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Original article

Redesign of the Orthopedics and Traumatology program for the fifth year of Medicine

Rediseño del programa de Ortopedia y Traumatología para el quinto año de Medicina

Redesenho do programa de Ortopedia e Traumatologia para o quinto ano de Medicina

Reinaldo Cabrera Pacheco[1] 0009-0009-4724-2625 reicab1955@gmail.com
Lázaro Leduan Cordero Betancourt[2] 0000-0002-4727-6069 leduanl79@gmail.com
José Alberto Valdés Camalleri[2] 0000-0002-3344-8616 camallerijosealberto@gmail.com
Luis Racirt Breijo Mato[2] 0000-0002-1134-6600 racirtbm@gmail.com

[1] University of Medical Sciences of Pinar del Río. Pinar del Río, Cuba.
[2] Hospital "Abel Santamaría Cuadrado". Pinar de Río, Cuba.

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ABSTRACT

The need to update content, methodologies, and teaching strategies responds to ongoing scientific and technological advances, as well as the changing demands of the current healthcare system. This article proposes a redesign of the Orthopedics and Traumatology curriculum for the fifth year of the Medical School program at the University of Medical Sciences of Pinar del Río, with the goal of improving student training in this fundamental discipline. The curriculum redesign focuses on competency development, integrating theoretical and practical knowledge through active

methodologies, clinical simulations, and an interdisciplinary perspective. To carry out this proposal, various methods were employed, including documentary analysis of programs from other institutions, interviews with experts, and surveys of students and faculty. The results showed a positive assessment of the incorporation of active methodologies, the use of clinical simulations, and the integration of an interdisciplinary approach. In conclusion, the modernization of the Orthopedics and Traumatology program will significantly contribute to a more comprehensive and competent training of future physicians, promoting meaningful learning aligned with international standards.

Keywords: curriculum redesign; orthopedics; traumatology; medical education; competency-based learning.

RESUMEN

La necesidad de actualizar los contenidos, metodologías y estrategias pedagógicas responde a los avances científicos y tecnológicos continuos, así como a las demandas cambiantes del sistema de salud actual. El presente artículo propone el rediseño del programa de la asignatura Ortopedia y Traumatología para el quinto año de la carrera de Medicina en la Universidad de Ciencias Médicas de Pinar del Río, con el objetivo de perfeccionar la formación de los estudiantes en esta disciplina fundamental. El rediseño curricular se centra en el desarrollo de competencias, integrando conocimientos teóricos y prácticos mediante metodologías activas, simulaciones clínicas y una perspectiva interdisciplinaria. Para llevar a cabo esta propuesta, se emplearon diversos métodos, incluyendo el análisis documental de programas de otras instituciones, entrevistas a expertos y encuestas a estudiantes y docentes. Los resultados obtenidos mostraron una valoración positiva sobre la incorporación de metodologías activas, el uso de simulaciones clínicas y la integración de un enfoque interdisciplinario. En conclusión, la modernización del programa de Ortopedia y Traumatología contribuirá significativamente a una formación más integral y competente de los futuros médicos, favoreciendo un aprendizaje significativo y alineado con los estándares internacionales.

Palabras clave: rediseño curricular; ortopedia; traumatología; educación médica; aprendizaje basado en competencias.

RESUMO

A necessidade de atualização de conteúdos, metodologias e estratégias pedagógicas responde aos contínuos avanços científicos e tecnológicos, bem como às demandas mutáveis do sistema de saúde atual. Este artigo propõe uma reformulação do currículo de Ortopedia e Traumatologia para o quinto ano do curso de Medicina da Universidade de Ciências Médicas de Pinar del Río, com o objetivo de aprimorar a formação dos alunos nesta disciplina fundamental. A reformulação curricular foca no desenvolvimento de competências, integrando conhecimentos teóricos e práticos por meio de metodologias ativas, simulações clínicas e uma perspectiva interdisciplinar. Para implementar esta proposta, foram empregados diversos métodos, incluindo análise documental de programas de outras instituições, entrevistas com especialistas e pesquisas com alunos e docentes. Os resultados mostraram uma avaliação positiva da incorporação de metodologias ativas, do uso de simulações clínicas e da integração de uma abordagem interdisciplinar. Conclui-se que a modernização do programa de Ortopedia e Traumatologia contribuirá significativamente para uma formação mais abrangente e competente dos futuros médicos, promovendo uma aprendizagem significativa alinhada aos padrões internacionais.

