs in other countries [13, 14]. The results of our survey found a glaring disparity between the numbers of men and women in management roles, a situation that has been repeated within medical education for decades and persists to the present day. We agree with Marcotte et al. that "…, and yet progress to close the gap has been untenably slow." [15]. In response, it is crucial to do as these authors argue: "Rather than expecting faculty to adapt to existing systems, we need to change the promotion process to work better for all" [15]. So, the key to ending this disparity lies in the commitment made by the University itself, in the time and funding devoted to this end, and we believe that ongoing monitoring and improvement are no less important [15]. Gender inequality in medicine affects biomedical research [16], women's attachment to and involvement in clinical activity, and training in clinical simulation, as can be seen from the results of the present survey. Findings by Samuriwo et al. [17] support our belief that medical educators should be fully aware of the gender gap and must lend equal support to all genders right from the first years of the degree course so the all students may reach their full potential in clinical practice, and promote women's involvement in clinical activities. An important factor in this context is the shift in the sexes of staff and students in Faculties of Medicine in recent years. Years ago, the gender gap was partly due to the fact that there were more men than women in faculties of medicine, but this is now quite the reverse. There remains much to be done to correct this disparity [18].

The most notable finding of the present work was that 87.60% of teaching staff at the faculty of medicine (the University of Granada, Spain) had received no training in debriefing. We think that this lack of training is largely due to unawareness of debriefing and its role as an effective pedagogical tool. Following the experience of clinical simulation, the teacher guides students through a thinking and feedback process whose objective is to connect theory to clinical practice, something they will have to do on a daily basis once they qualify as doctors. There is a clear need to set up and implement a training system in universities (even more so with the current expansion and use of digital media and communication) that can provide medical educators with the tools and understanding to conduct debriefing practices, as the positive outcomes of this pedagogical tool are proven. In this sense, Joum and Corral argue that educational institutions must address the issue of teachers' professional development, especially in areas of technological knowledge, which their research found to be the most serious shortfall perceived by medical educators [10]. According to Berger-Estilita et al., the relationships formed between the content communicated during debriefing sessions and learning outcomes improve the efficacy of informative sessions and of medical training based on simulation [9]. Simulation provides students with opportunities to acquire basic clinical skills [2]. Cheng et al. insist that it is crucial that future research into debriefing describe all the key debriefing characteristics along with their associated descriptors [8].

An interesting fact pointed out by Kaskie [19] is the increasing age of university teachers in all areas including medicine. This runs parallel to the increased life expectancy across western societies. Older teachers are not being replaced by the upcoming generations in sufficient numbers, which is of particular relevance in medical education. This is due to a lack of forward planning and policies that have failed to recognize the academic ageing that is taking place [19]. The present survey found that teaching staff aged over 45 had undergone more training in clinical simulation, which makes sense as this group have had more experience and so more learning in the different medical simulation techniques. For this reason, there is a notable need to boost training among younger members of the teaching staff in this area, as clinical simulation to aid learning and clinical skills acquisition

is a fundamental part of medical training [2]. This is an interesting finding that might be explained by the fact that teaching staff who are also doctors dedicate more hours of their professional life to clinical activity and less to acquiring and developing teaching skills and methods. This points to a need for universities to motivate the doctors on their staff and implement courses in teaching methods and methodology. But as Zibrowski has pointed put, the response given by the busy university teacher regarding the viability of attending training courses is always the same: "I don't have the time" [20]. So, courses aimed at these doctors must be adapted to their timetables, compensating the participants for the time taken out of their usual schedule. A higher percentage of teaching staff with degrees other than medicine enter relevant teaching positions more quickly, as they do not have to devote time to clinical activities and can develop and multiply scientific production through participation in research projects and publishing scientific articles. No less importantly, in the university academic environment, teaching is less valued than research, which is also true of other countries, as affirmed in the 2009 work by Steinert et al. [21]. Likewise, while teachers with degree qualifications other than medicine had received more training in virtual environments, doctors had received more training in clinical simulations. This is understandable given the different professional activities the two groups devote time to. The percentages of teaching staff trained in PBL, and debriefing were similar, whereby only 12.64% of those with medical degrees had received training and 11.76% of staff with other degrees. This constitutes a glaring generalized insufficiency and highlights the need to promote training in debriefing in the university faculty of medicine.

Strength and limitations

The outstanding strength of the present work is its sample size, which was very inclusive in the sense that it encompassed each and every sector of the teaching staff in the faculty of medicine at the University of Granada; the percentage of teachers who responded out of the total number of teaching staff far exceeded the average usually reached in this type of survey. As far as we are aware, no similar studies appear in the literature, and there is no relevant scientific evidence regarding the problem that we set out to describe and analyze. As for limitations, the study only looked at one faculty, but as this is a pilot study it does provide insight into a problem that needs to be investigated on a broader front with a multi-center study. As only one University faculty was investigated, the external validity of the study is limited, and the findings apply only to a limited geographical reach but nevertheless we believe its findings may be of wider relevance. Due to the absence of articles dealing with the same problem, it was difficult to make any comparative analysis. In future work, we propose increasing the sample size, the number of variables, and of course, broadening the scope of the work as a multi-center study including all the public university faculties in Andalucia, Spain (AndalucíaEducaMed Project).

Conclusions

According to the results of the present survey, it may be concluded that the main points requiring improvement are: a definitive solution to the existing gender gap; generalized implementation of new teaching models and methods (particularly PBL, clinical simulation, and debriefing); generational transformation; improvements to the training processes for medical educators with clinical attachment. These present challenges that medical education needs to overcome in the coming years.

Author contributions

G.G.M.: Conceptualization; data curation; formal analysis; investigation; methodology; supervision; validation; writing-original draft; writing-review and editing. T.R.F.S.: Conceptualization; data curation; formal analysis; investigation; methodology; supervision; validation; writing-original draft; writing-review and editing. M.A.M.P.: Conceptualization; data curation; formal analysis; methodology; supervision; validation; writing-original draft; writing-review and editing. A.C.C.: Conceptualization; data curation; formal analysis; investigation; methodology; supervision; validation; writing-original draft; writing-review and editing. The authors read and approved the final manuscript.

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Data availability

Data are available from the corresponding author (Gerardo Gómez-Moreno) upon reasonable request.

Declarations

Ethics approval

The study was approved in advance by the University of Granada Research Ethics Committee on 27th July 2022 (registration number: 2944/CEIH/2022).

Consent to participate

Every participant in the study was informed and provided their informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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