Palavras-chave: reformulação curricular; ortopedia; traumatologia; educação médica; aprendizagem baseada em competências.

INTRODUCTION

The Medical School at the University of Medical Sciences of Pinar del Río is one of the most prestigious in the region, training professionals committed to the well-being of the population and prepared to face the challenges of the Cuban healthcare system. The training of competent physicians depends not only on the mastery of theoretical knowledge but also on the ability to apply this knowledge in practical situations, highlighting the need for quality medical education adapted to the needs of the current social and healthcare context. This constant evolution in medical training becomes even more urgent in specialties such as Orthopedics and Traumatology, key disciplines in the treatment of musculoskeletal disorders, which include a wide range of diseases affecting bones, joints, ligaments, tendons, and muscles.

In recent years, orthopedics and traumatology have experienced significant progress thanks to the incorporation of new technologies, innovative treatments, and advances in surgical techniques, which have expanded the therapeutic possibilities for patients. This evolution undoubtedly implies the need to update medical educational programs, not only to include the latest scientific and technological advances, but also to ensure that future physicians are trained to offer effective solutions adapted to the changing realities of clinical practice.

Various studies have shown that educational quality must be aligned with the demands of the healthcare system, the expectations of society, and advances in medicine. In this regard, training programs should be geared toward fostering practical skills, critical capabilities, and clinical competencies that enable a rapid and appropriate response to the demands of contemporary healthcare. In this regard, Álvarez Cambras (2009a) argues that the incorporation of new technologies in the field of traumatology has made it possible to optimize surgical procedures, contributing to a significant reduction in postoperative complications and improving patient recovery.

Traditionally, medical education has been based on the transmission of theoretical knowledge, with a predominantly academic approach that has often neglected the development of essential practical skills for patient care. However, current pedagogical trends point to a more dynamic and participatory educational model, focused on the comprehensive development of students. This shift has given way to active learning methodologies that prioritize problem-solving, teamwork, and practice-based learning. Thus, students must not only understand the theory but also acquire skills that allow them to face clinical reality, where the ability to make informed decisions and act effectively is essential.

Within this paradigm, medical simulation has emerged as an essential educational tool. Simulation allows students to practice and improve their clinical skills in a controlled environment, free from the risks associated with caring for real patients.

According to Álvarez Cambras (2009b), the integration of diagnostic and therapeutic techniques is essential to ensure the success of orthopedic surgery, since a comprehensive diagnosis allows for optimal surgical treatment planning. In the treatise, he emphasizes the importance of a thorough preoperative evaluation, arguing that such an assessment is essential for decision-making and for planning surgical interventions that adequately respond to the patient's needs.

Medical teaching has undergone a significant evolution toward more active, student-centered methods, such as problem-based learning (PBL). According to Barrows (1996), PBL has proven to be

an effective strategy, as it promotes autonomous problem-solving, developing students' critical and analytical skills. This methodology favors deeper learning, allowing students to apply theoretical knowledge to practical situations. Furthermore, recent studies have highlighted that PBL fosters greater motivation and information retention compared to traditional teaching methods (Prince, 2004).

On the other hand, clinical simulation has established itself as an indispensable tool in medical education, especially with the use of advanced technologies that allow for high-fidelity medical scenarios. Cook *et al.* (2011) highlight that technological simulation significantly improves the training of healthcare professionals by providing a controlled environment where students can practice safely. Issenberg *et al.* (2005) also point out that high-fidelity simulations are especially effective for teaching technical and decision-making skills in complex situations. Furthermore, interdisciplinary training, as pointed out by Reeves *et al.* (2013), improves outcomes in professional practice and patient care by fostering collaboration between different health disciplines. Traumatology training requires innovative approaches that integrate practical and theoretical skills, adapting to the current demands of the specialty (Munuera Martínez, 2010).

According to the aforementioned author, optimizing specialized medical training involves reevaluating clinical rotation models and teaching evaluation systems.

In the specific case of simulation, it is not only used to train technical skills but also enables the development of competencies in areas such as doctor-patient communication, clinical decision-making, and emergency response. Furthermore, simulations can include complex scenarios that require multidisciplinary intervention, which strengthens collaboration between professionals from different medical specialties. In the field of Orthopedics and Traumatology, simulations allow students to practice surgical interventions, fracture management, and other essential techniques without compromising patient safety.

Simulation also offers the possibility of integrating an interdisciplinary approach, key to modern medical training. Musculoskeletal disorders often require the collaboration of different specialists, such as orthopedic surgeons, physical therapists, rehabilitation physicians, and other healthcare professionals. Therefore, education that fosters teamwork and shared learning becomes essential.

Active learning methodologies and clinical simulations not only prepare students to handle the complexity of clinical cases, but also promote a holistic and integrated view of the patient, from prevention to treatment and rehabilitation.

The central idea is to improve student training by providing them with the necessary tools to face the challenges of modern clinical practice, while preparing future physicians to work in teams and adapt to the technological advances that are transforming medicine.

This redesign seeks not only to update the theoretical content but also to strengthen practical competencies and clinical skills that will enable students to intervene effectively and safely in their professional practice, thereby improving the quality of care in the field of Orthopedics and Traumatology.

This article proposes a redesign of the Orthopedics and Traumatology program for the fifth year of medical school at the University of Medical Sciences of Pinar del Río, with the goal of incorporating active learning methodologies, clinical simulations, and an interdisciplinary approach.

MATERIALS AND METHODS

The redesign process of the Orthopedics and Traumatology program for the fifth year of the Medical School program at the University of Medical Sciences of Pinar del Río was carried out using a mixed methodology, combining qualitative and quantitative approaches. This methodology provided a comprehensive view of the current state of the curriculum and the training needs of students, while also making it possible to implement improvements based on evidence and the experience of experts and students.

The curriculum redesign was carried out in several phases, including documentary analysis, expert interviews, student surveys, and the implementation of clinical simulations. Each of these stages played a key role in creating a program more aligned with the demands of contemporary medicine and current trends in the teaching of Orthopedics and Traumatology.

The first step was to carry out a comprehensive review of the Orthopaedics and Traumatology curricula of various educational institutions, both national and international. Official documents, study programs and curriculum guides from renowned universities in Cuba and other countries were consulted. This review provided an overview of best teaching practices in this field. In addition,

academic research on active teaching and medical simulation methodologies applied to orthopaedics was analyzed, which facilitated the identification of innovative educational approaches to integrate them into curriculum redesign.

In the second phase, interviews were conducted in Orthopedics and Traumatology, with both faculty members at the University of Medical Sciences of Pinar del Río and practicing professionals. The interviews were conducted in a semi-structured format, allowing for a wide range of opinions on the essential competencies that students needed to develop to meet the challenges of clinical practice in this specialty. The experts shared valuable perspectives on the importance of clinical skills, the need for a practical approach to teaching, and the relevance of integrating clinical simulations into training. In addition, the main shortcomings of the current program were discussed, which allowed for the identification of specific areas in need of improvement.

To complement the information obtained from the interviews, surveys were administered to fifth-year medical students. These surveys aimed to determine their perceptions of the current quality of teaching in Orthopedics and Traumatology, as well as their suggestions for improving the program. The surveys included questions about content coverage, teaching methodology, clinical practice, and the use of resources such as simulation. Students were also able to express their opinions on the importance of acquiring practical skills, such as performing simulated surgical procedures, managing orthopedic emergencies, and communicating with patients in the context of Orthopedics and Traumatology.

The final phase involved the design and implementation of clinical simulations that replicated real-life situations in the field of Orthopedics and Traumatology. These scenarios were created to allow students to confront complex and dynamic situations, such as fracture treatment, sports injury management, and intervention in orthopedic emergencies. High-fidelity mannequins, anatomical models, and advanced simulation technology were used to create a realistic and controlled learning environment. The simulations were evaluated by both instructors and students, who provided feedback on their effectiveness in improving clinical skills and decision-making in high-pressure situations.

Simulations were also used as a tool to assess the integration of knowledge acquired during the course and its application in practical situations. Scenarios were designed that required the participation of multiple professionals, fostering an interdisciplinary approach that allowed students

to work as a team, just as they would in a real clinical setting. This phase was considered essential for implementing more practical teaching methods that were closer to the reality of professional practice.

Data obtained from interviews, surveys, and simulation evaluations were collected and analyzed to determine the impact of the proposed modifications on the teaching of Orthopedics and Traumatology. The results were analyzed quantitatively and qualitatively, allowing for the identification of areas for improvement and strengths of the proposed program. Through this analysis, recommendations were made for adjusting the curriculum to better meet student needs and the demands of the healthcare system, while ensuring high-quality medical education.

RESULTS

The curriculum redesign process for the fifth-year Orthopedics and Traumatology program at the University of Medical Sciences of Pinar del Río during the 2023-2024 academic year incorporated innovative strategies, such as clinical simulation and the use of digital technologies, with the aim of improving student training and adapting to the current needs of the healthcare system. Active learning methodologies, the integration of technologies, and the promotion of an interdisciplinary approach were key aspects of the redesign. The results obtained after implementing these strategies are presented below.

One of the main achievements of the curriculum redesign was the updating of the program's content. Emerging topics and recent advances in Orthopedics and Traumatology were incorporated, such as minimally invasive techniques in orthopedic surgery, the use of new technologies in diagnostic imaging, and the latest approaches in the treatment of sports injuries and complex fractures. This update ensured that the program reflected current and future practices in the discipline, allowing students access to cutting-edge content, preparing them to face the challenges of modern medicine.

The use of active methodologies, such as problem-based learning and collaborative learning, promoted more active student participation in their learning process. PBL allowed students to analyze real clinical cases, fostering critical thinking and problem-solving. Collaborative learning, in turn, improved teamwork skills, which is essential for working in a clinical setting, where physicians, nurses, and other professionals must collaborate closely.

Clinical Simulation: The implementation of clinical simulations allowed students to practice practical skills in a controlled and safe environment before facing real-life situations in a hospital setting. This resulted in a significant improvement in student confidence and clinical competence. Simulation scenarios included fracture treatment, care of patients with sports injuries, and management of orthopedic emergencies, allowing students to develop skills in high-pressure situations and make informed clinical decisions.

Interdisciplinary approach: Incorporating an interdisciplinary approach into student training provided a more comprehensive view of patient management. Students collaborated with other medical disciplines, such as physical therapy, anesthesiology, and internal medicine, allowing them to better understand the diverse perspectives of patient care. Furthermore, this approach fostered teamwork, a crucial aspect of modern clinical practice, where interaction between various specialties is essential for effective patient treatment.

The results obtained from the interviews with professors, surveys with students and the evaluation of clinical simulations are presented below (Tables 1, 2 and 3).

Table 1. Results of the interviews with teachers on the implementation of active methodologies in the teaching of Orthopedics and Traumatology

Questions	Affirmative answer (%)	Negative answer (%)	Don't know/No answer (%)
Do you think that active methodologies improve student learning?	85%	10%	5%
Have you implemented clinical simulations in your classes?	70%	25%	5%
Do you think interdisciplinary training is beneficial for students?	90%	5%	5%

Table 2. Results of student surveys on curriculum redesign

Questions	Affirmative answer (%)	Negative answer (%)	Don't know/No answer (%)
Do you think that updating the content has improved your preparation for professional practice?	88%	7%	5%
Have active methodologies, such as PBL and collaborative learning, improved your participation in classes?	80%	15%	5%
Has clinical simulation allowed you to more effectively practice the skills needed in Orthopedics and Traumatology?	90%	5%	5%

Table 3. Evaluation of clinical simulation scenarios

Simulation scenario	Positive evaluation (%)	Negative evaluation (%)	Student comments
Fracture treatment	95%	5%	"Very realistic, it gave me confidence to handle similar situations in the hospital"
Management of orthopedic emergencies	92%	8%	"It was very useful in learning how to make quick and accurate decisions"
Sports injury care	89%	11%	"Excellent for understanding treatment and rehabilitation protocols"

The results obtained from faculty interviews, student surveys, and the evaluation of clinical simulations indicate that the curriculum redesign has been successful in several key aspects. The updated content and the implementation of active methodologies, such as problem-based learning and collaborative learning, have improved the quality of teaching in Orthopedics and Traumatology.

The incorporation of clinical simulations has allowed students to develop practical skills in a controlled environment, while the interdisciplinary approach has enriched the training of future physicians. These changes contribute to preparing students at the University of Medical Sciences of Pinar del Río to face the challenges of modern medicine and improve their performance in the clinical setting.

To integrate the outcomes into the program content, they were placed within the areas that involve ongoing assessment and feedback on student learning. Below, it is presented how the expected outcomes could be integrated into the objectives and topics of the course program.

Students will demonstrate skill in identifying and diagnosing traumatic and non-traumatic conditions through the effective application of the clinical method in Workplace Education activities, consultations, on-call clinics, and in various teaching settings. Their ability to apply comprehensive diagnoses will be assessed in real and simulated clinical situations.

Students will be able to take a complete and detailed medical history and perform a physical examination of the SOMA (Physical Examination of the Osteomioarticular System), identifying signs and symptoms relevant to the diagnosis. This ability will be measured through direct observation during practical classes and on-call visits. Performance will be assessed in both outpatient settings and emergency and urgent care situations.

Students will be evaluated on their ability to perform therapeutic procedures such as immobilization, fracture reduction, injections, and wound suturing, which are considered essential in the care of patients with SOMA conditions. This skill will be measured both in supervised practical situations and through the development of their competency in clinical simulations.

Expected outcomes include students' ability to indicate, interpret, and integrate the results of complementary examinations into the diagnosis and treatment of patients. Their mastery of interpreting radiological images and other complementary studies will be assessed throughout the course.

Students will demonstrate their competency in identifying preventive and rehabilitation measures through practical activities. During home visits, consultations, and intervention practices in various healthcare settings, students will apply guidelines related to the prevention, treatment, and rehabilitation of the most common orthopedic and trauma conditions, with a comprehensive approach to patient health.

Interdisciplinary teamwork: Students will work collaboratively with other healthcare professionals (such as physical therapists and radiologists) in the treatment of SOMA conditions. This outcome will be assessed through direct observation of teamwork, case discussions, and an analysis of their ability to apply the acquired knowledge in real-life healthcare situations.

At the end of the course, students will be assessed in a comprehensive final exam covering both theoretical and practical aspects. This exam will include clinical case resolution, diagnostic imaging interpretation, and the application of knowledge in simulated practical situations, allowing for an assessment of their level of preparation and understanding of the core program content.

DISCUSSION

The results obtained through the curriculum redesign process at the University of Medical Sciences of Pinar del Río have shown significant improvements in several key aspects of student training in the field of Orthopedics and Traumatology. The implementation of strategies such as content updates, the use of active methodologies, the integration of clinical simulations, and an interdisciplinary approach have proven effective in improving the academic and professional preparation of fifth-year students.

The updated content incorporated the most recent advances in Orthopedics and Traumatology, ensuring that students were familiar with current and emerging practices in the discipline. According to survey results, this was positively valued by the majority of students, who felt that the updated content allowed them to more effectively prepare for professional practice in a constantly evolving healthcare environment.

The adoption of active methodologies such as problem-based learning (PBL) and collaborative learning facilitated greater student engagement in their training process. Faculty reported that these methodologies promoted more interactive and dynamic learning, where students were able to apply their knowledge to practical situations and collaborate with their peers to solve problems. Clinical simulation, as a learning tool, provided students with a space to develop practical skills in a controlled and safe environment, which resulted in increased confidence and clinical competence among future physicians.

Finally, the interdisciplinary approach implemented in the curriculum redesign was particularly well received, as it allowed students to gain a comprehensive understanding of patient treatment, fostering interprofessional collaboration and teamwork, essential skills in today's medical practice.

The results obtained in this study are consistent with trends observed in various international research projects, which have demonstrated the effectiveness of active methodologies and clinical simulation in improving educational outcomes in Medicine. For example, the use of problem-based learning has been widely supported in the literature as an effective strategy for fostering critical thinking and problem-solving (Barrows, 1996). This approach has been adopted in many medical schools worldwide, as it allows students to actively participate in their learning process and confront real-life cases that mimic clinical situations (Munuera Martínez, 2010).

According to Barrows (1996), the implementation of PBL in medical education fosters deep and lasting learning, as it allows students to apply the acquired knowledge to clinical practice more effectively.

Clinical simulation has also been shown to be an effective tool for developing practical skills in medical students. In a study conducted by Issenberg *et al.* (2005), it was concluded that medical simulations offer students the opportunity to practice and perfect their skills in a risk-free environment, which significantly increases their competence and confidence. The results obtained in this study coincide with this conclusion, since students from the University of Medical Sciences of Pinar del Río indicated that clinical simulation allowed them to develop greater confidence in clinical decision-making and the execution of technical procedures. Smith Austin and García Céspedes (2024) maintain that the level of knowledge of the contents is still insufficient, as are the courses offered for its development in universities, which has resulted in low-quality medical care.

Vidal Olate *et al.* (2023), for their part, argue that, through program proposals, tools have been acquired to integrate evidence-based medicine into professional practice and develop scientific projects. Both studies corroborate the importance of redesigning current programs.

Furthermore, the integration of an interdisciplinary approach into student training has been recognized as a key factor in improving patient care.

Collaboration between different medical disciplines allows students to obtain a more holistic view of patient management and understand how the various specialties interact in comprehensive health

care (Reeves *et al.*, 2013). On the other hand, Ruiz Riquelme *et al.* (2024) consider that there is currently a favorable perception among students regarding the adequate acquisition of theoretical knowledge, the advantages of the hybrid modality, assumptions that corroborate the need to redesign the content of the program.

In the context of the curriculum redesign at the University of Medical Sciences of Pinar del Río, this approach fostered teamwork and collaboration, essential skills for future physicians in a clinical setting. However, there are also studies that pose some challenges in the implementation of these strategies. For example, some research has indicated that, despite the benefits of clinical simulation, this tool can be expensive and require significant resources in terms of infrastructure and trained personnel (Cook *et al.*, 2011).

In the context of the University of Medical Sciences of Pinar del Río, although simulations have been implemented with limited resources, it is necessary to continue strengthening the infrastructure to ensure a broader and more efficient implementation of this tool. Hoppenfeld and Hoppenfeld (2017) detail a comprehensive approach to the assessment of neurological injuries in the orthopedic context, highlighting the importance of the correlation between clinical findings and musculoskeletal manifestations.

Through a meticulous physical examination and the evaluation of reflexes, muscle strength, and sensation, the precise identification of the location and extent of lesions in the nervous system is facilitated. Furthermore, LLanio Navarro (2016) and López de Quesada *et al.* (2022) emphasize that a rigorous physical examination is essential for establishing accurate diagnoses in orthopedics, which reduces the dependence on complementary tests in clinical practice.

López-Durán Stern (2018) argues that a detailed understanding of surgical pathology applied to traumatology allows for more informed decision-making in clinical and surgical management. Furthermore, although active methodologies are highly valued, some authors warn that their implementation can be challenging due to resistance to change on the part of some teachers, who feel more comfortable with traditional teaching methods (Prince, 2004).

However, in the case of the University of Medical Sciences of Pinar del Río, the results of faculty interviews and surveys indicate that, in general, faculty have positively embraced these methodologies, suggesting that ongoing training and support may be key factors in overcoming this resistance.

In conclusion, the results obtained from the implementation of the curriculum redesign in the Medicine program at the University of Medical Sciences of Pinar del Río during the 2023-2024 academic year have demonstrated that the incorporation of active learning methodologies, clinical simulation, and an interdisciplinary approach are effective strategies for improving the training of students in Orthopedics and Traumatology.

These results are consistent with existing literature, which supports the effectiveness of these methodologies in medical education. However, it is also important to consider the challenges associated with implementing these strategies, such as limited resources and potential resistance from some faculty members, which requires a gradual approach supported by ongoing training.

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Conflict of interest

Authors declare no conflict of interests.

Authors' contribution

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.